

SEVENTH EDITION

M O D E R N
DICTIONARY
of
ELECTRONICS

RUDOLF F. GRAF



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**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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purpose of making the receiving device unresponsive to outgoing signal currents.

duplex cable—A cable composed of two insulated stranded conductors twisted together. They may or may not have a common insulating covering.

duplex channel—A communication channel providing simultaneous transmission in both directions.

duplexer—1. A radar device that, by using the transmitted pulse, automatically switches the antenna from receive to transmit at the proper time. 2. Highly selectable, tunable filters that allow a transmitter and receiver to use one common antenna.

duplexing assembly (radar)—See transmit-receive switch.

duplex operation—Simultaneous operation of transmitting and receiving apparatus at two locations.

duplex system—A system with two distinct and separate sets of facilities, each of which is capable of assuming the system function while the other assumes a standby status. Usually both sets are identical in nature.

duplex tube—A combination of two vacuum tubes on one envelope.

duplicate—To copy in such a way that the result has the same physical form as the source. For example, to make a new punched card that has the same pattern of holes as an original punched card.

duplication check—A computer check in which the same operation or program is checked twice to make sure the same result is obtained both times.

Duraspark—Conventional (Ford Motor) electronic ignition for use with high-voltage, high-energy spark timing control.

duration control—A control for adjusting the time duration of reduced gain in a sensitivity time control circuit.

duress alarm device—A device that produces either a silent alarm or local alarm under a condition of personnel stress such as holdup, fire, illness, or other panic or emergency. The device is normally manually operated and may be fixed or portable.

duress alarm system—An alarm system that employs a duress alarm device.

during cycle—The interval while a timer is operating for its preset time period.

dust core—A pulverized iron core consisting of extremely fine iron particles mixed with a binding material for use in radio-frequency coils.

dust cover—A device specifically designed to cover the mating end of a connector so as to provide mechanical and/or environmental protection.

DUT—Abbreviation for device under test.

duty cycle—1. Ratio of working time to total time for intermittently operated devices. 2. The ratio of on-time to off-time in a periodic on-off cycle. 3. The ratio of operating time to total elapsed time of a device that operates intermittently, expressed as a percentage. 4. In percent, $100(t_o/T)$, where T is the period between pulses and t_o is the pulse width.

duty cyclometer—A test meter that gives a direct reading of duty cycle.

duty factor—1. In a carrier composed of regularly recurring pulses, the product of their duration and repetition frequency. 2. Ratio of average to peak power. 3. Same as duty cycle except it is expressed as a decimal rather than a percentage. Usually calculated by multiplying pulses per second times pulse width.

duty ratio—In a pulsed system, such as radar, the ratio of average to peak power.

DVD—Abbreviation for the digital versatile disc and digital video disk. A high capacity optical storage medium

with improved capacity and bandwidth over the CD for prerecorded multimedia program material with applications in video playback and PC areas.

dv/dt —The rate of change of voltage with respect to time. Proportional to current in a capacitor.

Dvorak keyboard—A keyboard arrangement designed by August Dvorak for increased speed and comfort. It reduces the rate of errors by placing the most frequently used letters in the center of the keyboard for use by the strongest fingers.

DX—1. Abbreviation for distance. 2. Reception of distant stations. 3. Distant and/or difficult to hear radio stations.

DXer—One who listens to distant or hard-to-hear stations as a hobby.

DX hound—An amateur who specializes in making distant contacts.

DXing—The hobby of listening to distant or otherwise hard-to-hear stations.

dyadic Boolean operator—A Boolean operator that has two operands. The dyadic Boolean operators are AND, exclusive OR, NAND, NOR, and OR.

dyadic operation—An operation on two operands.

dye laser—A laser using a dye solution as its active medium. Its output is a short pulse of broad spectral content, and its achievable gain is high. Dye lasers function at room temperature. Synchronous pumping can be used to produce a continuous train of tunable picosecond pulses for sustained periods.

dynamic—1. Of, concerning, or dependent on conditions or parameters that change, particularly as functions of time. 2. A speaker drive principle using the interaction between the magnetic field surrounding a voice coil carrying a signal current and a fixed magnetic field to move the coil and the cone to which it is attached. 3. A headphone driver using a voice coil in a magnetic field driving a paper or plastic diaphragm, as in a speaker.

dynamic acceleration—Acceleration in a constantly changing magnitude and direction, either simple or complex motion, usually called vibration. Also measured in gravity units.

dynamically balanced arm—A type of tonearm whose masses are balanced about its pivot, with tracking force applied by a spring. This type of arm does not require that the turntable be level for proper tracking.

dynamic analogies—The similarities in form between the differential equations that describe electrical, acoustical, and mechanical systems that allow acoustical and mechanical systems to be reduced to equivalent electrical networks, which are conceptually simpler than the original systems.

dynamic analysis—Execution of an instrumented program to collect information on its behavior and correctness.

dynamic behavior—The way a system or individual unit functions with respect to time.

dynamic braking—1. A system of braking of an electric drive in which the motor is used as a generator, and the kinetic energy of the motor and driven machinery is employed as the actuating means of exerting a retarding force. 2. A type of motor braking caused by current being applied to the windings after the power is shut off. This is accomplished either by self-excitation (dc motors) or by separate excitation (ac motors).

dynamic burn-in—High-temperature test with devices subject to actual or simulated operating conditions.

dynamic cell—A memory cell that stores data as charge (or absence of charge) on a capacitor. A typical cell isolates the capacitor from the data line (bit line) with a transistor switch. Thus, when no read or write operation is desired, there is essentially no power required

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.

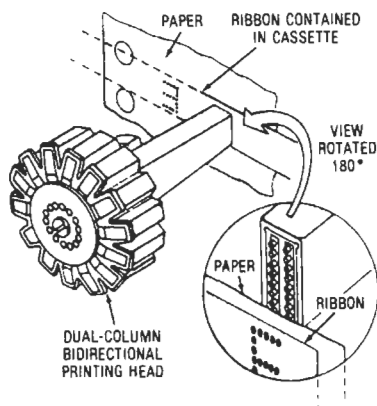
IMOS—See ion-implanted MOS.

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).

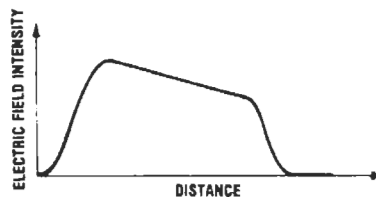
impact printing—Printing that is produced by the impact of a key on an inked ribbon, transferring the impression of a character onto the paper located behind the ribbon.

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.

beta particles that strike a phosphor. Two photocells then convert the light output from the phosphor into electrical energy.

prompt—1. A symbol that alerts the user that a device is online and connected to a channel for transmission. 2. Information sent to a PC from the remote computer requesting more input. 3. An on-screen hint to the user about what to do next.

prong—See pin.

proof pressure—1. The maximum pressure that may be applied to the sensing element of a transducer without changing the transducer performance beyond specified tolerances. 2. The maximum pressure that a diaphragm, capsule, or element can withstand without permanent deformation. Expressed in terms of input pressure.

propagated error—An error that is carried through succeeding computer operations.

propagation—Also called wave propagation. 1. The travel of electromagnetic waves or sound waves through a medium. Propagation does not refer to the flow of current in the ordinary sense. 2. The means by which radio signals are carried from one location to another.

propagation anomaly—An irregularity introduced into an electromagnetic or other sensing device by discontinuities in the propagation medium.

propagation constant—1. The transmission characteristic that indicates the effect of a line on a wave being transmitted along the line. It is a complex quantity having a real term called the attenuation constant and an imaginary term called the phase constant. 2. Also called transfer factor. The natural logarithm of the ratio of the current into an electric transducer to the current out of the transducer, with the transducer terminated in its iterative impedance.

propagation delay—1. A measure of the time required for a logic signal to travel through a device or a series of devices forming a logic string. It occurs as the result of four types of circuit delays—storage, rise, fall, and turn-on delay—and is the time between when the input signal crosses the threshold-voltage point and when the responding voltage at the output crosses the same voltage point. 2. Time delay occurring between the application of an input to a digital logic circuit and the change of state at the output. 3. The time necessary for a signal to travel from one point in a circuit to another. 4. The time required for a pulse or a level transition to propagate through a device. 5. See insertion delay.

propagation error—For ranging systems, the algebraic sum of propagation-velocity error and curved-path error. Except at long ranges and low angles, the curved-path component of propagation error is generally negligible.

propagation factor—See propagation ratio.

propagation loss—The loss of energy suffered by a signal while passing between two points.

propagation ratio—Also called the propagation factor. For a wave that has been propagated from one point to another, the ratio of the complex electric-field strength at the second point to that at the first point.

propagation time—1. The time it takes for a signal to travel from point to point. In a communications channel, the velocity of signal propagation is less than that of radio. A signal delay of 20 ms per thousand miles or 1600 kilometers is a reasonable maximum. 2. The time required for transmission of a unit of binary information (high or low voltage) from one physical point in a system or subsystem to another, such as from the input to the output of a device.

propagation time delay—The time required for a wave to travel from one point to another along a transmission line. It varies according to the type of line.

propagation velocity—See velocity of propagation.

property sort—In a computer, a technique for the selection of records meeting a certain criterion from a file.

proportional—1. A linear (straight line) relationship between two variables. 2. Method of printing characters in which each character takes up only the horizontal space it needs, rather than a fixed amount of space, e.g., the character "i" takes up less space than "m."

proportional band—The range of the controlled variable corresponding to the full range of operation of the final control element.

proportional control—1. A method of control in which the intensity of action varies linearly as the condition being regulated deviates from the conditions prescribed. 2. Also called galloping ghost. An advanced type of radio-control system in which the rudder (and sometimes the elevator) can move as much (or as little) as the operator wishes. 3. A control system in which corrective action is always proportionate to any variation of the controlled process from its desired value. For example, instead of snapping directly open-closed in the manner of two-position control, a proportional valve will be always positioned at some point between open and closed, depending on the flow requirement of the system at any given moment.

proportional counter tube—A sealed tube containing an inert gas such as argon, krypton, xenon, methyl bromide, etc. It is used like a Geiger-Mueller counter and operated at about 100 volts in the proportional region.

proportional linearity—A manner of expressing nonlinearity as the deviation from a straight line in terms of a given percentage of the transducer output at the stimulus point under consideration (i.e., as a percentage of the reading).

proportional region—In a radiation counter tube, the applied-voltage range in which the gas amplification is greater than unity and is independent of the charge liberated by the initial ionizing event.

proportional temperature control—A method of stabilizing (an oscillator) by providing heater power that is directly proportional to the difference between the desired operating temperature and the ambient temperature.

proprietary alarm system—An alarm system that is similar to a central station alarm system except that the annunciator is located in a constantly manned guard room maintained by the owner for his or her own internal security operations. The guards monitor the system and respond to all alarm signals or alert local law enforcement agencies, or both.

protected area—An area monitored by an alarm system or guards, or enclosed by a suitable barrier.

protected location—A computer storage location reserved for special purposes, in which data cannot be stored without being subjected to a screening procedure to establish suitability for storage at that location.

protected memory—Storage (memory) locations reserved for special purposes, in which data cannot be entered directly by the user.

protected port—A point of entry, such as a door, window, or corridor, that is monitored by sensors connected to an alarm system.

protected wireline distribution system—Also known as approved circuit. A communications system to which electromagnetic and physical safeguards have been applied to permit secure electrical transmission of unencrypted, classified information, and that has been approved by the cognizant department or agency. The

signal shifter—A variable-frequency oscillator for shifting amateur transmitters to a less crowded frequency within a given band.

signal splitter—A passive device that enables two or more TV sets to divide a TV signal between them with proper balancing and isolation. Available in either 75- or 300-ohm impedances.

signal strength—1. The strength of the signal produced by a transmitter at a particular location. Usually it is expressed as so many millivolts per meter of the effective receiving-antenna length. 2. The intensity of the television signal measured in volts, millivolts, microvolts, or decibels, using 0 dB as a reference. Equal to 1000 microvolts in rf systems; generally 1 volt in video systems.

signal-strength meter—Also called an S meter. A meter connected in the AVC circuit of a receiver and calibrated in dB or arbitrary "S" units to read the strength of a received signal.

signal-to-distortion ratio—The ratio of desired to undesired signal in a transmitted single-sideband signal.

signal-to-noise ratio—Abbreviated SNR or s/n ratio. Also called signal-noise ratio. 1. Ratio of the magnitude of the signal to that of the noise (often expressed in decibels). 2. In television transmission, the ratio in decibels of the maximum peak-to-peak voltage of the video television signal (including the synchronizing pulse) to the rms voltage of the noise at any point. 3. The ratio of the amplitude of a signal after detection to the amplitude of the noise accompanying the signal. It may also be considered as the ratio, at any specific point of a circuit, of signal power to total circuit-noise power. 4. Ratio of the root-mean-square facsimile signal level to the root-mean-square noise level. 5. The difference, measured in decibels, between a specified signal reference level and the level of unwanted noise. The higher the ratio, the better the equipment. 6. The span, measured in decibels, of signal intensity between a device's overload point at the upper limit and its background noise at the lower limit. (In tape recording, the s/n ratio usually lies between the permissible limit of saturation distortion and the tape's background hiss.) 7. The ratio, in decibels, between a reference power output (usually an amplifier's rated power) and the hum and noise power in the output of the amplifier. The higher this ratio, the better. 8. The ratio, usually in decibels, between the level of the loudest undistorted tone that can be recorded and the noise that is generated and recorded when no signal is present. 9. The ratio of the power in a desired signal to the undesirable noise present in the absence of a signal. 10. The difference between the nominal or maximum operating level and the noise floor; usually specified in decibels. 11. The ratio of the peak value of the video signal to value of the noise. Usually expressed in decibels.

signal tracer—A test instrument used for tracing a signal through a circuit in order to find faulty wiring or components.

signal tracing—The process of locating a fault in a circuit by injecting a test signal at the input and checking each stage, usually from the output backwards.

signal voltage—The effective (root-mean-square) voltage value of a signal.

signal wave—A wave with characteristics that permit it to carry intelligence.

signal-wave envelope—The contour of a signal wave that is composed of a series of wave cycles.

signal winding—Also called an input winding. In a saturable reactor, the control winding to which the independent variable (signal wave) is applied.

signature (target)—The characteristic pattern of the target displayed by detection and classification equipment.

signal shifter — significant digits (of a number)

signature analysis—Abbreviated SA. 1. A synchronous process, whereby activity at an electrical node (referenced to a clock signal) is monitored for a particular stimulus over a given time. The analysis that follows the nodal monitoring is based on data compression. The long, complex pattern of a data stream is reduced to a 16-bit, 4-digit "signature." Correct signatures for a particular circuit are determined empirically from tests on a known-good product. 2. A means of isolating digital logic faults at the component level applicable to all digital systems. The technique involves the tracing of signals and the conversion of lengthy bit streams into 4-digit hexadecimal "signatures." Using logic diagrams and schematics specially annotated with correct signatures at each trace node, and guided by troubleshooting trees, a circuit can be traced back to a point in the circuit that has a correct input signature and incorrect output signature. Signatures are traced under the direction of a test PROM. 3. A patented troubleshooting technique (Hewlett-Packard Co.) based on the principle that a good digital circuit in a known (initialized) state will produce the same output when stimulated repeatedly by the same input. If the repeated output of a device is not the one it has been designed to produce, it has failed. 4. A specific digital-circuit-testing troubleshooting technique that makes use of coded representations of serial bit streams. Using a known input signal, a signature-analysis system generates such a coded representation at each point on a known-good pc board. The signature at each point on a board under test should then be the same as the signature at the corresponding point on the known-good board. 5. A technique for compressing large amounts of digital data into a relatively short data word, or signature. If the signature matches a reference signature it can be assumed, to an extremely high probability, that the data stream is valid. Signature analysis, therefore, can be used to verify the integrity of data streams.

signature analyzer—An instrument that compares stored patterns (signatures) against actual received patterns.

signature testing—Comparison of the actual output digital signatures, such as transition counts, with the expected correct signatures recorded from a known-good device.

sign bit—1. In complementary arithmetic, the leftmost bit of a number. If the sign bit is 1, the number is negative; if it is 0, the number is positive. 2. The leftmost bit of a computer word, which is sometimes used to indicate whether the number it contains is positive or negative. A 0 usually means a positive number, and a 1 a negative number.

sign-control flip-flop—In computers, a flip-flop in the arithmetic unit used for storing the sign of the result of an operation.

sign digit—A character (+ or -) used to designate the algebraic sign of a number.

significance—Weight. In positional representation, the factor by which a digit must be multiplied to obtain its additive contribution to the value of a number; the factor is determined by the digit position.

significant digits (of a number)—1. A set of digits from consecutive columns, beginning with the most significant digit other than zero, and ending with the least significant digit whose value is known or assumed to be relevant. The digits of a number can be ordered according to their significance, which is greater when occupying a column corresponding to a higher power of the radix. 2. A digit that contributes to the precision of a number. Significant digits are counted from the first digit on the left that is not zero and continue to the last accurate digit on the right. (A right-hand zero may be counted if it is

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"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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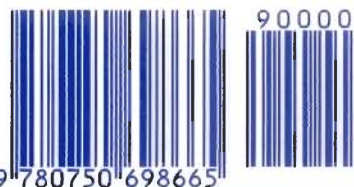


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