HANDOUT

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Book 2 of 2

Technical Training

Precision Measuring Equipment Specialist

METROLOGY HANDBOOK

January 1984

3400TH TECHNICAL TRAINING WING
3450th Technical Training Group
Lowry Air Force Base, Colorado

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Contents

Supersedes HO G3ABR32430 002-I, August 1981, which may be used until existing stocks are exhausted.

abberration - A board term covering several types of image defects in a lens or lens system. The oversheet or ringing of a square wave displayed on an oscilloscope.

abort - Halts the program and returns control to the operator or operating system. Performed in the uLab by the RESET key.

abscissa - The horizontal or x-axis on a chart graph.

absolute pressure - Actual pressure on a confined gas, irrespective of the atmosphere on the outside. Absolute pressure = gage pressure + atmospheric pressure.

absolute system - A system of units in which a small number of units is chosen as fundamental and all other units are derived from this group.

absolute temperature - Temperature measured from absolute zero as in the Kelvin and Rankine scales.

absolute zero - This is the temperature at which the volume of an ideal gas would become zero. The value calculated from the limited value of the coefficient of expansion of various real gases is -273.15°C.

absorption - The loss of energy in traveling through a medium. Examples: Electromagnetic energy is lost when radio waves travel through space. A yellow filter absorbs all wavelengths except yellow just as red paint will absorb all colors except red which is reflected.

absorption wavemeter - An instrument for measuring wavelength containing a variable turned circuit which absorbs a small portion of the radiated energy under measurement.

AC generator - (1) A rotating electric machine, generally known as an alternator, that converts mechanical power into alternating current power. (2) A vacuum-tube oscillator, or any other device, that is designed for the purpose of producting an alternating current.

AC resistance - The total resistance offered by a device in an alternating current circuit, including resistance due to eddy current, hystersis, dielectric, and corona losses as well as the direct current resistance. Also called high-frequency resistance and radio-frequency resistance.

accelerating electrode - An electrode used in cathode-ray tubes and other electronic tubes to increase the velocity of the electrons in a beam. Such an electrode is operated at a high positive potential with respect to the cathode.

acceleration - A rate of change in velocity per unit time. Positive acceleration means an increase in velocity while negative acceleration means a decrease in velocity per unit time. Avoid the use of the term "deceleration."

acceptor - A substance (impurity) which, when added to a pure semiconductor material, results in an increase in the number of holes so that major conduction through the material takes place as a transfer of the hole structure from molecule to molecule. Since this is equavalent to the transfer of a positive change, the resulting alloy is called a P-type semiconductor.

access time - The time required to receive valid data from a memory device following a read signal.

accumulator - One or more registers associated with the Arithmetic and Logic Unit (ALU), which termporarily store sums and other arithmetical and logical results of the ALU.

accuracy - The term accuracy refers to how close we are to the nominal value. In the past we have used this term to indicate error in a measurement device. For instance, the accuracy of a standard cell is plus or minus 0.01 percent. Use of the word accuracy in this sense is incorrect because what we mean is the inaccuracy or error is plus or minus 0.01 percent. However, this is still a common method of describing accuracies. To remedy this practice, the National Bureau of Standards has dropped the term accuracy, when used in this respect, and uses instead the term "uncertainty."

achromatic - A lens doublet, to two lenses combined to eliminate chromatic aberration.

acorn-tube - An acron-shaped vacuum tube designed for use at ultra-high frequencies. It has low interelectrode capacitance because of the small size of electrodes, and low electron transit time because of the close spacing of the electrodes. The electrode leads are brought directly out through the sides of the tube. There is no base.

Actual value (true value) - It is not possible to determine a completely true value of a quantity as there is always some error in every measurement. Theoretically we could say the "true" value of a measured quantity can be derived by taking the average of an infinite number of measurements assuming that the conditions contributing to deviations act is a completely free and random manner.

acuity - Visual acuity is the resolving power of the eye, normally taken as 1 minute arc. Vernier acuity is the ability of the eye to make coincidence settings.

adhesion - The molecular attraction exerted between the surfaces of bodies in contact.

A/D - See Analog to Digital Converter

ADC - See Analog to Digital Converter.

adder - Device that forms, as output, the sum of two or more numbers presented as inputs.

address - Number that indicates the position of a word in the memory. Typically, addresses are sixteen bits long and therefore can range from 0 to 64K.

address bus - Set of wires (typically 16) used to transmit addresses, usually from the microprocessor to a memory or I/O device.

address decoding - Process of selecting a specific address or field of addresses to enable unique devices.

addressing modes - Various methods of specifying an address as part of an insturction. See Direct Addressing, Indirect Addressing, Immediate Addressing, and Indexed Addressing.

admittance - The measure of the ease with which an alternating current flows in a circuit. It is the reciprocal of impedance.

AGC (automatic gain control) - A circuit arrangement which continuously adjusts the gain of an amplifier in a specified manner in response to changes in the input signal level. This is also called AVC (automatic volume control).

air core coil - A coil with no iron in its magnetic circuit (no iron either inside or outside the wire).

algebra - A continuation of arithmetic in which letters and symbols are used to represent definite quantities whose actual values may or may not be known.

algorithm - Step-by-step procedure for the solution to a problem. First the problem is stated and the algorithm is devised for its solution.

alloy - A mixture of two or more metals, such as brass (zinc and copper), bronze (copper and tin), and manganin (nickel, manganese, and copper).

alnico - An alloy consisting chiefly of aluminum, nickel, and cobalt. It has high retentivity and is used to make powerful small-size permanent magnets which hold their magnetism indefinitely.

alpha - The current amplification factor when connected in a common base configuration.

alpha particle - Particle identical with a helium nucleus emitted from the nucleus of a radioactive atom.

alphanumeric - Set of all alphabetic and numeric characters.

altenating current - An electric current that is continually varying in value and reversing its direction of flow at regular intervals. Each repetition, from zero to a maximum in one direction and then to a maximum in the other direction and back to zero, is called a cycle.

alternation - One half of a complete cycle, consisting of a complete rise and fall of voltage or current in one direction. There are 120 alternations per second in 60 Hz alternating current.

altimeter - An aircraft instrument that indicates the elevation in respect to a reference. The aneriod altimeter is referenced to sea level, while an electronic altimeter uses the radar method. See barometer.

ALU - See Arithmetic and Logic Unit.

amplitude distortion - A change that occurs in a waveshape resulting in an output that is no longer a linear representation of the input.

ambient temperature - The temperature of the air in the immediate vicinity.

ambiguity - The quality of having more than one meaning.

amici - A prism, sometimes referred to as a roof prisim, which produces a 90° deviation and inverts the image.

ammeter - An instrument used for measuring the amount of current in amperes. A meter that indicates the current value in milliamperes is a milliammeter, and one that indicates values in microampers is a microammeter.

ampere - Unit of electric current. The constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular sections, and placed 1 meter apart in a vacuum, will produce between these conductors a force equal to 2×10^{-7} newtons per meter of length. The practical unit of current.

amplifier - An amplifier is a device used to increase the voltage, current, or power of a signal to a desired level.

amplfication factor - The ratio of a small change in plate voltage to the small change in control grid voltage, under the conditions that the plate current remains unchanged and that all other electrode voltages are maintained constant. It is a measure of the effectiveness of the control grid voltage with respect to that of the plate voltage in controlling the plate current.

amplitude - (1) The maximum displacement of the value of an alternating current or wave from the zero position. (2) The extent of a vibratory movement measured from the mean position to an extreme.

amplitude modulation (AM) - A form of modulation in which the amplitude of the carrier is varied above and below its normal value in accordance with the amplitude of the modulating signal.

analog - Continuous range of voltage or current values.

analog to digital converter - Converts analog voltages and currents to the digital representation used by computer systems. This enables the computer to sense real-world signals.

angle of incidence - The angle formed by the line of an incident ray and a perpendicular line arising from the point of incidence.

angle of lag - The angle with which one alternating electrical quantity lags behind another quantity in time, expressed in degrees (1 cycle equals 360°) or in radians (1 cycle equals 2 radians).

angle of reflection - The angle formed by the line of a reflected ray and a perpendicular line arising from the point of incidence.

angle of refraction - The angle formed beteween the line of a refracted ray and a perpendicular line drawn through the point of refraction.

angular velocity - The speed of a rotating object measured in radians per second and generally designated by the lower case Greek letter omega. In the case of a periodic quantity, such as alternating current, the angular velocity is equal to a 2 f.

anode - That electrode of an electron tube toward which the principle electron stream flows. It is at a positive potential with respect to the corresponding negative electrode called the cathode.

antenna - A conductor or system of conductors for radiating or receiving RF energy exclusive of the connecting wires, transmission line, or waveguide between its main portion and the apparatus associated with it.

antilogarithm - Number from which the log was derived. Obtained as a result of using the inverse procedure of obtaining a log. It is often written as "antilog."

Anti-Miller Effect - The decrease in the effective grid-cathode capacitance of a vacuum tube due to the charge induced electrostatically on the grid by the cathode through the grid-cathode capacitance.

aperture - An opening or gap. In optics, the effective aperture is the portion of an objective lens that is actually used.

apparent power - The power value obtained in an alternating current circuit by multiplying the effective values of voltage and current. The results is expressed in volt-amperes, and must be multiplied by the power factor to secure the average or true power in watts.

apsis - The point at which an orbiting body is the greatest or least distance from the center of attraction. The greatest distance is called the higher apsis and the least distance is called the lower apsis.

-quadag - The graphite coating on the inside of cathode-ray tubes for collecting the secondary electrons emitted by the screen.

arc - (1) A luminous glow formed by the flow of electric current through ionized air, gas, or vapor between separated electrodes of contacts. (2) A portion of the circumference of a circle.

Archimedes' principle - When a body is placed in a fluid, it is buoyed up by a force euqal to the weight of the displaced fluid.

architecture - Logical structure of a computer system.

Arithmetic and Logic Unit (ALU) - One of three essential components of a microprocessor. The other two are the registers and the control block. The ALU performs various forms of addition, subtraction, and logic operations, such as ANDing the contents of two registers or masking the contents of a register.

armature - (1) A piece of ferromagnetic material that is placed between or across the pole pieces of a magnet in such a manner that it may have motion relative to the pole pieces. (2) The buzzer, relay, magnetic phonograph pickup, or another electromagnetic device that depends on physical motion of a part of its magnetic circuit. (3) Originally the rotating part of an electric motor or generator. It carries the conductors that have motion relative to the magnetic field.

Armstrong oscillator - An inductive feedback oscillator, which consists of a turned grid circuit and an untuned tickler coil in the plate circuit. Control of feedback is accomplished by varying the coupling between the tickler and the grid circuit.

artificial line - A network which simulates the electrical characteristics of a transmission line.

ASCII - American Standard Code for Information Interchange. Character code used for representing information in most computer systems.

Assembler Program - Translates assembly language statements (mnemonics) into machine language.

Assembly Language - Machine-oriented language. A program is normally written as a series of statements using mnemonic symbols that suggest the definition of the instruction. It is then translated into machine language by an assembler program.

astable multivibrator - A free running multivibrator.

astigmatism - (1) A visual aberration caused by lack of sphericity of the cornea. (2) Ablurring of the trace of an oscilloscope.

Asychronous - Any circuit of system that is not synchronized by a common clock signal.

atom - Smallest particle of an element that can enter into combination with other elements.

atomic number - The number of protons in the nucleus, hence the number of positive charges on the nucleus.

atomic weight - The relative weight of the atom of an element based on an atomic weight of 16 for the oxygen atom as the usual chemical standard. The sum of protons plus neutrons is the approximate atomic weight of an atom.

attenuation - (1) The ratio of initial to final load power, expressed in decibels, when a network is inserted into a measuring system in which both the generator and load impedances have been adjusted so that they are nonreflecting. (2) The insertion loss measuring in an nonreflecting system. (3) The amplitude reduction of an electronic signal.

audio frequency - Any frequency in the range from about 20 to 20,000 Hz, corresponding to audible sound waves.

autocollimation - A process in which collimated rays of light emanating from an instrument, and carrying the image of a reticle, are aimed at a reflective surface. The reticle image is reflected back into the focal place of the telescope for comparison with the actual reticle as a measure of relative tilt, between the optical axis and the reflective surface. An instrument used for this purpose is called an autocollimator.

autoreflection - A process in which the reflected image of a target surrounding the front end of a telescope is compared with the telescope reticle as a measure of relative tilt. (The focal length is twice the dimension from the instrument to reflective surface.)

autotransformer - A transformer having one winding that is tapped somewhere along its length to provide three terminals. Usually, a part of the winding is considered the primary and the secondary includes all the turns on the coil.

autumn equinox - First day of autumn in the northern hemisphere. It usually falls on September 21st in the northern hemisphere. There are about 12 hours of light and 12 hours of darkness every place on the Earth during an equinox.

avalanche breakdown - In semiconductors, the condition when the applied voltage is sufficiently large to cause the covalent structure of the crystal to break down. Sometimes called the Zener point.

average value - (1) The value obtained by dividing the sum of a number of quantities by the number of quantities represented. (2) The average of many instantaneous amplitude values taken at equal intervals of time during an alternation (half-cycle) of alternating current. The average value of an alternation of a pure sine wave is 0.637 times its maximum or peak amplitude value.

Ayrton-Perry winding - Consists of two parallel opposed windings, either in a single layer crossing at every turn, or one layer wound over the other.

axis - A straight line, real or imaginary, passing through a body, on which the body revolves.

azimuth - The direction of one object with respect to another, expressed as an angle measured in a horizontal plane and in a clockwise direction from the north (true north, unless otherwise indicated).

B+ (B plus) - The positive terminal of a B battery or other plate-voltage source for a vacuum tube, or the plate-circuit terminal to which the positive source terminal should be connected.

B- (B minus) - Symbol used to designate the point in a circuit to which the negative terminal of the plate supply is to be connected.

B-H curve - A characteristic curve showing the relation between magnetic induction (B) and magnetizing force (H) for a magnetic material. It shows the manner in which the permeability of a material varies with flux density. Also called "magnetization curve."

backlash - A form of mechanical hystersis (lag) in which there is a lag between the application of a driving force and the response of the driven object.

backplane - The circuit board that other boards in a system plug into. Usually contains the system buses. Sometimes called a motherboard.

ballast resistor - A self-regulating resistor, usually connected in the primary circuit of a power transformer, which tends to compensate for variations in line voltage.

ballast tube - A tube which contains a ballast resistor, usually an iron wire resistor in a hydrogen-filled blub, which reduces the radiation of heat from the resistor.

band - Frequencies within two definite limits. Example: The standard broadcast band extends between 550 and 1600 KHz.

bandpass - The number of hertz cycles per second expressing the limiting frequencies at which the desired fraction (usually the halfpower points) of the maximum output is obtained.

bandpass filter - A filter that passes a desired band of frequencies, while frequencies above and below the desired frequency band are attenuated.

band rejection filter - An electrical device or circuit which suppresses an unwanted band of frequencies.

bandwidth - The number of cycles, kilocycles, or megacycles per second expressing the difference between the limiting frequencies of a frequency band. It can apply to any entity having frequency limits, as a tuned circuit, a combination of tuned circuits, a modulated radio signal, or a group of radio station channel assignments.

barometer - An instrument for measuring atmospheric pressure. There is a direct relationship between atmospheric pressure and altitude and many barometers are equipped with an altitude scale. Two types of barometers are "mercury" and "aneroid." The aneroid barometer with an altitude scale is an altimeter.

barretter - A bolometer consisting of an appropriately mounted short length of very fine wire, usually platinum, or a metallic film which has a positive temperature coefficient of resistance.

base - The center semiconductor region of a double junction (NPN or PNP) transistor. The base is comparable to the grid of an electron tube.

BASIC - An easy-to-learn, easy-to-use language, which is available on most microcomputer systems.

Baud Rate - Measure of data flow; the number of signal elements per second. When each element carries one bit, the Baud rate is numerically equal to bits per second (bps). For example, teletypes transmit at 110 baud. Each character is 11 bits, and the TTY transmits 10 characters per second.

BCD - Binary Coded Decimal. A 4-bit representation of the 10 decimal digits "0" through "9". Six of the sixteen possible codes are unused. Two BCD digits are usually packed into one byte.

beam - A beam of light can be regarded as the path traced by a small section of an advancing wave front, which is comprised of an infinite number of light rays.

beam-power tube - A vacuum tube having special deflecting electrodes that concentrate the electrons into a beam, giving high power output and other desirable characteristics. Another feature of this type is to minimize screen current and to create a concentration of electrons, between screen grid and plate, which acts as a suppressor grid.

beat frequency - One of the two additional frequencies obtained when signals of two different frequencies are combined in a nonlinear device. Their values are equal to the sum and difference, respectively, of the original frequencies.

Bernoulli's principle - With a fluid in motion, if the velocity is low, the pressure is high and vice versa.

benchmark - Method used to measure performance of a computer in a well-defined situation.

beta - The current amplification factor of a transistor when connected in a common-emitter configuration.

beta particle - Particle identical to an electron emitted from the nucleus of a radioactive atom.

bias - The average DC voltage between the control grid and cathode of a vacuum tube used to establish the quiescent operating condition of the tube. Increasing the bias will make the grid more negative with respect to the cathode.

bidirectional - Indicates that signal flow may be in either direction. Common bidirectional buses are three-state or open collector TTL.

bidirectional coupler - A device with two outputs, designed for insertion in a waveguide. It simultaneously samples and presents at one output a voltage that is largely a function of the wave traveling in one direction, and at the other output, a voltage that is largely a function of the wave traveling in the opposite direction.

bifilar winding - A method of winding transformers in which the wires are placed side by side, and wound together.

bilateral - Having, or arranged upon, two sides.

bimetallic element - Two strips of dissimilar metal bonded together so that a change in temperature will be reflected in the bending of the element, as a result of differential expansion. Used in thermostats, dial thermometers, and temperature compensating devices in the better pressure gages.

binary - A system of numbers using 2 as a base, in contrast to the decimal system which uses 10 as a base. The binary system requires only two symbols, 0 and 1. Two is expressed in binary by the number 10.

binary search - Technique in which the search interval is divided by two at every iteration.

bistable multivibrator - A circuit having two stable states. One side of the multivibrator will be cut off while the other side will be at a high level of conduction. This circuit is often called the Eccles-Jordan multivibrator in honor of the inventors. In some literature the bistable is mistakenly called a flip-flop multivibrator.

bit - Contraction of binary digit. A single digit in a binary number.

Bit-Slice - Method that implements an n-bit slice of the CPU, usually n=4. A bit processor chip implements a complete data path across the CPU. A thirty-two-bit processor could be constructed by using eight 4-bit CPU slices.

bleeder resistor - A resistor connected in parallel with the output of a power supply to improve voltage regulation by drawing a fixed bleeded current. Also used to dissipate the charge remaining in filter capacitors when the power supply is turned off.

blocked oscillator - A blocking oscillator that is biased to cutoff and must be triggered. It develops a sharp pulse for each trigger input.

blocking capacitor - Any capacitor used in a circuit to block the flow of DC while allowing an AC signal to pass.

blocking oscillator - A free running oscillator operating intermittently with grid bias increasing during oscillation to a point where oscillation stops, and then decreasing until oscillation is resumed. The output consists of sharp pulses.

blooming - Term applied to a CRT when too many electrons strike the screen and increase spot size. This is usually caused by an improperly set intensity control.

board tester - Product programmed to automatically simulate the circuits on a PC board and check the responses. Electrical failures can be detected and diagnosed to facilitate board repair.

boiling - Rapid vaporization which disturbs a liquid, and which occurs when the vapor pressure within a liquid is equal to the pressure on its surface.

bolometer - A small resistive element used in the measurement of low and medium RF power. It is characterized by a large temperature coefficient of resistance which is capable of being properly matched to a transmission line. The barretter and thermistor are widely used bolometers.

bonded strain gage - A thin metallic resistance element, usually of wire or foil, chemically cemented to a device being subject to loading or stress. As the load (stress) changes, the electrical resistnce of the strain gage changes. Thus, for a fixed value of applied voltage, the output voltage from the strain gage varies in proportion to the strain and provides an indication proportional to the load causing the stress and resultant strain.

Boolean Algebra - The branch of symbolic logic that is used extensively for binary computer applications.

Boolean Logic - Named after George Boole, who defined binary arithmetic and logical operations such as AND, OR, NOT, and XOR.

bootstrap - Program used to initialize the computer. Usually cleans memory, sets up I/O devices, and loads the operating system.

bounce - Oscillations and noise generated when a mechanical switch is opened or closed. See debounce.

bourden element - A curved, hollow tube sealed at one end. When fluid under pressure is forced in the tube it has a tendency to straighten out. With a pointer attached to the sealed end and allowed to move across a scale it becomes a bourdon gage.

Boyle's Law - If the temperature of a gas is kept constant, then the volume of the gas will be inversely proportional to the pressure.

branch - See jump.

breakdown voltage - The voltage at which the insulation between two conductors or parts will break down.

breakpoint - Software or hardware device that stops the program and saves the current machine status, under user specified conditions.

bridge circuit - An electrical network that is basically composed of four branches connected in the form of a square. One pair of diagonally opposite junctions is connected to the input, and the other pair is connected to the output circuit which contains an indicating device.

bridge rectifier - A full-wave rectifier with four elements connected as in a bridge circuit. Alternating voltage is applied to one pair of junctions.

British Thermal Unit (BTU) - The amount of heat that will raise the temperature of 1 pound of water 1° Fahrenheit from 62°F to 63°F.

broadband amplifier - An amplifier that maintains a flat response over a wide range of frequencies.

Bubble Memory - Memory that utilizes microscopic magnetic domains in an aluminum garnet substrate. Important because they are nonvolatile, solid-state memories.

buffer - An IC that is used to restore the logic drive level.

buffer - An isolating circuit used to avoid reaction of a driven circuit upon the corresponding driving circuit.

buncher - (1) The input resonant cavity in a conventional klystron oscillator. (2) The electrode of a velocity-modulated tube which concentrates the electrons in a constant current electron beam into bunches.

bug - An error. Eliminating errors is known as debugging.

burn-in - Component testing method used to screen out early failures by running the circuit for a specified length of time.

buoyancy - The power to float or rise in a fluid.

buoyant force - The upward force which any fluid exerts on a body placed in it.

bus - An uninsulated conductor. Its cross section may be solid, hollow, square, or round.

bus - Path for signals that have a common function. Most microprocessors use three buses: the data bus, address bus, and control bus.

bus conflict - Conflict that occurs when two or more device outputs of opposite logic states are placed on a three-state bus at the same time.

bus controller - Generates bus commands and control signals.

bus driver - An IC that is added to a bus to provide sufficient drive between the CPU and the other devices that are tied to the bus. These are necessary because of capacitive loading, which slows down the data rate and prevents proper time sequencing of microprocessor operation.

bus termination - Method of preventing reflection at the end of a bus. Necessary only in high-speed systems.

by-pass capacitor - A capacitor that is used to provide a comparatively low impedance path for alternating currents around a circuit element.

byte - Group of 8 bits. Can be used to represent a character. Microcomputer instructions require one, two, or three bytes. A word can be one or more bytes.

calibrate - To detemine by measurement or comparison the correct value of each scale reading on a meter or other device being calibrated. To determine the settings of a control that corresponds to particular values of voltage, current, frequency, or some other characteristic.

call - Jump to a subroutine. A jump to the specified address is performed, but the contents of the program counter are saved (usually in the stack) so that the calling program flow can resume when the subroutine is finished.

calorie - The amount of heat required to raise the temperature of 1 gram of water 1° Celsius at 15° Celsius.

candela - Unit of luminous intensity. It is of such a value that the luminous intensity of a full radiator at the freezing temperature of platinum (1773°C) is 60 candela per centimeter squared. Candela was formerly termed candlepower, or simply candle.

capacitance - (1) The ability to store electrical energy, measured in farads. (2) The property of a capacitor or circuit which determines the amount of electrical energy which can be stored in it by applying a given voltage. (3) In a semiconductor diode, the small signal capacitance measured between the terminals of the diode under specified conditions of bias and frequency.

capacitive reactance - That type of reactance which is caused by the capacitance of a circuit. It is measured in ohms, designated by X_C, and is equal to the reciprocal of $2 \pi fC$, where C is in farads and f is in hertz.

capacitor - Two conducting surfaces, or sets of conducting surfaces, separated from each other by an insulating material (dielectric) such as air, paper, mica, glass, or oil. A capacitor stores electrical energy, blocks the flow of direct current, and limits the flow of alternating current to a degree dependent upon the capacitance and the frequency.

capacitor input filter - A filter which has a capacitor connected directly across (in parallel with) its input.

capillarity - The characteristic of a liquid to be raised or depressed in a tube or small bore. This action is caused by a combination of cohesive, adhesive, and surface tension forces.

carbon resistor - A resistor made of carbon particles and a ceramic binder molded into a cylindrical shape, with connecting leads attached to opposite ends.

carrier frequency - The frequency of the unmodulated carrier wave, if sinusodial, or the center frequency of the unmodulated carrier, when a recurring series of pulses is used.

carry flag - Flag bit in the microprocessor's status register, which is used to indicate the overflow of an operation by the arithmetic logic unit.

cascade - In sequence, as tuning circuits or amplifier stages used one after another.

cascade amplifier - An amplifier of several stages, the output of one being the input of the next.
cascode amplifier - A two-stage amplifier circuit combining a grounded-cathode input section with a grounded-grid output section. This amplifier provides good gain and low noise.

cathode - The electron-emitting electrode of a radio tube. Thermionic vacuum tubes employ heated cathodes. Gas tubes often employ cold cathodes.

cathode interface - An additional tube containing caused by separation of the cathode coating from the metal. It causes an overshoot at the leading edge of a square wave.

cathode bias - A method of biasing a vacuum tube by placing the biasing resistor in the common return circuit.

cathode ray tube (CRT) - An electron tube containing an electron gun that directs a beam of electrons at a fluorescent screen inside the large end of the tube. A glow is produced at the point where the beam strikes the screen. Electrostatic deflecting plates or electromagnetic deflecting coils are used to sweep the beam over the screen and make it trace thereon the waveform of a voltage or current or produce a pattern or complete image.

cavity resonator - A space totally enclosed by a metallic conductor and excited in such a way that it becomes a source of electromagnetic oscillations. The size and shape of the enclosure determines the resonant frequency. For a cylinder, the maximum resonantors wavelength is 2.61 times the radius. Cavity resonators have an extremely high Q factor, which can be as great as 50,000. They are used in ultrahigh frequency systems.

CCD - Charge Coupled Device. Serial storage technology that uses MOS capacitors.

Celsius temperature scale - A temperature scale based on mercury in glass thermometer with the freezing point of water defined at 0°C and the boiling point of water defined at 100°C, both under conditions of normal atmospheric pressure. Often called the Centigrade scale.

center of instrument - In optics, the intersect point of the vertical, horizontal, and optical axis of a transit or similar instrument when perfectly calibrated.

Central Processing Unit - Computer module in charge of fetching, decoding, and executing instructions. It incoporates a control unit, an ALU, and related facilities (registers, clock, drivers).

certify - To attest a being true or as represented, or to meet a certain standard.

cgs system - The common metric system of units (centimeter-gram-second).

characteristic curve - A graph which shows interraltion between two changing values, as the effect of a change in grid voltage on the plate current of a vacuum tube.

characterisitc impedance - The ratio of applied voltage to steady state current at a given frequency for a uniform and infinitely long transmission line. It is measured in ohms and designated Z_0.

charge - (1) The electrical energy stored in a capacitor or held on an insultated object. An object having more electrons than normal has a negative charge. An object having fewer electrons than normal has a positive charge. (2) To furnish electrical energy to a capacitor, insulated metal object, or storage battery.

charging current - (1) The current flowing into a capacitor when a voltage is applied. (2) A current flowing in the correct direction to charge a storage battery. (3) The correct current at which a particular storage battery should be charged.

Charles Law - The volume of a gas is directly proportional to its absolute temperature, providing the pressure is constant.

chassis - The metal framework on which the parts of the circuitry are mounted.

checkerboard - Memory test pattern in which alternate 1's and 0's are stored in the cells of the memory array.

checksum - Method used to verify the integrity of data loaded into the computer.

chemical compound - A pure substance composed of two or more elements combined in a fixed and definite proportion by weight.

chip - Common name for all ICs.

Chip Enable (CE) - See Chip Select.

Chip Select (CS) - Usually enables three-state drivers on the chip's output lines. Most LSI chips have one or more chip selects. The CS line is used to select one chip among many.

choke coil - An inductor that is used to limit or suppress the flow of alternating current without appreciably affecting the flow of direct current. Also called an impedance coil.

chopper circuit - A circuit that produces a square wave from a DC voltasge by opening and closing the circuit.

chromatic aberration - A property of lenses that causes the various colors in a beam of light to be focused at various points, this causing a spectrum to appear.

circuit - A complete path over which electrons can flow from the negative terminal of a voltage source through parts and wires to the positive terminal of the same voltage source.

clamping circuit - A circuit which either amplitude extreme of a waveform is maintained at a certain potential level. Also known as a DC restorer.

class A amplifier - An amplifier in which pate current flows at all times and the amplification is essentially linear. The grid voltage is chosen to place the operating point in such a way that the input signal voltage will swing over a straight portion of the tube characteristic curve at all time but will never swing down to the curve portion near cutoff.

class B amplifier - An amplifier in which the grid bias is at, or very near, cutoff so that the plate current is essentially zero when there is no input signal. Plate current then flows for approximately one-half of each input signal cycle. If grid current does not flow during any part of the input cycle, the subscript "2" is used. Class B operation is used in both radio frequency and audio frequency amplifiers, generally in push-pull stages.

class C amplifier - An amplifier in which the grid bias is considerably greater than cutoff, so that the plate current is zero with no input signal to the grid and flows appreciably less than one-half of each input signal cycle. The grid may swing positive far beyond saturation.

clear - Set a circuit to a known state, usually zero.

clinometer - The clinometer is, in principle, a level mounted on a rotatable member, whose angle of inclination relative to its base can be measured by a circular drum scale.

clock - Reference timing source in a system. A clock provides regular pulses that trigger or synchronize events.

closed-loop - Circuit operating with feedback, whose input are a function of its outputs.

coaxial cable - A cable consisting of one conductor (usually a small copper tube or wire) within, and insulated from, another conductor of larger diameter (usually copper tubing or braid).

coaxial transmission line - Consists of two conductors, one of which is hollow. The second conductor is placed inside the hollow conductor and spaced uniformly throughout the length of the line. It can be used for frequencies up to 12.4 GHz.

code - A machine language itself, or the processing of converting from one language to another.

coefficient of coupling - A numerical rating between 0 and 1 that specifics the degree of coupling between two circuits. Maximum coupling is 1 and no coupling is 0.

coefficient of linear expansion - The change in unit length in a solid temperature is changed 1°.

coefficient of volume expansion - The change in unit volume of a solid when its temperature is changed 1°.

cohesion - The force that causes molecules which are brought close together, as in liquids and solids, to stick together. This force is especially strong in solids when the distance between molecules is very small.

oincidence - Exact correspondence. In optics, a coincidence bubble is :quipped with a prismatic or mirror arrangement for simultaneously viewing)oth ends of the bubble for more precised adjustment.

:oincidence tube - An electronic tube that requires a positive potential on its control grid and suppressor grid before it will conduct.

cold cathode - A cathode that is not heated. Electrons may be pulled out of the cathode by field emission.

collector - A electrode of a transistor. One of the outer layers of a junction-type transistor. It corresponds roughly to the plate of a triode tube. It collects charge carriers.

collimation - The process of aligning the axis of the optical elements with respect to the mechanical axis of an instrument.

collimator - An instrument designed to produce collimated (parallel) rays of light, usually equipped with displacement and tilt graticules.

Colpitts oscillator - An oscillator in which the parallel-tuned tank circuit is connected between grid and plate. The tank capacitor consists of two series voltage deivider capacitors. The regenerative feedback is developed across one of these capacitors.

Combinational Logic - Circuit arrangement in which the output states is determined only by the present state of the input. Also called combinatorial logic.

Comment Field - Field within an instruction that is reserved for comments, ignored by the compiler or the assembler when the program is converted to machine code.

commutator - A cylindrical arrangement of copper segments mounted radially on the shaft of an armature, separated from each other and the armature by insulation, and connected to individual armature coils.

compiler - Translation program that converts high-level instructions into a set of binary instruction (machine code) for execution. Each high-level language required a compiler or an interpreter. A compiler translates the complete program, which is than executed.

complement - Process of changing each 1 to a 0 and each 0 to a 1.

complex number - The expression resulting when a real number is united with an imaginary number by a plus or minus sign.

complex vibration - The combination of two or more sinusodial vibrations existing simultaneously.

composition resistor - A resistor made of a mixture of carbon and clay molded into a cylindrical shape with wire terminals imbedded in each end of the unit.

compound - Two or more substances combined in definite proportions by weight and united chemically.

computer - General-purpose computing system incorporating a CPU, memory, I/O facilities, and power supply.

concave - A lens that is thicker at the ends than the middle. A concave lens diverges (spreads) rays of light.

concentricity - Having a common center, as circles or spheres one within another.

condensation - The change of state from a gas or vapor to a liquid.

condition code - Refers to a limited group of program conditions, such as carry, borrow, overflow, etc. that are pertinent to the execution of instruction. The codes are contained in a condition code register. Same a flag register.

conditional jump or call - Instruction that when reached in a program will cause the computer either to continue with the next instruction in the original sequence or to transfer control to another instruction, depending on a perdetermined condition.

conductance - The ability of a material to conduct or carry an electric current. Conductance is the reciproical of resistance and is measured in mhos.

conductance band - The minimum energy level an electron must obtain to become a free electron.

conductivity - The specific conductance of a unit specimen of a material reciprocal of resisitivity.

constant - A fixed value.

constant amplitude signal generator - A signal generator that keeps a constant amplitude as the frequency of the output is changed.

contact resistance - The resistance in ohms caused by the resistance of the contacts of terminal connections, relays, and switches. The value of resistance is gererally only a fraction of an ohm but is important because it can cause a large error in precise measurement of low value resistors.

continuous wave (CW) - An unmodulated, constant amplitude wave.

control block - Circuits that perform the control functions of the CPU. That are responsible for decoding instructions and then generating the internal control signals that perform the operations requested.

control bus - Set of control lines in a computer system. Provides the synchronization and control information necessary to run the system.

control grid - That electrode in a vacuum tube which has the most effective control over the plate current passed by the tube. The control grid is usually the electrode nearest the cathode.

control program - Sequence of instruction that guide the CPU through the various operations it must perform. This program is stored permanently in ROM memory where it can be accessed by the CPU during operation. Usually this ROM is located within the microprocessor chip. Same as microprogram or microcode.

copper-oxide rectifier - A rectifier consisting of a disk of copper coated with copper oxide on one side, with a soft lead washer providing electrical contact with the oxide surface. The resistance is considerably lower for electron flow from the copper to the oxide than for electron flow in the reverse direction; hence rectification is obtained in alternating current circuits.

core - Small magnetic toruses of ferrite that are used to store a bit of information. These can be string on wires so that large memory arrays can be formed. The main advantage of core memory it is nonvolatile.

correction - The correction is the value in proportional parts, that must be algebraically added to the nominal value to obtain the certified value. The correction is equal in absolute magnitude but opposite in sign to the error. Correction is what must be done to the nominal to reach the actual.

cosmic rays - Rays of higher frequency than radioactive gamma rays; highly penetrating, of unknown origin, traversing interplanetary space.

coulomb - Unit of quantity of electricity. The quantity of electricity transported in 1 second by a current of 1 ampere, or a movement of 6.28×10^{18} electrons past a given point in 1 second.

counter electromotive force - In an inductor, an induced voltage that opposes the inducing voltage at every instant of time in an effort to oppose any change in the magnetic flux linkage.

counting circuit - A circuit that receives uniform pulses representing units to be counted and produces a voltage in proportion to their frequency.

coupling - The means by which signals are transferred from one circuit to another.

convex - A lens that is thicker in the middle than the ends. A convex lens converges rays of light.

CPS - Characters Per Second.

CPU - See Central Processing Unit.

crash - Hardware or software malfunction that causes the system to halt or become lost in a loop.

CRC - See Cyclic Redundancy Check.

creep - The long term change in dimensional characteristics of a body under load, in an elastic force measurement device, this term refers to the change in reading which occurs when a constant load is applied for a period of time.

critical angle - The angle at which total reflection begins, when the angle of incidence of a light ray entering glass from air is increased to the extent that reflection, instead of refraction occurs.

critical coupling - The degree of coupling that provides maximum transfer of energy at the resonant frequency. Also called optimum coupling.

critical damping - The minimum viscous damping that will allow a displated system to return to its initial position without oscillation about the neutral position.

Cross-Assembler - Assembler that runs on a processor whose assembly language is different from the language being assembled.

Crosstalk - Interference between two signals.

CRT Terminal - Computer terminal using a CRT display and a keyboard, usually connected to the computer by a serial link.

critical frequency - A particular resonant frequency at which damage to or degradation of performance of equipment may or does result.

cryogenic - The science of refrigeration pertaining to the methods for producing and measuring very low temperatures.

crystal - Piezoelectric or oscillation-control crystal; a natural substance such as quartz or tourmaline, which is capable of producing a potential difference when subjected to mechanical pressure (deformation), or is capable of undergoing mechanical deformation when subjected to a potential difference. In a suitable feedback circuit, it vibrates at its mechanical resonant frequency and thereby produces stable electrical oscillations.

crystal controlled oscillator - An oscillator in which a crystal is used to determine the frequency and increase frequency stability.

crystal detector - Consists of a very small piece of semiconducting material mounted in a suitable container. It is widely used in microwave measurements due to its high sensitivity and wide frequency response.

crystal oven - An electrically heat enclosed space in which piezoelectric crystals are mounted so as to keep their tempatures constant, thus assuring freedom from frequency drift due to temperature changes.

current saturation - The condition in which the plate current of a therminonic vacuum tube cannot be further increased by increasing the plate voltage. The electrons are then being drawn to the plate at the same rate as they are emitted from the cathode. Also called plate saturation or voltage saturation.

current tracer - Hand-held troubleshooting tool used to detect current flow in logic circuits.

cutoff - (1) The minimum value of negative grid bias that will prevent the flow of plate current in a vacuum tube. (2) In a selective circuit, the frequency above or below which the circuit fails to respond.

cutoff frequency - Generally taken as the frequency at which the gain of a device is 3 db below its low frequency value. Used when referring to variations of alpha or beta respect to frequency.

cycle - (1) The complete sequence of instantaneous values of a periodic event that occurs during one period. (2) In electricity, one complete positive alternation and one complte negative alternation of an alternating current.

cycle time - Total time required by a memory device to complete a read or write cycle and become available again.

Cyclic Redundancy Check (CRC) - Binary polynomial. Used to generate check information on blocks of data. Similar to a checksum, but is harder to generate and more reliable.

D/A - See Digital to Analog Converter.

DAC - See Digital to Analog Converter.

daisy chain - Bus line that is interconnected with units so that the singal passes from one unit to the next in serial fashion.

damped waves - Alternating current waves that progressively decrease in amplitude during successive cycles.

damping - (1) The prevention of free swinging or vibration by some means, usually friction or resistance. (2) The dissipation of energy with motion or time.

damping (galvanometer) - When an induced current flows in a direction to oppose motion of the coil, the galvanometer is said to be damped and the coil moves slowly. It is possible to control damping in a galvanometer circuit by controlling the amount of induced current. For some particular value of external resistance placed across the terminals of the galvanometer the pointer will return to its zero position in a minimum time without swinging past zero. The galvanometer is then critically damped and the value of the external resistance is the external ciritical damping resistance (CDRX). When the external resistance is less than the CDRX, the pointer approaches zero sluggishly and the galvanometer is overdamped. If the external resistance is greater than the CDRX, the pointer swings past zero and tends to oscillate and the galvanometer is underdamped.

D'Arsonval movement - The basic moving coil meter movement. It consists of a coil of many turns suspended between the poles of a permanent magnet.

data - General term denoting any or all facts, numbers, letters, and symbols, or facts that refer to or describe an object, idea, condition, situation, or other factors. Connotes basic elements of information that can be processed or produced by a computer. Sometimes data is considered to be expressible only in numerical form, but information is not so limited.

data acquisition - Collection of data from external sensors, usually in analog form.

data base - Systemic organization of data files for easy access, retrieval, and updating.

data bus - Set of lines carrying data. The data bus is usually bidirectional and three-state.

data domain - Analysis or display of signals in which only their digital value is considered and not their precise voltage or timing. A logic state analyzer displays information in the data domain.

dbm - Units used in communications for measuring absolute power level; power decibels measured from a 1 milliwatt reference level.

DC amplifier - An amplifier that is capable of amplifying small variations in direct current. It employs direct coupling between stages.

DC plate resistance - The value of the DC plate voltage divided by the DC plate current of a vacuum tube.

debouncing - Elimination of the bounce signals characterisic of mechanical switches. Debouncing can be performed by either hardware or software.

debugger - Program designed to facilitate software debugging. In general, it provides breakpoints, dump facilities, and the ability to examine and modify registers and memory.

debugging - Process or eliminating hardware or software errors in a system.

decade box - In measurement work, a special device containing two or more sections. Each section is divided into 10 equal parts and has a value of 10 times the value of the preceding section. Switching arrangements permit selection of any desired value in its range.

decay time - The time required for the trailing edge of a pulse to decrease from 90 percent to 10 percent of its maximum amplitude. Also referred to as fall time.

decibel - A standard unit used for comparison of two quantities of electrical or acoustical (sound) power. One decibel is roughly the amount that the intensity of a pure sine wave sound must be changed in order for the change to be just barely detectable by the human ear. The amount of change in power level, expressed in decibels, is equal to 10 times the common logarithm of the ratio of the two powers.

decoder - Logic device the decodes binary inputs. A 3-bit decoder (e.g. 74138) will have 2^3=8 outputs because a 3-bit number can have 8 different values.

decoupling network - A network that is used to prevent the interaction of two circuits.

decrement - Programming instruction that decreases the contents of a storage location.

dedicated - Set apart for some special use. A dedicated microprocessor is one that has been specially programmed for a single application such as weight measurement, traffic light control, etc. ROMS by their vary nature are dedicated memories.

definition - The fidelity with which an oscilloscope forms an image having fine detail. When the image is sharp and has definite lines and boundaries, the definition is said to be good.

deflection coil - An inductor used to produce a magnetic field that will bend the electron beam a desired amount in the CRT of an oscilloscope. Also called the deflecting yoke.

deflector factor - The voltage required on the deflect plates to produce a unit deflection on the CRT screen. It is the reciprocal of the deflection sensitivity.

deflection sensitivity - The amount of displacement of the electron beam at the screen of a CRT per unit change in the deflecting field. Usually expressed in millimeters per volt applied between deflecting electrodes. It is the reciprocal of deflection factor.

degeneration - A circuit arrangement wherein a signal is fed back from the output to the input in such a way that it tends to cancel the input signal. It is used to stabilize the operation of the circuit.

deionization potential - The potential at which the ionization of the gas within a gas-filled tube ceases and conduction stops.

delay line - A real or artifical transmission line consisting of inductance and capacitance to delay a signal a prescribed amount.

delay time - The time required to change the charge of the emitter base capacitance from the reverse condition to the forward biased condition.

density - The quantity of matter contained in a body or, more definitely, the mass per unit volume.

De Santy bridge - An AC bidge used to measure capacitance and dissipation factor. It is composed of resistors and a standard capacitor. A variable resistor is used to obtain the amplitude null and a variable resistor as used to obtain the phase null.

detection - The process of extracting the intelligence, audio and video frequency component from the modulated RF signal. Also called demodulation.

Development System - Microcomputer system with all the facilities for hardware and software development for a given microprocessor. Generally consists of a microcomputer system, CRT display, printer, mass-storage (usually dual floppy-disk drives), PROM programmer, and in-circuit emulator.

dew point - The temperature at which the water vapor in the air begins to condense. At this temperature the relative humidity is 100 percent.

dial indicator - This is a mechanical lever system used for amplifying small displacements and measuring it be means of a pointer which transverses a graduated dial.

dielectric - The insulating material between the plates of a capacitor; generally air, mica, paper, or oil. All insulating materials are dielectrics in that they are capable of sustaining an electric field and undergoing electric polarization.

dielectric absorption - The property of an imperfect dielectric whereby all electric charges within the body of the material caused by an electric field are not returned by the field. Dielectric absorption increases with a decrease in frequency.

differential synchro - A synchro in which both rotor and stator are wound so that they produce rotating magnetic fields. Changing the position of the rotor causes a differential angle to be put into the system.

differential voltmeter - A voltmeter that operates on the potentiometric principle. The unknown voltage is compared to an adjustable calibrated voltage developed within the differntial voltmeter.

differentiating circuit - A circuit in which the output voltage is proportional to the rate of change of the input voltage. In an RC circuit the output is taken across the resistor, and in an RL circuit it is taken across the inductor.

diffraction - The bending of waves, light, sound, or radio, as they pass an obstruction or pass through a small aperture.

diffusion - (1) The penetration of one type of particle into a mass consisting of a second type of particle. (2) To spread out in all directions.

digit - Sign or symbol used to convey a specific quantity of information either by itself or with other numbers of its set; 2, 3, 4, and 5 are digits. The base or radix must be specified and each digit's value assigned.

digital - Having descrete states. Most digital logic is binary, with two states (on or off).

Digital to Analog Converter - Converts from the digital representation used in computers to the analog signal used in the real world.

digital voltmeter - An automatic electronic measuring instrument which displays its measurements directly in the decimal system. It is an automatic potentiometric measurement.

digitize - Process of converting an analog quantity into a digital quantity.

dimensional analysis - A process whereby the metrologist separates a quantity into its constituent parts to facilitate the solution to a problem.

diopter - The unit of lens power, is usually denoted by D and is the power of a lens of 1 meter focal length.

DIP - Dual In-line Package. Standard IC package with two parallel rows of pins.

direct addressing - Standard addressing mode, characterized by the ability to reach any point in main storage directly. The address is specified as part of the instruction.

direct coupling - The use of a conductor to connect two amplifier stages together and provide a direct path for signal currents. This allows very low frequencies and DC to pass between stages.

Direct Memory Access (DMA) - Method of gaining direct access to main storage in order to perform data transfers without involving the CPU.

disable - Process of inhibiting a device function.

discriminator - A circuit whose output voltage varies in amplitude and polarity in accordance with the frequency of the applied signal. Its principal uses are as a demodulator in a frequency modulation receiver and as an automatic frequency controlling device.

displacement - The amount of change inposition from a reference.

dissipation factor (DF) - The ratio of the energy dissipated to the energy stored. It represents the total power loss of a capacitor or inductor.

dissipative loss - That portion of attenuation contributed to the actual dissipative of energy as compared to the reflection of energy, used when referring to dissipative losses only in lieu of the common term "attenuation."

distortion - Any deviation from the desired waveform. Distrotion can be caused by irregularities in amplitude, frequency, phase, or noise.

distortion analyzer - A measuring instrument used to determine the distortion present on a sinusodial waveform.

distributed capacitance - Capacitance distributed between wires, parts or conducting elements, and the ground, as distinguished from capacitance concentrated in a capacitor.

DMA - See Direct Memory Access.

dominant mode - The waveguide mode that produces the longest operating wavelength, has the greatest enegy transfer efficiency, and has the simplest configuration.

donor - A substance (impurity) which, when added to a pure semiconductor material, results in an increase in the number of free electrons so that major conduction through the material takes place as a movement of electrons. Since this is equivalent to the transfer of a negative charge, the resulting alloy is called an N-type semiconductor.

DOS - Disk Operating System.

dot matrix - Method of forming characters by using many small dots.

Double Precision Arithmetic - Uses two words to represent each number.

dove - A prism which inverts the image without displacement. Also called a rotating prism.

Doppler effect - The change in the observed frequency of a wave reaching an observer, due either to motion of the source (toward or away from the observer), motion of the observer, or a shift in the reflecting layer.

drift - The movement of majority carriers in an electric field supplied by an external source, that is, electrons move toward a positive pole, holes toward a negative pole.

drift space - In an electron tube, a region substantilly free of externally applied alternating fields, in which relative repositioning of the electrons takes place.

dropping resistor - A series used to decrease the voltage by the amount of the voltage drop across the resistor.

ductility - That property of material which will permit it to be drawn into a wire.

dump - Transferring the contents of major blocks of memory.

duty cycle - Ratio of the on-time to the total time or the pulse width to pulse recurrence time (PW/PRT).

Dynamic Memory - Memory devices whose stored data must be continually refreshed to avoid degradation. Each bit is stored as a charge on a single MOS capacitor. Because of charge leakage in the transistors, dynamic memory must be refreshed every 2 ms by rewriting its entire contents. Normally,

echo - Action of sending a character input from a keyboard to the printer or display.

echo - A wave that has been reflected or otherwise returned with sufficient magnitude and delay to be seen (or heard) in some manner.

eddy currents - Circulating currents induced in a conductor by a varying magnetic field. These currents are undesirable in most instances because they represent loss of energy and cause heat. In the iron cores of transformers and other iron core devices carrying alternating current, laminated construction is used to shorten the paths for eddy currents and thus kep eddy current losses to a minimum.

Edison effect - The emission of electrons from hot bodies. The rate of emission increases rapidly with temperature. Also known as thermionic emission.

effective value (RMS) - The alternating current value that will produce the same amount of heat in a resistance as the corresponding direct current value. All alternating current meters, unless otherwise marked, indicate effective values of voltage or current. The effective value is also called RMS (root-mean-square) value.

efficiency - The ratio of useful output energy to input energy, usually expressed as a percentage. A perfect electrical device would have an

efficiency of 100 percent.

elasticity - The property of material to return to its original shape after stress is removed.

elastic limit - The smallest stress which produces permanent distortion.

E Layer - An ionized layer in the E region of the ionosphere. This layer occurs during daylight hours; its ionization depends on the angles of the sun.

Electromagnetic Interference (EMI) - Interference caused by electric fields.

electron - A subatomic particle processing a unit negative charge.

electron coupled oscillator - An oscillator circuit employing a screen grid tube so connected that its screen grid is used as a plate in connection with the control grid and cathode. It acts as an ordinary triode oscillator circuit, with the output taken from the plate circuit.

electron gun - The beam-forming structure in the neck of a CRT, consisting of an electron emitting cathode and associated electrodes that concentrate, control, and focus the stream of emitted electrons in a beam that produces a spot of the desired size on the screen at the end of the tube.

electron emission - The ejection of electrons from the surface of a material into surrounding space under the influence of heat, light, high voltage, impact, or any other cause. Quantitatively, electron emission is the rate at which electrons are emitted from an electrode.

electronics - That branch of physics which relates to the emission behavior and effects of electron condition through gases, vacuum, semiconducting or electronic switch - An electronic circuit designed to cause a start and stop action or a switching action.

electron volt - Energy required to move an electron between two points which have ptotential difference of 1 volt.

electrostatic - Pertaining to electricity at rest, such as charges on an object (static electricity).

electrostatic voltmeter - A voltmeter that works on the principle of attraction or repulsion of like electrical charges. The electrostatic voltmeter could be likened to a capacitor with one moveable plate, on which a pointer is mounted. The electrostatic voltmeter is used to measure high values of AC and DC voltages.

electrical angle - A means of specifying a particular instant in an alternating current cycle. One cycle is considered equal to 360°, hence a half-cycle is 180° and a quarter-cycle is 90°. If one voltage reaches a peak value a quarter of a cycle after another the electrical angle between the voltages (the phase difference) is 90°.

electric field - A region in space surrounding a charged object, or the electric component of the electromagnetic field associated with radio waves and with electrons in motion. Lines drawn to represent the direction in which the electric field will act on other charged objects are called electric lines of force.

electricity - A fundamental quantity in nature, consisting of electrons and protons at rest, or in motion. Electricity at rest has an electric field that possesses potential energy and can be exert force, as in charged pith balls. Electricity in motion ordinarily consists of a movement of electrons through a conductor or through space.

electrode - A terminal at which electricity passes from one medium into another, as the individual elements of a vacuum tube, the plate of battery cells or the plates of capacitors.

electrolyte - The liquid, chemical paste, or other conducting medium used between the electrodes of a battery, electrolytic capacitor, or electrolytic rectifier.

electrolytic capacitor - A capacitor consisting of two metallic plates separated by an electrolyte. Under the action of the applied DC voltage a film of hydrogen has is formed on one plate. This film acts as the dielectric. The electrolyte is actually the negative electrode.

electromagnet - A core of soft iron that is temporarily magnetized by sending current through a coil or wire wound around the core.

electromagnetic spectrum - Total range of frequencies of electromagnetic waves.

electromagnetic waves - Radiation taking many different forms and exhibiting widely differing properties. Long wavelength radiations (radio waves) consist of electric and magnetic fields perpendicular to each other and the line of travel. As wavelength decreases, the radiation acts less like waves and more like energy particles.

electromagnetism - Magnetic effects produced by currents rather than by permanent magnets.

electromotive force (EMF) - Difference of electrical potential, or pressure, measured in volts. The property of a device which tends to produce an electric current in a circuit.

element - (1) In chemistry, one of the 100-odd primary substances that cannot be divided into simpler substances by chemical means. (2) A component part of a vacuum tube.

elevation - The vertical distance above a reference level, usually sea level, to a point or object on the surface of the Earth, as distinguished from altitude, which refers to points above the Earth's surface.

empirical - Based on actual measurement, observation, or experience without regard to science and theory.

enable - Input signal that allows the device function to occur.

energy - Capacity for performing work. Energy due to the motion of a piece of matter is called kinetic energy. Energy due to the position of a piece of matter is called potential energy.

envelope - (1) The glass or metal housing of a vacuum tube. (2) A curve drawn to pass through the peaks of a graph showing the waveform of a modulatd RF carrier signal.

EPROM - Erasable Programmable Read Only Memory. A PROM that can be reused. Most EPROM's can be erased by exposing them to ultraviolet light.

equivalent circuit - A relatively simple circuit arrangement of resistors, inductors, and/or capacitors which is electrically equivalent to a more complicated circuit or device. Used to simplify circuit analysis.

erect - Not inverted, the normal position.

erector lens - Additional optics fitted to the eyepiece lens system enabling the image to be viewed in the normal (erect) position.

error - The error is the difference between an observed value or calculated value and the true or actual value.

Error Correcting Code - Code using extra bits to automatically detect and correct errors.

evaporization - The change of state from a liquid to a gas.

execute (cycle) - Last cycle of instruction execution. During this time, the instruction operation is performed.
execution time - Time required for the execution of an instruction.

exponent - Power of ten by which a number is multiplied, used in floating point representation. For example, the exponent in the decimal number 0.9873×10^{7} is 7.

extinction potential - The lowest value to which the plate voltage of a gaseous tube can be reduced from a higher value under given conditions, without stopping the flow of plate current.

exponential - Pertaining to varying exponents or to an expression having varying exponents. Any constant base affected with an exponent is exponential.

eyepiece - An essential component of a telescope which receives a real image in its focal plane and forms a magnified virtual image.

Fahrenheit scale - A thermometric scale on which the freezing point of water is 32° and boiling point 212°, both at standard pressure.

falling edge - High-to-low logic transition.

fall-time - (1) In transistors, the time needed for the output pulse to decrease from 0.9 to 0.1 of its maximum amplitude. (2) In dead weight testers, a leak test within the system is closed and the rate of fall of the piston is indicative of the overall leakage. (3) Often used to describe the decay time of a pulse.

Fan-In - Electrical load presented by an input. Usually expressed as the number of equivalent standard input loads.

Fan-Out - Electrical load that an output can drive. Usually expressed as the number of inputs that can be driven.

farad - Unit of electric capacitance. The capacitance of a capacitor between the plates of which there appears a difference of potential of 1 volt when it is charged by a quantity of electricity equal to 1 coulomb.

feedback - The transfer of energy from the output circuit of a device back to its input. Degenerative feedback is the process whereby a part of the power in the output circuit reacts upon the input circuit in such a manner as to reduce initial power, thereby decreasing the amplification. Regenerative feedback is the process whereby a part of the power in the output of an amplifying device reacts upon the input circuit in such a manner as to increase the initial power, thereby increasing the amplification.

feedback - Information from one or more outputs to be used as inputs in a control loop.

Fermi level - The Fermi level in a semiconductor is located at the value of energy at which there is a 50% probability of an energy state (at that level) being occupied by an electron. It is merely a mathematical marker in energy terms and is not a physical entity in the same sense as an atomic level.

fetch - Reading an instruction from memory.

fidelity - The degree with which equipment reproduces the essential characteristics of the signal which is impressed upon its input.

FIFO - First-In-First-Out memory structure. Data is entered at one end and removed from the other. A FIFO is used as a buffer to connect two devices that operate asynchronously.

filament - Directly heated cathode which carries its own heating current, as distinguished from an indirectly heated cathode.

filter - A network of resistors, inductors, and capacitors, or any one or two of these, which offers comparatively little opposition to certain frequencies or to direct current, while blocking the passage of other frequencies. An example is the filer used in a power supply, which allows the direct current to pass, but filters out the ripple.

firmware - Progam stored in ROM. Normally, filmware designates any ROM-implemented program.

firing potential - The grid plate voltage required in a gaseous triode to make the tube conduct or fire.

fixed bias - A bias voltage of constant value, such as obtained from a battery, generator, or other power supply.

Fixed Point Representation - Number representation in which the decimal point is assumed to be in a fixed position.

flag - Information bit that indicates some form of demarcation has been reached, such as overflow or carry. Also an inductor of special conditions such as interrupts.

flat line - A transmission line that has no standing waves. At every point along the line the amplitude of voltage is the same.

flat response - Term used to indicate that the gain varies only slightly within a stated frequency range. The response curve plotted for such an amplifier is almost a straight line.

floating - Logic node that has no active outputs. Three-state bus lines, such as data bus lines, float when no devices are enabled.

Floating-Point Representation - Technique used to represent a large range of numbers, using a mantissa and an exponent. The precision of the representation is limited by the number of bits allocated to the mantissa. See Mantissa and Exponent.

floppy disk - Mass storage device that uses a flexible (floppy) diskette to record information.

flowchart or flow diagram - Graphical representation of program logic. Flowcharts enable the designer to visualize the procedure necessary for each item in the program. A complete flowchart lead directly to the final code.

fluorescence - The property of emitting electromagnetic radiation, usually as visible light due to the absorption of radiation from some other source.

flux - (1) A material used to promote fusion or joining of metals in soldering, welding, or smelting. Rosin is widely used as a flux in electric soldering. (2) A general term used to designate collectively all the electric or magnetic lines of force in a region.

flux linkage - A value obtained by multiplying the number of turns in a coil by the number of magnetic lines of force passing through the turns.

fly back - A portion of the time base in the operation of a CRT in which the spot is returning to the starting point.

flywheel effect - The ability of a resonant circuit because of its energy storage, to operate continuously from short pulses of energy of constant frequency and phase.

focal length - The distance from the optical center of a lens to the point where light rays converge.

focal point - The point at which light rays converge after passing through a convex (positive) lens.

focus - Correct adjustment of a lens to produce a clear image.

focusing anode - One of the electrodes in a CRT, the potential of which may be varied to focus the electron beam.

focusing control - The control that is used to obtain a sharp, clear image on the screen of a CRT in a television system or an oscilloscope.

force - A push or pull. That which produces or prevents motion or has a tendency to do so.

force measurement device - Refers to any device by which a quantitative determination of an applied force can be made.

forced vibration - Motion caused by some mechanical excitation.

form factor - Term used in describing the quantity of rectified current. It is the ratio of the effective current to the average current (1.11 in the case of a sinewave).

forward bias - Voltage applied across a semiconductor in order to neutralize repelling forces at the junction and permit a flow of current in a forward direction at low resistance.

Foster-Seely discriminator - A discriminatr that produces a DC voltage output proportional to the deviation of frequency from a center frequency.

footcandle - The amount of illumination which a standard source of 1 candle (candlepower) will throw upon a surface placed 1 foot away and at right angles to the rays of light.

foot-pound - A term used in the study of torque representing a force of 1 pound applied perpendicular to a moment arm 1 foot long.

free electron - An electron within a substance or gas but not permanently attached any one atom, and not restricted in its movements.

free-run - Process of allowing a digital circuit (typically a microprocessor) to run without feedback (open-loop).

free virbration - Vibration that occurs without forcing, as after a tuning fork is struck.

frequency - The number of recurrences of a periodic phenomenon in a unit of time. In specifying electrical frequency, the unit of time is the second.

frequency distortion - Distortion caused when different frequency components in a signal are given unequal amplification.

frequency divider - A circuit which produces an output frequency equal to a submultiple of the input frequency.

frequency meter - An instrument for measuring the frequency of an AC signal.

frequency modulation (FM) - A form of modulation in which the frequency of the carrier is varied in accordance with the frequency of the modulating signal. The amplitude of the carrier remains constant at all times.

frequency multiplier - A circuit that is used to develop multiples of a precise frequency.

frequency response - The operating range over which a circuit or device handles all frequencies uniformly.

frequency response curve - A graph showing the frequency response of a circuit or device.

full-wave rectification - Rectification in which both halves of each alternating current cycle are used to produce direct current.

fundamental frequency - The lowest frequency component of a complex waveform.

fundamental mode of vibration - The lowest natural frequency.

fusion (heat) - The change of state from a solid to a liquid.

gage - An instrument for measuring or testing; a device for determining whether specific dimensions are within specified limits.

gage block - A block of alloy steel, usually rectangular, with two gaging surfaces. The standard length as nominally represented on the side is in inches between the two gaging surfaces with an uncertainty in the neighborhood of 6 microinches.

gain - The ratio of output voltage, current, or power in an amplifier stage system to the input voltage, current, or power, respectively; usually expressed in decibels. Increasing the gain means increasing output signal strength.

galvanometer - A D'Arsonval laboratory instrument usually of the suspension type capable of measuring very small electrical currents. It is usually used to indicate a null. Since the galvanometer is used in this application, to indicate whether or not a current is present, and not necessarily the actual magnitude of the current, the primary requirement of the galvanometer is to show a readable delfection for the smallest current that is significant for a particular measurement.

gamma - (1) The current amplification factor when connected in a common collector configuration. (2) Reflection coefficient of voltage in microwave applications.

gamma ray - Radiant energy of extremely short wavelength emitted spontaneously by a radioactive substance.

gas - The state of matter that has no definite shape or volume. The molecules of a gas have almost no cohesive forces, hence the expansion of a gas in free space is almost unlimited.

gauss - Unit of magnetic induction (also called magnetic flux). One gauss represents one line of flux per square centimeter.

geometry - Study of the properties, measurement, and relations between lines, angles, surfaces, and solids.

generator - (1) A machine that changes mechanical energy into electrical energy. (2) An oscillator that generates an alternating voltage at a desired frequency when energized with DC or low frequency AC power.

gilbert - The unit of magnetomotive force in the centimeter-gram-second electromagnetic system.

glitch - Pulse or burst of noise. Also used to indicate any unexplained system failure.

glow-discharge voltage regulator - A gas tube (VR tube) that varies in resistance between about 5,000 and 30,000 ohms, depending on the value of the applied voltage. It is used to maintain the supply voltage constant.

glow lamp - A lamp in which light is produced by a glow discharge between two electrodes in an evacuated envelope into which a small quantity of gas such a neon or argon has been introduced.

Go and No-go gages - These are gages that do not measure actual size but merely determine whether parts are within specified limits.

grain - A measure of mass in the English gravitational system equal to one seven-thousandth (1/7000th) pound.

gram - Metric unit of mass or weight. One pound is equal to 453.59 grams.

graph - A pictorial presentation of the relation between two or more variable quantities.

grass - The pattern on the CRT display of the radar or similar system, which is produced by the random noise output of the receiver.

graticule - A reticle composed of lines ruled on a transparent plate.

gravity - A measure or direction, of the force from the mass centers of one body to another. In particular, to the center of the Earth.

gravitational acceleration - The acceleration due to the force of gravity.

gravitational units or "G" units - The usual way of expressing acceleration intensity, in terms of gravitational constant, is equal to the acceleration in inches/sec/sec divided by 386.087 inches/sec/sec.

grid bias - The DC difference in potential between the control grid and the cathode of a vacuum tube.

grid circuit - The circuit connected between the grid and cathode of a vacuum tube, forming the input circuit to the tube.

grid leak - The resistance in the grid circuit of a vacuum tube.

grid leak bias - The bias obtained by grid current flowing through the grid leak resistance. The amount of grid leak bias depends on the amplitude of the signal input.

grid leak resistor - A resistor used in the grid circuit of a vacuum tube to provide a discharge path for the grid coupling capacitor. The value of the resistor determines the average value of the grid leak bias.

grid limiting - Limiting the positive grid voltage of a vacuum tube circuit by means of a high resistance grid resistor.

gross error - A gross error is simply a mistake.

ground - A reference point in an electrical circuit which is usually a connection between an electrical circuit and the Earth or some conducting body serving in place of the Earth.

group velocity - The axial velocity at which a signal travels through a waveguide. Group velocity is always less than the velocity of a signal in open air.

guarding - A feature provided on many high-precision measuring instruments which refers to the use of special circuitry, insulated from ground, to provide freedom from adverse effects of leakage currents. The stray current is bypassed through a noncritical path so that it does not affect the accuracy of measurement.

half life - The length of time during which half of a given number of atoms of a radioactive element will disintegrate.

half spilling - Troubleshooting technique used for fault isolation. It involves the examination of circuit nodes approximately midway through a circuit. Once the operational state of these nodes has been determined, the source of the fault can be isolated to the circuits either before or after this point. This process can then be continued.

halt - Command to stop the computer.

hand assemble - Translate a program from assembly language to machine code without the assistance of an assembler program.

handshake - Control signals at an interface in which the sending device generates a signal indicating that new information is available, and the receiving device then responds with another signal indicating that the data has been received.

hardness - The internal resistance of an object to having its molecules forced further apart or closer together.

harmonic - A sinusodial component of a periodic wave or quantity having a frequency that is an integral multiple of the fundamental frequency. Thus, a component whose frequency is twice the fundamental frequency is called the second harmonic.

Hartley oscillator - An oscillator circuit characterized by a tuned circuit having a tapped winding those outer ends are connected to the grid and plate, respectively, of the vacuum tube, with the tap going to the cathode.

hardware - Individual components of a circuit, both passive and active, have long been characterized as hardware in the jargon of the engineer. Today, any piece of data processing equipment is informally called hardware.

hard-wired logic - See Random logic.

Hay (parallel inductance) bridge - An AC bridge that permits measurement of inductors with a high Q in terms of capacitance. The bridge contains resistors and a variable standard capacitor. The amplitude null is obtained with the variable standard capacitor and the phase null with a variable resistor.

head - The vertical depth of any point below the free surface of a liquid.

heat - The energy of molecular motion measured in terms of the effect on some material substance.

heat of fusion - The amount of heat needed to melt a unit mass or weight of a substance at its normal melting point.

heat of vaporization - Heat required to vaporize a unit mass or weight of a liquid at its normal boiling point.

heat sink - A device for the absorption or transfer of heat away from a device.

helipot - A multiturn spirally wound potentiometer used in many instruments to get a high resolution.

henry - Unit of electric inductance. The inductance of a closed circuit in which the electromotive force of 1 volt is produced when the electric current in the circuit varies uniformly at a rate of 1 ampere per second.

hertz - A unit of frequency equal to 1 cycle per second.

heterodyne - The mixing of two alternating currents of different frequencies in a nonlinear impedance device which generates a current having the sum, difference, and both original frequencies, any or all of which may be selected by properly tuning the output.

hexidecimal - Base 16 number system. Since there are 16 hexidecimal digits (0 through 15) and only ten numerical digits (0 through 9), six additional digits are needed to represent 10 through 15. The first six letters of the alphabet are used for this purpose. Hence, the hexidecimal digits read: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. The decimal number 16 becomes the hexidecimal number 10. The decimal number 26 becomes the hexidecimal number 1A.

high-level language - Problem-oriented programming language, as distinguished from a machine-oriented progamming language. A high-level language is closer to the needs of the problem to be handled than to the language of the machine on which it is to be implemented.

high-order - Most significant bits of a word. Typically, bits 8 through 15 of a 16-bit word.

high-pass filter - A filter designed to pass currents at all frequencies above a critical frequency, while substantially reducing the amplitudes of currents of all frequencies below this critical frequency.

hold time - The time data must be stable following the completion of a write signal.

hole - A mobile vacancy in the electronic valance structure of a simeconductor, which acts as a positive electronic charge.

Hooke's Law - Within the limits of perfect elasticity, stress is directly proportional to strain.

horizontally polarized waves - Electromagnetic waves in which the electric field (E) is parallel to the horizon (or Earth's surface).

horizontal sweep - The scanning motion from left to right across a CRT.

hunting - Refers to a tendency of a mechanical system to oscillate about a normal condition, or about the point of alignment.

humidity - See relative humidity.

hydrometer - An instrument used to determine the specific gravity of liquids.

hydraulics - The study of liquids in motion.

hygrostatics - The study of liquids at rest.

hydrograph - An instrument for automatic recording of variations in atmospheric humidity.

hygrometer - Any of several instruments for measuring the humidity of the atmosphere.

hygroscopic - Readily absorbing and retaining moisture, often reflecting this absorption by changing physcial appearance and shape.

hysteresis - (1) The word hystersis means "lag." One example is the lagging of the magnetic flux, in a magnetic material, behind the magnetizing force which is producing it. Another example is the lag of a standard cell in returning to its initial voltage following a change in temperature. (2) In force measurement, hystersis may refer to the difference in indication for two identical loads, one obtained by reducing from a larger load and the other built up from a lesser value.

hysteresis loss - Power loss in an iron core transformer or other alternating current device due to the magnetic hystersis.

illumination - To supply or brighten with light.

immediate addressing - In this mode of addressing, the operand contains the value to be operated on, and no address reference is required.

impedance (Z) - An indication of the total opposition that a circuit offers to the flow of alternating current or any other varying current at a particular frequency, measured in ohms.

impedance match - The condition in which the impedance of a connected load is equal to the internal impedance of the source, thereby giving maximum transfer of energy from source to load.

impedance triangle - A diagram which is a right-angle triangle with sides proportional to the resistance and reactance of an alternating current circuit. The hypotenuse represents the impedance of the circuit. The cosine of the angle between the sides representing resistance and impedance is the power factor of the circuit.

incident wave - Energy moving from the generator toward the termination of a transmission line.

In-Circuit Emulator (ICE) - Debugging aid that connects to the system under test by plugging into the microprocessor's socket. This allows the ICE to gain full control over the system. Typical features include the ability to set breakpoints, single-step a program, examine and modfiy registers and memory, and divide memory and I/O between the system under test and the ICE system.

inclination - Refers to a difference between the slope of the line or place in question and some other reference line or plane.

increment - Adding the value one to the contents of a register or memory location.

incremental attenuation - The difference in attenuation between a given setting and the zero setting of an attenuator.

indexed addressing - Mode in which the actual address is obtained by adding a displacement to a base address.

index of refraction - The ratio of the speed of light in a vacuum to its speed in a given substance.

index register - Contains address information used for indexed addressing.

indirect addressing - Addressing a memory location that contains the address of data rather than the data itself.

inductance - The property of a circuit that opposes any change in current, or property of a electric circuit or two neighboring circuits which determines how much electromotive force will be induced in one of the circuits by a change of current in either of them. Inductance is measured in henrys and designated by L.

induced voltage - A voltage produced in a circuit by a change in the number of magnetic lines of force passing through a coil in the circuit.

inductive reactance - That type of reactance which is due to the inductance of a circuit or coil. It is measured in ohms, designated by X_L and is equal to $2 \pi fL$.

inductronic amplifier - A sensitive DC automatic potentiometer. It sense a small difference in EMF and develops a corrective voltage in a voltmeter calibration system.

inertia - That property of mass which resists a change in motion.

infinite - Subject to no limitation or external determination, extending indefinitely.

infinite line - A transmission line having characteristics corresponding to those which would be obtained with an ordinary line that is infinitely long.

initialization - Setting a system to a knowns state.

input/output - Lines or devices used to transfer information outside the system.

input port - Circuit that connects signals from external devices as inputs to the microprocessor system.

insertion loss - A special case of substitution loss. The ratio of the initial load power to the final load power, expressed in decibels, when a network is inserted into a measuring system. The value of insertion loss measured depends upon the reflection coefficients of the generator and load as well as the network under test.

instability - An undesired change over a period of time, which change is unrelated to input, operating conditions, or load.

instruction - Single command within a program. Instructions may be arithmetic or logical, may operate on registers, memory, or I/O devices, or may specify control operations. A sequence of instructions is a program.

instruction cycle - All of the machine states necessary to fully execute an instruction.

instruction decoder - Unit that interprets the program instructions into control signals for the rest of the system.

instruction register - Register inside the microprocessor that contains the opcode for the instruction being executed.

instruction set - Total group of instructions that can be executed by a given microprocessor. Supplied to the user to provide the baisc information necessary to assemble a program.

intensity modulation - Control of the brilliance of the trace on the screen of a CRT. This is also known as "Z axis modulation."

interface - Indicates a boundary between adjacent components, circuits, or systems that enables the devices to exchange information. Also used to describe the circuit that enables the microprocessor to communicate with a peripheral device.

interface - In optics, a boundary between two media in which light travels with different velocities.

interference - In optics, when two sets of light waves of equal wave length and amplitude from the same source meet, so that the crests of one coincide with the troughs of another, they cancel out. Similarly, if two sets of light waves meet when the crests of one coincide with the crests of the other they reinforce each other.

interferometer - An instrument that is used to measure minute linear displacement through the phenomena of light interference.

interferometry - The use of light interference patterns for measurements with apparatuses such as the optical flat.

interpolation - The process of estimating in a transmission line due to power dissipation.

interrupt - Involves suspension of the normal program that the microprocessor is executing in order to handle a sudden request for service (interrupt). The processor then jumps from the program it was executing to the interrupt service routine. When the interrupt service routine is completed, control returns to the interrupted program.

interrupt mask - Register that has one bit to control each interrupt. Used to selectively disable specific interrupts.

interrupt service routine - Program that is executed when an interrupt occurs.

interrupt vectoring - Providing a device ID number or an actual branching address in response to the interrupt acknowledge signal. Allows each interrupt to automatically be serviced by a different routine.

interval timer - Programmable device used to perform timing, counting, or delay functions. Usually treated as a peripheral.

intrinsic attenuation - The attenuation in a transmissio line due to power dissipation.

inversion - The condition that exists when both axis of an image are reversed.

inverter - Any mechanical or electrical device for converting direct current into alternating current.

inverse peak voltage - The peak value of the instantanious voltage across a rectifier tube during the half of the cycle in which current does not flow.

I/O Mapped I/O - I/O devices that are accessed by using instructions and control signals that differ from those of the memory devices in a system. Assigns I/O devices to a separate address space.

ion - An electrified particle formed when an atom or group of atoms gains or loses one or more electrons. A negative ion has gained electrons; a positive ion has lost electrons.

ionization - The process by which molecules of a gas are converted into positive ions by loss of electrons, or into negative ions by gain of electrons. Ionization can be produced in a number of ways, by collisions of ions with electrons, by the action of ultraviolet light or other radiations.

ionosphere - That region of the atmosphere, 70 to 250 miles above the surface of the Earth, containing layers of highly ionized air that are capable of bending or reflecting radio waves back to Earth. Reflection from the ionosphere makes possible long distance reception of radio waves.

iron vane movement - A meter movement in which the moveable element is an iron vane which is drawn into the magnetic field produced by flow of the current being measured. Iron vane meters have a square law response and scale.

isolation transformer - Used in conjunction with AC bridge circuits to isolate the AC null detector from the AC power source. Isolation transformers can also provide a greater measure of safety for personnel.

iterative - Procedure or process that repeatedly executes a series of operations until some condition is satisfied. Usually implemented by a loop in a program.

j - The square foot of minus one.

JAN specification - A military specification which covers all branches of the military.

jitter - Small, rapid variations in a waveform due to mechanical disturbances or to changes in the supply voltages.

Johnson (thermal) noise - The noise caused by the thermal agitation of charges in a conductor. It is proportional to the absolute temperature and the frequency bandwidth over which the noise is measured.

joule - Unit of energy. The work done when the point of application of 1 newton is displaced a distance of 1 meter in the direction of the force.

jump - Instruction that results in a change of sequence.

junction transistor - A type of transistor employing a sandwich type of construction where the outside layers are quite thick as compared to the thin center layer. The semiconductor material is used alternately to form PNP or NPN transistors.

K - Symbol for 1000 (10^3). When referring to bits or words, K=1024 (2^{10}).

keeper - Iron or steel bar placed across the poles of a horseshoe magnet. The keeper prevents gradual demagnetization by providing a low reluctance path for the magnetic circuit.

Kelvin bridge - A double Wheatstone bridge requiring two conditions of balance. Primarily used for precision measurement of low value resistance.

Kelvin degree - Unit of temperature. The unit of temperature determined by the Carnot cycle with the triple-point temperature of water defined as exactly 273.16°K.

Kelvin scale - The absolute temperature scale in the cgs system. Kelvin is equal to degrees Celsuis plus 273.15.

Kernel - Minimum circuitry required to allow the microprocessor to function. Usually consits of the microprocessor, clock circuit, interrupt and DMA control lines, and power supply.

keyboard - Group of push buttons used for inputting information to a system.

kilogram - Unit of mass. The mass of a particular cylinder of platimumiridium alloy, called the International Prototype Kilogram, which is preseved in a vault at Sevres, France, by the International Bureau of Weights and Measures.

kinetic energy - Energy due to motion.

Kirchhoff's Laws - (1) The sum of the currents flowing to a given point in a circuit is equal to the sum of the currents flowing away from that point. (2) The algebraic sum of the voltage drops in any closed path in a circuit is equal to the algrbraic sum of the electromotive forces in that path. Also called the laws of electric networks.

klystron - A vacuum tube for converting DC energy into RF energy by alternating current that delivers power to a cavity resonator.

label - Name assigned to a memory location. When an assembly language program is written, a label is assigned to an instruction or memory location that must be referred to by another instruction. Then when the program is converted to machine code, an actual address is assigned to the label.

laminated core - An iron core for a coil, transformer, armature, etc., built up from laminations stamped from sheet iron or steel. The laminations are more or less insulated from each other by surface oxides and sometimes by application of varnish. Laminated construction is used to minimize the effect of eddy currents.

lapping - A smoothing or polishing operation.

Large Scale Integration (LSI) - Technology by which thousands of semiconductor devices are fabricated on a single chip.

laser - An optical cavity capable of oscillating in the visible and nonvisible light spectrum. The laser is a true light amplifier because light energy is used for excitation.

latch - Hardware device that captures information and holds it (e.g. a group of flip-flops).

leakage current - (1) Undesirable flow of current through or over the surface of an insulating material or insulator. (2) The flow of direct current through a capacitor. (3) The alternating current that passes through a rectifier without being rectified. (4) The current that flows between two or more electrodes of a tube may be any path other than across the vacuous space between the electrodes.

leakage inductance - The difference between the total inductance of a transformer winding and that used in transferring energy from one winding to another.

Least Significant Bit (LSB) - Rightmost bit in a number, which has the least numerical weight.

lecher wire - A transmission line which uses the characterisitcs of standing waves for the determination of wavelength at the higher frequencies.

LED - Light Emitting Doide. Semiconductor device that emits light when current is passed through it.

left-hand rule - (1) For generators: If the thumb, first, and second fingers of the left hand are stretched at right angles to one another, with the thumb representing the direction of motion, the first finger representing the direction of magnetic lines of force, and the second finger representing the direction of electron flow, the relations between the directions will then be correct for a conductor in the armature of a generator. (2) For a current-carrying wire: If the fingers of the left hand are placed around the wire in such a way that the thumb points in the direction of electron flow, the fingers will be pointing in the direction of the magnetic field.

lens, converging - See convex.

lens, diverging - See concave.

Lenz's Law - The current induced in a circuit as a result of its motion in a magnetic field is in such a direction that it exerts a mechanical force opposing the motion. Also called "law of inducted current."

LIFO - Last-In-First-Out buffer. Same as push-down stack. See stack.

light - The aspect of radiant energy of which an observer is aware through the visual sense.

light beam chopper - A circuit that produces a square wave from DC. It uses photosensitive resistors, a light beam, and a synchronous motor turning a disc with apertures, to control the operation of the photosensitive resistors.

lighthouse tube - A single tube oscillator operating at a frequency of about 2500 MHz. It gets it name because of its construction which resembles a lighthouse.

limiter (clipper) - A circuit which removes amplitude variations from the signal by cutting off all positive and/or negative peaks that exceed a certain amplitude.

Linear Select Decoding - Address decoding technique that uses the most significant address bits to directly enable devices in the system.

line of force - An imaginary line in an electric or magnetic field that coincides in direction with the field intensity at each point. It was conceived by Faraday, and is used for convenience in the study of magnetic and electric fields. When used as a unit of magnetic flux, a line of force is sometimes called a maxwell.

line of sight - A straight line passing from the center point of the reticle through the principle point of the objective lens.

linear - A relation such that any change in one of two related quantities is accompanied by an exactly proportional change in the other.

liquid - The state of matter which has definite volume but no definite shape.

Lissajous pattern - A family of scope patterns used to show phase relationships, make frequency comparison measurements, and indicate the percentage of AM modulation.

listener - Device that inputs data from a data bus. An output port is a listener.

load cell - A type of force tranducer designed primarily for the measurement of load or weight. Electric load cells usually employ bonded strain gage resistance elements to provide an electrical output signal proportional to the load. Hydraulic and pneumatic load cells generally make use of a bourdon-type device, such as a Heise gage.

loading effects - An error of measurement resulting in a change of the system under test caused by insertion of the test instrument.

load line - A straight line drawn across a series tube or transistor characteristic curves to show how output current will change with input voltage when a specified plate load resistance is used.

logarithm - The logarithm of a number is the power to which a second number, called the base, must be raised in order to yield the original number. Bases in common use are 10 and 2.718 (ϵ).

logarithmic meter scale - A nonlinear scale used with a moving coil meter, where the pointer deflection is directly proportional to the logarithm of the applied voltage. Power is directly proportional to the logarithm of the applied voltage if the meter has a linear voltage response.

logic - The synthesizing of a network of logical elements to perform a specificed function.

logic analyzer - Test system capable of displaying 0's and 1's, as well as performing complex test functions. Logic analyzers typically have 16 to 32 input lines and can store sequences of sixteen or more bits on each of the input lines.

logic circuits - Circuits whose functions can be described by simple statements of formal logic using the connective words, and, or, not.

logic comparator - Test product that compares pin-for-pin operation of an IC operating in-circuit with a known good reference IC.

logic diagram - A circuit diagram which represents the function of logic circuits and their interconnections without necessarily expressing their construction or engineering details.

logic probe - Hand-held troubleshooting tool that detects logic state and activity on digital circuit nodes.

logic pulser - Hand-held troubleshooting tool that injects controlled digital signals into logic nodes.

logical element - In a computer or data processing system, the smallest building blocks which can be represented by operators in an appropriate system of symbolic logic.

loop - Part of a program that is repeatedly executed.

loop - The point, line, or surface of a stationary wave system, at which maximum amplitude exists.

loose coupling - A small amount of coupling between two coils or circuits.

lossy - An adjective applied to a dielectric material which dissipates energy.

lossy line - A transmission line with a high degree of attenuation.

low-order - Pertaining to the weight or significance assigned to the digits of a number. In the number 123456, the lower order digit is six. The three low-order bits of the binary word 11100101 are 101.

lumen - Unit of luminous flux. It is the luminous flux emitted in a solid angle 1 steradian by a uniform point source having an intensity of 1 candela.

LSB - See Least Significant Bit.

LSI - See Large Scale Integration.

LSTTL - Low power Schottky TTL. Digital integrated circuits that employ Schottky transistors for improved speed/power performance over standard TTL.

magnet - Any object which has the property of attracting iron, nickel, or cobalt objects with forces which are much greater than those of graviation and which do not depend on the presence of electric charges on either body.

magnetic deflection - Method of bending electrons in a CRT by means of the magnetic field produced by coils placed outside the tube.

magnetic deflection - (1) The magnetic quantity (number of magnetic lines of force) that determines how much voltage will be induced in a conductor moving through a particular point in a magnetic field. It is expressed in gausses. It is also called magnetic flux density. (2) The process of magnetizing an object by bringing it into the magnetic field of an electromagnet or permanent magnet.

magnetic saturation - That condition in an iron core in which further increases in magnetizing force produce little or no increase in magnetic flux density.

magnetism - A property possessed by iron, steel, and certain other materials when in a particular condition of internal structure, by which these materials can exert a mechanical force on neighboring masses of magnetic materials and can cause voltages to be induced in conducting bodies moving relative to the magnetized bodies.

magnetomotive force - Magnetic potential difference. Expressed in gilberts, that is, ergs per magnetic pole.

magnetron - A high vacuum thermionic tube (containing two electrodes) in which the flow of electrons from cathode to anode is controlled by an externally applied magnetic field. It is used for generating microwaves.

majority carriers - In semiconductos, the type of carrier constituting more than half of the total number of carriers. The majority carrier may be either holes or free electrons found in P-type or N-type semiconductors, respectively.

malleability - The property of a metal which allows it to be hammered or rolled into sheets.

manganin - An alloy used in making precision wirewound resistors because of its low temperature coefficient of resistivity. Many standard resistors are made of manganin.

mantissa - Fractional value used as part of a floating point number. For example, the mantissa in the number 0.9873×10^7 is 0.9873.

marker generator - A generator that develops pulses (markers) from a calibrated circuit. These markers are used to calibrate the time base of an oscilloscope.

mask - Pattern used to selectively set certain bits of a word to 1 or 0. Usually ANDed or ORed with the data.

mask programmed - An IC that is programmed by generating a unique photomask used in the fabrication of the IC.

mass - The measure of the quantity of matter that a body contains.

mass density (P) - Mass per unit volume.

mass storage - Secondary, slower memory for large files. Usually floppy disk or cassette.

master flat - A surface plate, usually round rather than square with a high degree of surface flatness.

matched line - A transmission line terminated in its characteristic impedance in order to maximize power flow and minimize the voltage standing wave ratio.

matter - Anything which has weight and occupies space.

Maxwell (series inductance) bridge - An AC bridge that permits measurement of inductors with a low Q, in terms of capacitance. The bridge contains resistors and a variable standard capacitor. The amplitude null is obtained with the variable standard capacitor and the phase null with a variable resistor.

Mcleod gage - A primary instrument for the measurement of pressure in a vacuum system. The gage consists of a glass bulb with a vertical capillary tube at the top.

mean solar day - The average of all apparent solar days in a given year.

measurement - The overall process that a person goes through in reaching a decision as to the magnitude of some quantity.

Medium Scale Integration (MSI) - Technology by which a dozen or more gate functions are included on one chip.

memory - Part of a computer system into which information can be inserted and held for future use. Storage and memory are interchangeable terms. Digital memories accept and hold binary numbers only. Common memory types are core, disk, tape, and semiconductor (which includes ROM and RAM).

memory map - Shows the address assignments for each device in the system.

memory mapped I/O - I/O devices that are accessed by using the same group of instructions and control signals used for the memory devices in a system. The memory and I/O devices share the same address space.

meniscus - The curved upper surface of a column of liquid which is concave when the walls of the container are wet and convex when the walls of the container are dry.

mercury - A heavy, silver-colored metal which is liquid at ordinary room temperatures.

metallic insulator - A shorted quarter wave section of a microwave transmission line which acts as an electrical insulator at the frequency for which its length is one quarter wavelength.

meter - Unit of length. The length of exactly 1,650,763.73 wavelengths of the radiation in vacuum corresponding to the unperturbed transition between the levels 2p10 and $5d_5$ of the atom of Krypton 86, the orange-red line.

metrology - The science of measurement.

microcode - See microprogram.

microcomputer - Complete system, including CPU, memory, and I/O interfaces.

micron - A unit of length equal to one-millionth of a meter.

microphonic - A condition in which mechanical movement of a vacuum tube, variable capacitor, or other part in an amplifier system causes corresponding variations in circuit current.

microprocessor - Central processing unit fabricated on one or two chips. The processor consists of the arithmetic and logic unit, control block, and registers.

microprogram - Program that defines the instruction set. The microprogram (also called microcode) tells the CPU what to do to execute each machine language instruction. It is even more detailed than machine language and is not generally accessible to the user.

microwave - Electromagnetic waves in the frequency range from 300 MHz to 100 GHz.

Miller effect - The increase in the effective grid-plate capacitance of a vacuum tube due to the charge induced electrostatically on the grid by the plate through the grid-plate capactiance. Also true for base to collector of a transistor.

Miller integrator - A circuit used to develop a linear sawtooth (ramp) voltage.

Military Specification Code - A code developed to insure that devices purchased by the government would meet the military standards regardless of the manufacturer.

minority carrier - In semiconductor devices there always exists a small but measurable reverse current which results from the presence of current carriers which are opposite to the predominate carriers. These may be either holes or excess electrons found in N-type or P-type semiconductors, respectively.

minute - A minute is 1/60th of a degree. This is more correctly described as a "minute of arc."

mixer - That stage in a superheterodyne receiver in which the incoming modulated radio frequency signal is mixed with the signal from the local oscillator to produce the intermediate frequency signal.

MKS system - The meter-kilogram-second system.

Mnemonic code - Codes designed to assist the human memory. The microprocesor language consists of binary words, which are a series of 0's and 1's, making it difficult for the programmer to remember the instructions corresponding to a given operation. To assist the human memory, the binary numbered codes are assigned groups of letters (or mnemonic symbols) that suggest the definition of the instruction. For example, the 8085 code 32 means load accumulator and is represented by the mnemonic LDA.

mode - (1) One of several types of electromagnetic waves that may be sustained in a given resonant system. Each type of vibration is designated as a particular mode and has its own particular electric and magnetic field configuration. (2) One of several methods of exciting a resonant system.

mode - (1) One of several types of electromagnetic waves that may be

molecule - The smallest particle of any substand which can exist free and still exhibit all properties of the substance.

moment arm - The length of a torque wrench from the center of pivot to the point where force is applied.

monitor - Program that controls the operation of a microcomputer system and allows users to run programs, examine and modify memory, etc.

monitoring - Periodic or continuous determination of the amount of some quantity. This is often achieved by use of a recorder.

monochromatic light - Light of only one wavelength or color.

monolithic - Describes any system which is completely contained on one chip or substrate. In MPU terms, it usually refers to a system containing not only the logic unit but also memory or input/output circuits.

monostable multivibrator - Referring to a circuit with one stable state. The circuit requires one trigger to perform a complete cycle. This circuit is also called a one-shot multivibrator or a flip-flop multivibrator.

motherboard - See backplane.

moving coil meter - The basic D'Arsonval meter movement consisting of an electromagnetic coil mounted between the poles of a permanent magnet.

MPU - Microprocessing Unit. See Microprocessor.

MSB - See Most Significant Bit.

MSI - See Medium Scale Integration.

MTBF - Mean Time Between Failures.

MTTR - Mean Time to Repair.

Multiplexing - Process of transmitting more than one signal via a signal link. The most common technique used in microprocessor systems in time division multiplexing, in which one signal line is used for different information at different times.

multivibrator - A form of relaxation oscillator which uses two stages, so coupled that the input of each one is derived from the output of the other. A multivibrator can be free running or synchronized. Its frequency can be determined by the value of its own circuit parameters or an external synchronizing voltage. The output is essentially a square or rectangular wave.

mutual inductance - The common property of two associated electric circuits determining, for a given rate of change of current in one of the circuits, the amount of electromotive force induced in the other. Mutual inductance is measured in henrys.

nadir - The point of the celestial sphere that is directly opposite the zenith and vertically downward from the observer.

National Bureau of Standard (NBS) - An independent agency of the U.S. Department of Commerce charged with the improvement and maintenance of all kinds of standards. The bureau operates radio stations WWV, WWVH, WWVB, and WWVL which broadcast accurate frequency and time standards.

natural frequency - (1) The natural resonant frequency of an object. (2) The frequency at which an object will vibrate, when struck.

negative feedback - See degenerative feedback.

negative logic - The logic false state is represented by the more positive voltage in the system, and the logic true state is represented by the more negative voltage in the system. For TTL, 0 becomes 12.4 volts or greater, and 1 becomes 1.4 volts or less.

negative resistance - A resistance that varies with current in such a way that when the current increases the voltage drop across the resistance decreases. This characteristic is possessed by an electric arc and by vacuum tube circuits under certain conditions.

neon - An inert element which is a gas at room temperature. When ionized by current flow it produces a bright orange-red glow.

nested - Subroutine that is called by another subroutine or a loop within a larger loop is said to be nested.

network - A system of interconnected resistors, inductors, or capacitors or any combination thereof.

neutralization - The process of cancelling the voltage fed back through the interelectrode capacitance of an amplifier tube by providing an equal voltage of opposite phase. Generally this is necessary only with triode tubes.

neutron - A neutral particle found in the nucleus of an atom.

newton - Unit of force. That force which gives to a mass of 1 kilogram an acceleration of 1 meter per second. One newton equals 100,000 dynes.

Newtonian fluid - A fluid whose absolute viscosity is the same for all values of shear stress.

node - Any point, line, or surface in a stationary wave system at which the amplitude of the wave shaping variable is minimum.

node - Any signal line connected to two or more circuit elements. All logic inputs and outputs electrically connected together are part of the same node.

noise - The sum of all undesirable signals. There may be generated within the circuit in question and/or induced from external circuits. Noise can be caused by atmospheric conditions as well. Noise is characterized by randomness of amplitude and frequency distribution.

noise distrotion - This may be defined as all unwanted disturbances present in a waveform due to cases other than those producing amplitude, frequency or phase distortion. Factors that may contribute to excessive noise are power supply ripple, faulty circuit components, stray voltages induced from other circuits and atmospheric disturbances.

noise suppression - A circuit used in a receiver or amplifier to reduce noise.

nominal value - This is normally the value indicated by the manufacturer.

nomograph - A chart or diagram with which equations can be solved graphically by placing a straightedge on the two known values and reading the answer where the straightedge crosses the scale of the unknown values.

nonaxial loading - The condition existing when a force, or a component of a force, is not aligned with the major axis (primary loading axis) of the force measuring device to which it is applied.

noncorrosive flux - Flux that is free from acid and other substances which might cause corrosion in soldering.

nonlinear device - A device having a response that is not directly or inversely proportional to a given variable.

nonresonant line - A transmission line on which there are no standing waves at the operating frequency. Also called a "flat line."

nonsinusodial wave - Any waveform that differs from that of a sine wave.

nor-gate - A gate whose output is energized only when no signals are present at the inputs. A combination of a Not and an Or gate.

normalized impedance - In microwave, the complex impedance of the transmission line in use is normalized to the Z_0 of the line for use with the Smith chart, that is, the number in use has been modified to conform to a reference value.

not-circuit - A circuit used to invert a binary signal.

N-type semiconductor - An extrinsic semiconductor in which the conduction electron density exceeds the hole density.

nucleus - The positively charged central part of an atom that contains nearly all of the atomic mass and consists of protons and neutrons, except hydrogen which has only one proton.

null method - Any method of measurement in which the reading is taken at zero. Galvanometers, sensitive voltmeters, oscilloscopes, and earphones are used as null detectors.

number crunching - Action of performing complex numerical operations.

object code - Statements or instructions once they have been translated into object language.

object code file - Object code statements stored within a computer or microprocessor system.

object language - Not really a true language, but the machine-readable one in which a programmer could write if he did have access to a compiler or assembler which would do the translation for him (e, g, hexadecimal, octal, binary).

object program - End result of the source language program (assembly or high-level) after it has been translated into machine language.

object program - End result of the source language program (assembly or high-level) after it has been translated into machine language.

Octal - Base 8 number system. Often used to represent binary numbers, since each octal digit corresponds directly to the three binary digits.

oersted - The unit of magnetic intensity (magnetizing force) in the cgs electromagnetic system. The value of the magnetic intensity in oersteds, at any point in a vacuum, is equal to the force in dynes exerted on a unit mangetic pole placed at the point.

ohm - Unit of electrical resistance. The electric resistance between two points of a conductor when a constand difference of potential of 1 volt, applied between these two points, produces in this conductor a current of 1 ampere, this conductor not being the source of any electromotive force.

ohmmeter - An instrument for measuring resistance.

Ohm's Law - A fundamental electrical law which expresses the relationship between voltage, current, and resistance in a DC circuit, or the relationship between voltage, current, and impedance in an AC circuit.

One's Complement - Number representation system used for signed binary integers in which the negative of a number is obtained by complementing it. The left-most bit becomes the sign bit, with 0 for plus, 1 for minus.

opaque - Neither reflecting nor emitting light.

opcode - See operation code.

open circuit voltage - The voltage at the terminals of a battery or other voltage source when no load is connected.

open-loop - Circuit operating without feedback.

operating conditions - Those conditions, such as ambient temperature, pressure, vibration, humidity, etc., to which a device is subjected, but does not include the variable measured by the device.

operating point - That point on a grid voltage-plate current characteristic curve of a vacuum tube which corresponds to the direct voltage values being used for the grid and plate. Also called quiescent point.

operational amplifier - An amplifier having DC stability and immunity to oscillation, generally achieved by using a large amount of negative feedback. Used to perform analogue-computer functions such as summing and integrating.

operation code (opcode) - Segment of the machine-language instruction that specifies the operation to be performed. The other segments specify the data, address, or port. For the 8085, the first byte of each instruction is the opcode.

optical flat - A piece of glass or quartz which is accurately flat to within one-tenth of a wave length on one or both surfaces, used as a reference (proof plane) for comparison of flatness.

optical pyrometer - An instrument designed to estimate the temperature of glowing surfaces.

optics - The branch of physics which deals with the phenomena of light.

optimum - The most favorable degree or condition.

ordinate - The vertical or y-axis on a chart or graph.

oscillator - Any nonrotating device for generating and maintaining oscillations of a frequency determined by the physical constants of the system.

oscilloscope - An instrument that shows the instantaneous voltage waveform of a signal. It can be used to measure voltage, period, and frequency of a signal. Phase relationship and percentage of AM modulation can also be measured with an oscilloscope.

out of phase - Having waveforms that are of the same frequency but not passing through corresponding values at the same instants.

out-of-round - The high and low spots in a true circle. It is also the ovality or lobing effect which causes a change of true roundness of cylindrical objects.

output impedance - The impedance measured between the output terminals of a circuit. For maximum power transfer, the load impedance should match or be equal to this output impedance.

output port - Circuit that allows the microprocessor system to output signals to other devices.

overflow - Results when an arithmetic operation generates a quantity beyond the capacity of the register. An overflow status bit (the carry) in the flag register is set if an operation causes an overflow.

overload - A load that is greater than the device is designed to handle.

overshoot - The inital transient response to an unidirectional change in input which exceeds the steady state response.

oxide - An element combined with oxygen. Rust is an oxide of iron.

padder - Any small capacitor inserted in series with a main capacitor to adjust its capacity to some predetermined value.

page - Usually a block of 256 addresses. The lower eight bits of an address therefore specify the location within the page, while the upper eight bits specify the page.

pair production - The description of an electron leaving the valence band to enter the conduction band due to absorption of energy (usually heat). This provides a free electron carrier and a free hole carrier at the same time.

parallax - The apparent displacement of the position of an object caused by a shift in the point of observation. Thus, the pointer of a meter will appear to be at different positions on the scale depending on the angle from which the meter is read. To eliminate errors in meter reading due to parallex, the line of sight should be perpendicular to the pointer.

parallel circuit - A circuit in which two or more components are connected across the same pair of lines or terminal so that the current is divided between the components.

parallel resonant circuit - A circuit consisting of inductance and capacitance connected in parallel. This is also known as a "tank" circuit. It offers a high line impedance to the resonant frequency. It is often used to determine the frequency in an oscillator circuit.

paramagnetic - A term used to describe materials with magnetic permeability greater than that of a vacuum, such as iron, cobalt, and nickel.

parameter - (1) In mathematics, one of the constants entering into a functional equation and corresponding to some characteristic property, or dimension. (2) In an electronic circuit, a characteristic element or constant factor, such as: resistance, capacitance, or inductance values.

parameter - Value passed from one routine to another, either in a register or a memory location.

paraphrase inverter - A phase inverter consisting of one or two amplifiers which provides two output signals of opposite polarity from a single source.

parasitic oscillations - Undesired, self-sustaining oscillations at a frequency different from the operating frequency, occurring chiefly in vacuum tube circuits.

parity - Number of 1's in a word, which may be even or odd. When parity is used, an externl bit is used to force the number of 1's in the word (including the parity bit) to be even (even parity) or odd (odd parity). Parity is one of the simplest error detection techniques and will detect a single-bit failure.

Pascal's principle - The pressure applied on a confined fluid is transmitted undiminished in every direction.

patch - Section of coding inserted into a routine to correct a mistake or after the routine. It is usually not inserted into the actual sequence of the routine being corrected, but placed somewhere else. A jump to the patch and a return to the routine are then provided.

PC - Printed Circuit or Program Counter.

PCB - Printed Circuit Board.

peaking coil - A coil placed in an amplifier circuit to obtain better high frequency response.

peak inverse plate voltage (rating) - The maximum instantaneous plate voltage the tube can withstand in the direction opposite to the direction in which the tube is designed to pass current.

peak-to-peak amplitude - The amplitude of an alternating quantity measured from positive to negative peak. This is the value indicated on an oscilloscope.

peak-to-peak value - The algebraic difference between extreme values (as DA or double amplitude is twice the single amplitude).

peak voltage - A maximum voltage which can be applied to electrolytic capacitors for a period not to exceed 30 seconds. Also called "surge" voltage. Also, the maximum instantaneous value of an alternating quantity.

Peltier effect - When two unlike conductors are joined and kept at a constant temperature while a current passes through the junction. This is in addition to the I^2R loss. The Peltier effect is the inverse of the Seeback effect.

pentaprism - A five-sided prism which deviates rays of light by 90° without reversing or inverting the image.

pentavalent impurity - Any impure atom that has five electrons in its valence band.

pentode - A five-electrode vacuum tube containing an anode, a cathode, a control grid and two additional electrodes ordinatily in the form of grids.

period - The time corresponding to one cycle of a periodic phenomenon. The period of a galvanometer is the elapsed time between consecutive passages of the pointer in the same direction through its zero point.

peripheral - Any interface device connected to a computer. Also, a mass storage or communications device connected to a computer.

permanent magnet - A magnet which retains its magnetism without the action of external electric or magnetic fields.

permeability - A measure of the effectiveness of a material as a path for magnetic lines of force as compared with the effectiveness of air. The permeability of air is assumed as one. Pereability is measured as the ratio of magnetic induction to magnetizing force and is designated by μ (greek letter mu).

persistance - A measure of the length of time that phosphorescent light is emitted from the screen of a CRT.

phantastron - A stable circuit whose operation is similar to that of a monostable multivibrator. It can only be triggered when in the quiescent condition. The circuit values determine the time required to return to quiescence. The phantastron is often used as a frequency divider.

phase distortion - An undesirable alternation of a signal waveform caused by different phase shifts for various harmonics within a complex waveform.

phase inverter - A stage in an amplifier or other circuit whose chief function is to change the phase of a signal by 180°.

phase shift oscillator - An oscillator produced by connecting, between the output and the input of an amplifier, a network producing a 180° phase shift for the desired frequency of operation.

phase splitter - A circuit that produces two output signals of equal magnitude and opposite polarity from one amplifier using a single signal input.

phase velocity - (1) The velocity with which a point of a certain phase in an electromagnetic wave travels in the direction of propagation. (2) An illusion that wave peaks travel through a waveguide faster than the speed of light. It appears because the elementary waves travel at an angle to the walls of the guide. The true speed is group velocity.

photoelectric effect - The electrical effect of light or other radiation. This effect can be emission of electrodes, penetration of voltage, or a change in electrical resistance upon exposure to light.

photometry - The measurement of luminous intensity from a light source by comparison to a known standard.

photon - Small particles of light energy according to the quantum theory of light.

physics - The physical science which deals with matter and energy and with the transformations of energy.

physi-optics - Physi-optical practices combine the use of specific physical measuring standards with optical instruments and physical indicating apparatus.

pickup - See transducer.

Pierce oscillator - An oscillator in which a piezoelectric crystal unit is connected between the grid and the plate of an electronic tube, in what is essentially a Colpitts oscillator. The capacitive voltage division is provided by the grid-cathode and plate-cathode capacitances of the circuit.

piezoelectric effect - Generation of voltage between opposite faces of certain crystals (such as quartz) as a result of strain due to pressure or twisting and the reverse effect in which application of a voltage to opposite faces of the crystal causes deformation to occur at the frequency of the applied voltage.

pigtail - A flexible metallic connection usually consisting of braided wire used between a stationary terminal and a terminal having a limited range of motion.

plate resistance - The ratio of a small change in plate voltage to the corresponding small change in plate current.

plate voltage - The DC voltage that exists between the plate and cathode of a vacuum tube.

plug-in - Having terminals such that connections are made automatically by plugging the device into a socket or series of jacks.

plumbing - Common slang term for microwave coaxial or waveguide circuits.

plunge - To rotate the telescope of a theodolite 180° about the horizontal axis of the instrument.

pointer - The needle-shaped rod that moves over the scale of a meter or dial.

polar coordinates - A system of coordinates in which a point is located by its distance from a fixed point and the angle that the line from this fixed point to the given point makes with a fixed reference line called the polar axis.

polarized light - Light in which vibrations occur in a single place perpendicular to the ray.

polling - One method used to identify the source of interrupt request. The CPU must poll (read) the devices to determine which one caused the interrupt.

polyethylene - A tough, flexible, plastic compound that has excellent insulating properties, even at the ultra high frequencies. It is widely used as the insulating material in coaxial cable.

polystyrene - A clear thermoplastic material having very desirable dielectric properties. Many standard capacitors use polystyrene as dielectric.

pop - Operation of reading a word from the stack. Same as pull.

porosity - Small openings or spaces between particles of matter.

porro prism - A prism which causes an image to be rotated 180°, or reflected. The image is reversed in the plane in which the reflection takes place.

port - Point at which the I/O devices are connected to the computer.

positive feedback - See regenerative feedback.

positive lens - A convex lens, thicker at the center than at the edges, which converges rays of light through refraction.

positive logic - True level is the more positive voltage level in the system.

potential - The amount of voltage or charge between a point and a zero reference point. Bodies with an excess of electrons have a negative potential. Bodies with a deficiency of electrons have a positive potential. The electric potential at any point in an electric field is equal to the work done on a unit charge to bring the charge to that point from a place where the potential is zero.

potential energy - Energy due to position.

potentiometer (pot) - A variable resistance unit having a rotating contact arm that can be set at any desired point along a resistance element. The voltage source is connected to the end terminals of the resistance element, and the output circuit is connected between one end terminal and the moveable contact to give a voltage dividing action.

potentiometric measurement - DC voltage can be most accurately measured using the potentiometric method. It consists of comparing the unknown voltage with a known voltage from a calibrated potentiometer.

power - The time rate of doing work, or the rate of expending, transferring, or transforming energy. It is measured in watts.

power amplifier - An amplifier designed to produce a gain in signal power, as distinguished from a voltage amplifier.

power factor - The ratio of the actual power of an alternating or pulsating current, as measured by a wattmeter, to the apparent power, as indicated by ammeter and voltmeter readings; it is equal to the cosine of the phase angle between a sinusodial voltage and the resulting sinusodial current.

power supply - An electronic circuit that produces the multiple output voltage currents required to operate other electronic circuits from a single power source.

power-up reset - Initialization process whereby storage elements within a system are preset to defined conditions whenever power is first applied.

precision - The term precision can best be defined as repeatability. If a measurement is made a number of times and nearly the same value is read each time, it is a precise measurement, the readings may be all wrong. Care should be taken not to confuse precision with accuracy.

pressure - (1) Force per unit area (closed system). (2) Height times density (open system).

primary colors - Colors in terms of which all colors may be described or from which all colors may be evolved by mixtures.

primary standard - A unit established by some authority or developed through practical exact application of a formula. Secondary standards are calibrated against the primary standard.

primary winding - The transformer winding which is connected to the source of power.

principal focus - A point to which rays parallel to the principal axis converge, or from which they diverge after reflection.

printed circuit technique - A method by which circuit connections and many of the components are printed or painted on a plane surface with conductive or resistive media. These techniques permit the construction of extremely compact circuits.

priority - Number assigned to an event or device that determines the order in which it will receive service if more than one request is made simultaneously.

prism - A transparent body bounded in part by two plane faces that are not parallel, used to deviate or disperse a beam of light.

probability - The likelihood of the occurrance of any particular form of an event, figured as the ratio of the number of ways in which that form might occur to the whole number of ways in which the event might occur in any form.

probe - A probe is a link between the measuring instrument and the circuit under test. It is considered as part of the measuring equipment. Probes are used for isolation, to extend the voltage range of the measuring equipment or to rectify an AC input.

processor - Same as microprocessor.

program - For computers, a set of instructions arranged in proper sequence to instruct a computer to perform a desired operation or operations.

Program Counter (PC) - Register in the CPU that holds the address of the next program byte to be read. Branching requires loading of the jump address into the program counter; otherwise, the PC is incremented after each byte is read.

programming language - Language used to write a program. May be machine, assembly, or high-level.

PROM - Programmable Read-Only Memory. Integrated circuit memory that is manufactured with a pattern of all logical zero or one and has a specific pattern written into it by a special hardware programmer.

propagation - In communcations or electronics the travel of electromagnetic waves or sound waves through a medium, or the travel of a sudden electrical disturbance or sharp change in value along a line or scale.

propagation delay - Time required for a signal to propagate through a device.

protocol - Set of rules for exchange of information.

proving ring - An elastic ring in which the deflection of the ring, when loaded along a diameter, is measured by means of a micrometer screw and a vibrating reed. Note that all ring-type elastic force measuring devices are not proving rings, and such devices which do not make use of a micrometer screw and vibrating reed should not be called proving rings.

proving ring deflection - The difference between the reading for a given load and the reading for no load.

proton - A positively charged particle occupying the nucleus of an atom that has a charge equal to that of an electron.

Pseudo-Instruction - Instruction that is used in an assembly language program but is an instruction for the assembler. Pseudo-instructions have no direct correspondence to machine language.

psychrometer - An instrument for measuring relative humidity.

pull-up resistor - Used to provide the source current for open-collector and three-state logic gates or a termination for unused inputs. Pulls and voltage level up when no other device is driving the line.

pulse - A noninusodial waveform resulting from a sudden change in voltage or current levels for a specified period of time.

Pulse Amplitude Modulation (PAM) - The form of modulation in which the amplitude of a pulse carrier is varied in accordance with the amplitude and frequency of the modulating signal.

Pulse Recurrence Frequency (PRF) - The rate, usually given in pulses per second, at which pulses occur.

Pulse Repetition Time (PRT) - Time from the beginning of one pulse to the start of the next. Equal to 1/PRF.

pulse width - The elapsed time between the 50 percent point in the rise of a pulse to the 50 percent point in the trailing edge of the pulse.

pulser - See logic pulser.

punch through - It is unique to transistors and results when the reverse bias supply completely ionizes the base region.

push - Operation of adding a word to the stack.

push-down stack - See stack.

push-pull amplifier - An amplifier circuit containing two tubes arranaged with the control grids connected to opposite ends of the input transformer secondary winding or to other out-of-phase feed points and with the plates connected to opposite ends of the output transformer primary winding. Grid voltage is the a maximum on one tube when it is minimum on the other tube, so that the sum of the plate currents is constant. Signal components add in the output to give twice the output of a single tube. This arrangement also tends to cancel even harmonics that would otherwise cause distortion. Solid state devices are used as push-pull amplifiers also.

pyrometer - A device for measuring high temperatures.

quadrant - One of the four sections in which a plane is divided by two perpendicular lines.

quadrature - Two alternating quantities are in quadrature when the phase angle between them is 90°.

quality (Q) - A quality factor rating applied to a coil, capacitor, or resonant circuit. The ratio of the energy stored in a circuit to the energy dissipated.

quantum - One of the very small parts into which many forms of energy are subdivided.

quantum theory - The transfer of light and matter occurs only in discrete quantities proportional to the frequency of the energy transferred.

quartz crystal - A thin square or rectangular slice of quartz which, when precision-ground and smoothed, will vibrate at a frequency determined by its thickness and its original position in the natural quartz.

quiescence - A term used to describe the state of a circuit that exists before a trigger is applied. A stable operating condition.

radar - Radio detection and ranging. Widely used in military and civilian applications.

radian - The angle for which the arc length is equal to the radius. There are 2 π radians in 1 revolution (360°). A radian represents an angle of approximately 57.3°.

radiant energy - Energy in the form of electromagnetic radiation such as radio waves, heat waves, light waves, ultra violet rays or X-rays.

radiation - Electromagnetic energy traveling outward into space.

radio - General term denoting radio wave transmission and reception.

radioactivity - The spontaneous, uncontrollable disintegration of the nucleus of an atom with the emission of particles and rays.

radius - The shortest distance from the center of a circle or arc, to a point on the circumference.

radix - Total number of distinct characters of numbers used in a numbering system. Same as base.

RAM (Random Access Memory) - Usually used to mean semiconductor read-write memory. Strictly speaking, ROMs are also RAMs (see also random access).

ramp voltage - A popular name for a positive linear sawtooth waveform. It is composed of a sine wave fundamental and an infinite number of odd and even harmonics. The even harmonics starting out of phase and the odd frequencies starting in phase.

random access - Access method in which each word can be retrieved in the same amount of time (i.e., the memory locations can be accessed in any [random] order).

random error - Random errors are sometimes called "accidental" errors because they are as likely to occur in one direction as the other. They are the error left when all gross errors and systematic erros have been corrected.

random logic - Hard-wired (or random) logic design solutions require interconnection of numerous integrated circuits representing the logic elements. The function of the circuit is determined by the functional blocks, and their interconnections rather than by a program.

range - (1) Extent of coverage of effectiveness. (2) Measure of distance.

Rankine temperature scale - A temperature scale which corresponds to the Kelvin scale, but is based on the absolute zero of the Fahrenheit system, so the 0° Fahrenheit = 459.69° Rankine.

ratio bridge - A bridge circuit that uses a calibrated resistive or calibrated inductive voltage divider for one side of the bridge. Precision resistors, inductors, and capacitors are measured with ratio bridge circuits.

ratio transformer - A precisely wound autotransformer used as an AC voltage divider.

ray of light - Can be considered as the path traced by a point on an advancing wave front.

RC constant - The time constant of a resistor-capacitor, equal in seonds, to the value of the resistance multiplied by the value of the capacitance.

RC coupling - Resistor-capacitor coupling between two circuits. It has a long term constant and produces negligible waveshaping of a nonsinusodial waveform.

real image - A real image is one through which light rays actually pass and can be projected onto a screen.

reactance - The opposition in ohms offered to the flow of an alternating current by inductance or capacitance in a circuit. It is the componenet of the impedance of a circuit which is not due to resistance.

reactive kick - Surge currents produced in a galvanometer circuit when power is interrupted. These are due to the discharge of the circuit's capacitance and inductance. Reactive kick causes violent deflection of the galvanometer.

recorder - An instrument that makes a grahpic record in which the value of a quantity (voltage, current, power, temperature) varies with time.

rectangular wave - A periodic wave which alternately assumes one of two fixed values, the time of transition being negligible in comparison with the duration of each fixed value.

rectification - The process of converting AC into a undirectional current by removing or inverting that part of the wave lying on one side of the zero amplitude axis.

rectifier - The component that accomplishes the process of rectification of AC.

reference level - The level used as a starting point when designating the value of an alternating quantity or a change in the quantity by means of decibel units. A common reference value in voltage, current, and power designations is 0.001 watt for 0 db. For sound loudness, the reference level is usually the threshold of hearing.

reflected impedance - The impedance value that appears to exist across the input of a transformer or any four-terminal passive network as a result of the characteristics of the impedance connected across the output.

reflected wave - The sky radio wave, reflected back to Earth from an ionosphere layer.

reflection - The change in direction of waves after striking a surface.

reflection coefficient (Γ) - The magnitude and phase angle of the reflected wave on a transmission line.

reflex klystron - A velocity-modulated klystron serving as a feedback oscillator.

refraction - The bending of a ray of light, heat, sound, or a radio wave passing obliquely from one medium into another in which the velocity of propagation is different from the first medium.

refresh - Process of restoring the charge in a dynamic memory. Refresh logic must rewrite the contents of the complete RAM periodically (typically 2 ms), called refreshing the memory (see Dynamic Memory).

regenerative feedback - A method of securing increased output from an amplifier, by feeding part of the output back in such a way as to reinforce the input signal. It is also called positive feedback.

regulated power supply - A power supply containing a regulator device for maintaining constant current under changing load conditions.

register - Single word of memory. Registers within the CPU are more readily accessible than external memory locations. Registers external to the CPU are simply a group of flip-flops.

relative addressing - Specifying an address as a distance from the current address (e.g., three bytes ahead or four bytes backwards).

relative humidity - The ratio of the amount of water vapor in the air at a given temperature to the maximum water vapor (capacity of the air) at the same temperature.

relaxation oscillator - A device which generates a nonsinusodial wave by the charge and discharge of a capacitor through a resistor.

relay - The most common type of relay is an electromechanical device by means of which a current change in one circuit produces an armature movement that opens or closes contacts to produce a change in the electrical condition of another circuit.

reluctance - The property of a magnetic circuit that determines the amount of magnetic flux that will be produced as a result of the application of a given magnetomotive force.

remote cutoff tube - A tetrode or pentode tube in which the spacing of the control grid wires is wider at the center than at the ends. It is also called a "variable mu" tube. It will give higher amplification of small signals and less amplification of larger signals.

repulsion - A force tending to separate objects or particles having like electrical charges or magnetic polarities.

reset - To place a binary circuit in the initial state.

resident assembler - An assembler "situated" and used within the system in which the assembler code may be used.

residual loss - (1) The minimum or initial loss of a variable attenuator or isolator. (2) The loss or attenuation of a component which is ideally lossless.

resilience - The resilience of a body measures the extent to which energy may be stored in it by elastic deformation.

resolution - (1) The term resolution pertains to the scale of an instrument. It is the smallest readout at calibrated points. Resolution is sometimes referred to as "least count." (2) When uncalibrated adjustments are made, resolution is the smallest change which can be obtained by manipulation of the instrument controls. Resolution can be increased by use of vernier scales.

resolver - A type of transformer used for solving a vector for two mutually perpendicular components or resolving a vector into two mutually perpendicular components.

resonance - The frequency whereby any system responds with maximum amplitude to an applied force having a frequency equal or nearly equal to its own.

resonant cavity - A form of resonant circuit in which the current is distributed on the inner surface of an enclosed chamber. By making the chamber of the proper dimensions, the circuit can be made to have a high Q at microwave frequencies. The resonant frequency of a cavity can be changed by the adjustment of screws that protrude into the cavity or by changing the shape of the cavity. The cross-section of the cavity may be circular, rectangular, or any other shape.

resonant frequency - (1) Frequency, of a crystal unit, for a particular mode of vibration to which, discounting dissipation, the effective impedance of the unit is zero. (2) That frequency, for a given resonant circuit, at which the inductive reactance is equal to the capacitive reactance.

resonant line - One having standing waves.

restore - To return a register or other computer word to its initial or preselected value.

resultant - An entity or quantity obtained by means of, or as a result of, a given process.

restoring force - The constant mechanical force provided.

rest point - The equilibrium point or the point at which the pointer of the balance would come to rest once it has been set into oscillation.

retentivity - The ability of a material to retain its magnetism.

reticle - Crosslines found in the telescope of sight levels, transits, and theodolites. Initially in the form of a fine hair. They are now produced by engraving glass with a diamond point to achieve a line of 2.5 to 3 seconds thickness.

retrace - The path traced by the electron beam in a CRT in going from the end of one line to the start of the next line or trace.

return - Mechanism providing for a return in the usual sense in particular, an instruction at the end of a subroutine that causes control to return to the proper point in the main routine.

reverse - In optics, to rotate a theodolite 180° about the vertical axis.

reverse current - The small flow of electricity between the juntion of a diode receiving reverse bias; usually measured as only a few microamperes in contrast to a forward current measured in milliamperes.

rheostat - A variable resistor having one fixed and one moveable terminal.

rho - The magnitude of the reflection coefficient.

rhomboid prism - A prism which displaces the axis of a beam without introducing and without reverting the image.

right angle prism - A simple prism used when deviations of 90° are required. Reversion of the image takes place.

ringing - Damped oscillations occurring as the transient response of a resonant circuit to a shock excitation. Usually occurs as an unwanted effect in poorly designed circuits.

ripple - The AC component present in the output of a DC generator, rectifier system, or power supply.

rise time - The time needed for the leading edge of a pulse to rise from the 10 percent reference point to the 90 percent reference point.

rising edge - Low-to-high logic transition.

roentgen - The international unit of quantity of roentgen rays (X-rays).

ROM (Read-Only Memory) - Permanently programmed memory. Mask-programmed ROMs are programmed by the chip manufacturer. PROMs (Programmable ROMs) can be programmed by the user. EPROMs (Erasable PROMs) can be erased with ultraviolet light.

rosin-core solder - Solder made up in tubular form with the inner space containing rosing flux for effective soldering.

rotary motion - Motion in which every particle of a body moves in a circle and all the circles have their centers on the same straight line.

rotating joint - A device for permitting one section of a transmission line to rotate continuously with respect to another and still maintain a matched impedance.

rotor - (1) A rotating member such as the armature of a motor, generator, or synchro. (2) The rotating plates of a variable capacitor.

saturable reactor - A device consisting of a DC winding and an AC winding on the same core. The DC winding is used to vary the core saturation and thus controls the impedance to current in the AC winding.

saturation - The point in operation where an increase in a given quantity will have a negligible effect on the output or end result.

saturation current - The collector current flowing with a zero emitter current. Sometimes called leakage current or collector cutoff current. Abbreviated Ic_0 or Icb_0.

scale - (1) Something graduated when used as a measure or rule. A series of spaces marked by lines to indicate the magnitude of some quantity. (2) A weighing device.

scanning - Process of sequentially accessing individual signal lines in a group.

schematic diagram - A diagram which shows all of the electronic parts by means of symbols.

scintillation counter - A device used for the detection of radioactivity.

Schering bridge - An AC bridge comprised of resistors and capacitors used to measure the capacitance and dissipation factor of a capacitor. Variable capacitors are used to obtain the amplitude and phase nulls.

Schmitt trigger circuit - A variation of a bistable multivibrator. It always produces a rectangular or square wave output of constant amplitude, regardless of the input waveform. It is widely used as a wave-shaping circuit.

scratchpad - Memory containing intermediate data needed for final results.

screen - A metal partition or shield used to isolate an instrument or device from external magnetic or electric fields.

screen grid - A grid of a vacuum tube placed between the control grid and the plate, and usually maintained at a fixed positive potential for the purpose of reducing the electrostatic influence of the plate in the space between the screen grid and the cathode.

second (ephemeris second) - Unit of time. Exactly 1/31,556,925.9747 of the tropical year of 1900, January, 0 days and 12 hours ephemeris time.

secondary emission - Electron emission that is the direct result of the impact of electrons against a surface.

Seeback effect - The EMF produced in a circuit containing two contracting conductors of different metals having two junctions at different temperatures.

selectivity - The degree to which a receiver is capable of discriminating between signals of different carrier frequencies.

self-bias - Production of grid bias voltage, by a vacuum tube itself, by the flow of plate and other electrode currents through a resistor in the cathode lead. The resulting voltage drop across this resistor serves as the grid bias.

self-test - Test performed by a product on itself.

semiconductor - A class of solids whose electrical conductivity is between that of a conductor and that of an insulator.

sensitivity - (1) The degree of response of a circuit to signals of the frequency to which it is tuned. (2) An indication of the gain of a receiver. (3) A measure of the minimum signal to which a device shows a measurable response. (4) The ratio of a small change in instrument reading to the change in the measured quantity required to produce it. (5) Ratio between electrical output to mechanical output.

sequential logic - Circuit arrangement in which the output state is determined by the previous state and the current inputs. (Compare with combinational logic.)

serial - Transmitting data bits one at a time over a single wire, instead of using one wire for each bit.

series circuit - An electrical circuit in which the component parts are connected end to end to form a single continuous path for the current.

series motor - A commutator-type motor having armature and field windings in series. Characteristics are high starting torque, variation of speed with load, and dangerously high speed on no-load.

series resonant circuit - An inductor and capacitor in series, having electrical values such that the inductive reactance of the inductor is equal to the capacitive reactance of the capacitor at the frequency being handled. At resonance, the circuit current is a maximum and the voltage across either the inductor or the capacitor may be several times the voltage applied to the combination.

servo system - An electromechanical system which is used for positioning one element of a system in relation to another, for example, a PPI sweep in relation to the antenna. The change in position of one element of the system results in the reproduction of an error voltage that is used indirectly to cause a motor to drive the other element of the system to the point where the error voltage no longer exists.

set-up time - Time that data must be stable prior to a write signal.

shaded poles - A moving coil meter movement that has its permanent magnet poles offset to produce a logarithmic response.

sharp cutoff - Term applied to a tube or grid of a tube in which the control grid spirals are uniformly spaced. The result is that as grid voltage is made negative, plate current decreases steadily to cutoff.

shear - An action or stress from applied forces that causes two contacting part of a body, no slide relative to each other, in a direction parallel to their place of contact.

shell - One of a series of concentric spheres, called signals, which are designated in the order of increasing distance from the nucleus of an atom, as K, L, M, N, O, P, and Q shells. The number of electrons contained in each shell is limited.

shielded wire - Insulated wire covered with a metal shield, usually of tinned, braided copper wire.

shielding - A consturction feature of electrical instruments which refers to the grounding of the metal case and top plate, thus serving as an electrostatic shield and diverts external charges that might otherwise pass through the measuring circuit.
shift - To move the characters of a unit of information right or left. For a binary number, this is equivalent to multiplying or dividing by two for each shift.

short circuit - A low resistance connection between two points of different potential in a circuit.

short waves - A general term usually applied to a wavelength shorter than the lower limit of the standard U.S. broadcasting band (200 meters).

shunt - (1) A precision low-value resistor placed across the terminals of an ammeter to increase the range by allowing a definite part of the circuit current to go around the meter. (2) Any part connected, or the act of connecting any part of a circuit in parallel with some other part.

shunt box - A precision low resistance voltage divider used to enable measurements of high currents.

sidebands - The new frequencies above and below the carrier frequency produced as a result of the frequency modulation of the carrier. The sum frequencies form the upper sideband, the difference frequencies form the lower sidebands.

signal-to-noise-ratio - Ratio of signal amplitude to the amplitude of the noise. This is an important consideration when the input signal is of very low amplitude.

signal tracing - This consists of checking the input and output stages of an amplifier for the desired signal to localize a malfunction.

signature - Four-digit value generated by a signature analyzer, which is used to characterize data activity present on a logic node during a specific period of time.

signature analysis - Technique used to facilitate the troubleshooting of digtal circuits. Nodes of the circuit, simulated during a test mode, produce "signatures" as the result of the data compression process performed by the signature analyzer. When node signatures are compared to known good documented signatures, faulty nodes can be identified.

signature analyzer - Instrument used to convert the long, complex serial data streams present on microprocessor system nodes into four-digit signatures.

Silicon Controller Rectifier (SCR) - A three-junction semiconductor device which is capable of handling large values of current and voltage. It is similar to the gas-filled thyratron tube, yet it has a variety of applications for which a thyratron tube is not generally used.

simulator - Special program that simulates the logical operation of the microprocessor. It is designed to execute machine language programs on a machine other than the one for which the program is written. This allows programs for one microprocessor to be debugged on a system that uses another processor.
sine wave - A wave in which the amplitude varies as the sine of an angle or time function.

sinusodial vibration - A simplified back and forth motion of a constrained object which varies sinusodially with time.

single phase - Pertaining to a circuit or device that is energized by a single alternating voltage.

single-step - Process of executing a program one instruction or machine cycle at a time.

sink current - Current input capability of a device.

skin effect - The tendency of high frequency alternating currents to concentrate near the surface of a conductor, thus increasing the effective resistance of the conductor. The skin effect increases with frequency.

Small Scale Integration (SSI) - Technology of less complexity than medium scale integration. Usually means less than ten gate functions in the IC.

Smith chart - A diagram used to find the impedances, wavelengths, and standing wave ratio of a transmission line.

soft tube - A vacuum tube that has been fully evacuated than injected with enough gas to change its operating characteristics appreciably. Examples are: neon, thyratron, VR tubes. However, a vacuum tube in which a gas has developed is sometimes called a "soft tube" or a "gassy tube."

software - See programs.

solder - An alloy of lead and tin which melts at a fairly low temperature (about 500°F) and is used for making permanent electrical connections in electrical circuits.

solder bridge - Glob of excess solder that shorts two conductors. A common problem on production PC boards.

solder gun - A soldering iron having an appearance similar to that of a pistol. Usually has a fast-heating resistance element at the tip.

soldering iron - A device used to apply heat to a joint which is to be made permanent by soldering.

solenoid - An electromagnet having an energizing coil which is approximately cylindrical in form, acting on an armature positioned in the center of the coil.

solid - The state of matter which has a definite shape and definite volume.

solid state physics - That branch of physics which deals with the structure and properties of solids. In electronics, solid state refers to those devices which peform the functions of vacuum tubes.
sonar - Sound navigation and ranging. Electronic equipment used for underwater detection of objects and determination of their range.

sound - A vibration of a body which can be heard by human ears. The extreme limits of human hearing is 20 Hz to 20 KHz. Sound can travel through any medium which possesses the ability to vibrate; the vibrations are called sound waves.

source code - Program written in other than machine language. May be assembly language or a high-level language.

source code file - Source code statements stored within a computer or microprocessor system.

source language - A computer or microprocessor language which is intelligible to a (human) programmer; it probably uses mnemonics for instructions, labels for store locations and algebriac expressions for computations.

source program - A program written in a source language such as Fortran IV, Algol, Basic, etc.

space charge - The negative charge produced by the cloud of electrons existing in the space between the cathode and plate of a thermionic vacuum tube; formed by electrons emitted from the cathode in excess of those immediately attracted to the plate.

specific gravity - The ratio of the density of a substance to the density of a standard.

specific heat - The ratio of the heat capacity of a body to its mass or weight.

spectral lines - Sidebands of a modulated RF signal as displayed on spectrum analyzer CRT.

spectroscope - Any of various instruments for forming and examining the optical spectra.

spectrum - (1) The entire range of wavelengths within which electromagnetic radiations occur. (2) A segment of wavelengths which has a special function or possesses special properties.

spectrum analysis - The study of energy distribution across the frequency spectrum for a given electrical signal.

spectrum analyzer - A test instrument which provides a visual or panoramic display of the radio frequency electrical signal on a CRT, in the form of a graphical plot of amplitude (Y axis) and frequency (X axis).

spectrum width - The widest range of frequencies that can be observed on a spectrum analyzer CRT in a single sweep.

spherical aberration - The failure of parallel rays to meet at a single point after reflection, causing a blurred image.

square law detection - The term applied to the response of a detector whose response is a function of the square of the input voltage. Square law detection is used for microwave power measurements.

square law scale - A scale in which the deflection is proportional to the square of the applied voltage or current. The iron vane type meter movement has a square law repsonse. Therefore they must use a square law scale.

square wave - The waveform of a quantity that shifts abruptly from one to the other of two definite values producing a square waveform. The square wave is considered to consist of a sinewave fundamental frequency and an infinite number of odd harmonics, all starting in phase. RMS, average, and peak values of this waveform are the same.

SSI - See Small Scale Integration.

stack - Block of successive memory locations that is accessible from one end on a last-in-first-out basis (LIFO). For most processors, the stack may be any block of successive locations in the read/write memory.

stack pointer - Contains the address of the top of the stack. In general, the stack point is decremented immediately following the storage in the stack of each byte of information. Conversely, the stack pointer is incremented immediately before retrieving each byte of information from the stack.

standard - Anything taken as a basis of comparison. An authorized weight or measure having recognized excellence. It is desirable that the standard have an uncertainty that is one-tenth or less than the equipment being calibrated. A standard is a physical embodiment of a unit. In general it is not independent of physical condition, and it is a true embodiment of the unit only under specified conditions, for example, a yard standard has a length of one yard when at some definite temperature and supported in a certian manner.

standard cell - A very accurate battery used as a voltage standard. There are two types used, the saturated (normal) and the unsaturated cell. This saturated cell is used as the voltage standard.

standard deflection - A standard deflection of a galvanometer is defined as a deflection of the center of the light beam 1 millimeter in the scale, when the scale is the optical equivalent of 1 meter from the reflecting mirror.

standard deviation - The square root of the sum of the squares of the deviations from the arithmetic mean of a frequency distribution. The deviations from the arithmetic mean are squared and added, and the square root of this sum is the standard deviation.

standard pressure - The pressure exerted by a column of mercury exactly 760 mm high.

standard temperature - The temperature of melting ice.

Standing Wave Ratio (SWR) - The ratio of voltage (or current) at a loop (maximum) on a transmission line to the value at a node (minimum). It is equal to the ratio of the characteristic impedance to the impedance of the load connected to the output end of the line.

static error - The maximum difference between the true quantity and the indicated quantity when the applied (true) quantity is not changing.

static memory - Memory devices that do not need clocks or refreshing.

statement - Usually an instruction written in source language, also used for one line of source code. Statements often result in more than one machine code instuction when coded.

stator - A portion of a machine which contains the stationary parts of the magnetic circuit, with their associated windings.

status - Present condition of the device. Usually indicated by flag flip-flops or special registers. See flag.

steradian - One-fourth of the solid angle around a point.

storage - See memory.

storage circuit - Any circuit in which information can be stored. Often called a memory circuit.

storage time (Ts) - The time required to drain off the injected minority carriers in the base caused by saturating the collector.

strain - Deformation of a material body under the action of applied forces (stress).

stray capacitance - A capacitanve that exists between circuit elements, between adjacent conductor, and between those elements and conductors and the equipment chassis.

straightness - This is the uniformity of direction throughout the extent of that part feature such as the freedom from bend, warp, or twist of a shaft.

stray inductance - The inductance that exists between circuit elements, between adjacent conductors, and between those elements and conductors and chassis.

stress - Mutual force between contacting surfaces of bodies caused by an external force, such as tension or shear.

stress testing - Introducing mechanical, electrical, or thermal stress on electrical devices so as to modify their operation and allow intermittent problems to be observed.
stroboscope - An instrument used to determine the speed of a rotating body. It creates the optical illusion of slowing down or stopping the motion of an object by illuminating it with flashes of intense light at regular intervals.

sublimation - The change of state from a solid to a vapor or gas without going through the liquid state.

subroutine - Self-contained portion of a program that performs a well-defined task. May be used at different places in the same program.

substitution loss - The ratio of the initial to final load power, expressed in decibels, when a initial waveguide junction (a connector pair, two-port network, etc.) is removed and another substituted in its place.

summer solstice - Longest day of the year. It usually falls on June 21st in the northern hemisphere. The sun casts its shortest shadows in the summer solstice.

superheterodyne - A receiver in which the incoming signal is mixed with a locally generated signal to produce an intermediate frequency that is then amplified and detected.

suppressor grid - An electrode used in an electron tube to minimize the effects of unwanted secondary emission from the plate.

surface tension - The tendency of the surface of a liquid to contract.

swamping resistor - A resistor placed in parallel with a tank circuit to reduce the Q.

sweep voltage - The periodically varying voltage produced by a sweep oscillator and applied to the deflecting plates of a CRT to give a displacement that is a function of time.

synchro - The universal term applied to any of the various synchronous devices such as the "selsyn," "autosyn," "motor-torque generator," "magslip," and "siemens." The standard signal and control synchro today has two-pole single-phase rotor field and a delta or Y-wound single-phase variable-voltage stator.

systematic error - Systematic errors tend to bias all the measurements in one direction. The same error is occurring in measurement after measurement. Systematic errors can usually be blamed for trends, jumps, or drifts in a reading. They are also called persistent errors.

table - Collection of data in a form suitable for ready reference, frequently stored in sequential memory locations.

table look-up - Obtaining a value from a table of values stored in the computer.

tachometer - An instrument for measuring rotational speed in revolutions per minute (rpm).

talker - Device that outputs data to a data bus. A ROM is a talker.

tank circuit - A resonant circuit, consisting of inductance and capacitance in parallel, or series; one value is usually a variable.

telescope - An instrument for making objects appear nearer and larger. The telescope forms the basis upon which physi-optical instruments are designed, such as the transit and theodolite.

temperature - The quantitive measure of the relative hotness or coldness of an object.

temperature coefficient - A numerical value that indicates the relation between a temperature change and the resulting change in another property. The numerical value can be either negative or positive.

tensile strength - The force required to break a rod or wire of unit cross-sectional area.

terminal linearity - Ratio of the actual error voltage in the output to the total input voltage. This will vary with the setting of the ratio voltage divider.

termination - The load connected to the output end of a circuit or transmission line.

tertiary winding - A third winding added to a transformer in addition to the conventional primary and secondary winding. In most applications it is used as an additional secondary winding.

testing machine - A machine for applying forces to specimens of steel and other materal to determine the applied force which the test specimen will withstand.

test instrument - The device which is being compared with the calibration standard. The test instrument is the instrument whose accuracy is being tested.

test set - A combination of instruments needed for making a particular combination of tests, or for servicing a particular type of equipment.

text editor - A term used to describe the program which helps a user to create, adapt, sort or otherwise modify a source program.

theodolite - An optical instrument used for measuring horizontal or vertical angles.

thermal agitation - Random movement of free electrons in a circuit due to the presence of heat.

thermal energy - The potential and kinetic energy of the particles of a body which can be evolved as heat.

thermal converter meters - Meters that employ a therocouple to convert the meter input to a DC voltage proportional to the RMS value of the input. They are widely used for accurate measurement of AC voltage and current.

thermal runaway - A result of a regenerative increase in collector current and junction temperature.

thermal capacity - The amount of heat required to produce a unit temperature change. Water has the highest thermal capacity of any common substance.

thermionic emission - The evaporation of electrons from a heated surface.

thermistor - A resistor whose value varies with temperature in a definite desired manner, used in circuits to compensate for temperature variations in other parts. It may have either a negative or a positive temperature coefficient. One type is made from a semiconducting material such as uranium oxide or silver sulphide, having a relatively large negative temperature coefficient of resistance. The name is a contraction of thermal resistor.

thermocouple - Two dissimilar metals joined at one end. When a difference of temperature exists between the ends, and EMF is generated across the thermocouple. This DC voltage is proportional to the heat applied to the thermocouple junction.

three-state - Logic device whose output can be plced into a high-impedance (off) state, in addition to the usual high and low states. This feature allows more than one device output to be connected to the same logic node. Three-state operation is a fundamental requirement for devices used on microprocessor data buses. Same as true-state (registered trademark).

threshold sensitivity - Refers to the smallest fractional load which will cause a pressure system to indicate that a laod is starting to be applied.

throughput - Speed with which problems or segments of problems are performed. Thoughput will vary from one application to another.

thyratron - A hot-cathode gas-filled triode or tetrode which is used as an electronic switch. It controls electrostatically (with grids) the starting of the unidirectional current flow. To cut off the discharge, the plate-cathode potential must be reduced to the extinguishing regenerative feedback.

time - The period during which an action or process continues; measurement of duration.

time base - The time reference plotted along the X-axis of a CRT.

time constant - The time required for a quantity that varies exponentially to change by an amount equal to 0.632 times the total change that will occur. In a capacitor-resistor circuit, it is the number of seconds required for the capacitor to reach 63.2 percent of its full charge after a voltage is applied. In an inductor-resistor circuit, it is the number of seconds required for the current to reach 63.2 percent of its final value.

time delay relay - A relay with a heating element designed to delay full circuit operation until the filaments of the vacuum tubes have had time to reach operating temperatures.

time domain - Information that is a direct function of time. An oscilloscope displays information in the time domain.

time signals - One of the technical radio broadcast services of NBS radio stations.

toroid - A doughnut-shaped coil wound on a core of the same configuration. A toroid coil produces little interference to other circuits and is relatively inaffected by the magnetic fields of other circuits.

torque- The cause of rotary motion. Torque is equal to the applied force multiplied by the distance from the center of rotation.

torque wrench - A wrench with which the mechanic can apply specific amounts of torque, usually as indicated by the setting of the handle.

torr - 1/760 of an atmosphere - 1 mm Hg.

total force - The force acting against the entire area of a particular surface.

trace - The path followed by the spot as it is in motion across the screen of a CRT.

trace - To trace a progam usually means executing program instructions one at a time and checking, or reporting, the contents of registers, accumulators and specified memory locations at each stage.

tracer - See current tracer.

transconductance - The ratio of the amplification factor of a vacuum tube to its AC plate resistance expressed in mhos or micromhos. The change in plate current divided by the change in grid voltage when the plate voltage is held constant.

transducer - (1) Generally, a device which converts from one form into another, always retaining the characteristic amplitude variations of the energy converted. (2) A device which transfers energy from one circuit to another without changing the form of energy. (3) A device which converts vibratory motion into an electrical signal that is a function of some parameter of the experienced motion.

transfer method - An accurate method of measuring voltages and currents using a thermocouple meter and the universal potentiometer. It consists of measuring the input, and duplicating the input reading with an internal source. The internal source voltage is then read with the universal potentiometer.

transformer - An electrical device which, by electromagnetic induction, converts electrical energy from one voltage-current level to another voltage-current level.

transient - The instantaneous surge of voltage or current that occurs as the result of a change from one steady-state condition to another.

transient vibration - Abrupt changes or shocks in the levels of other motion.

transient response - The ability of an amplifier circuit to reproduce faithfully the shape and amplitude of transient voltages.

transistor - An electronic device for rectification and/or amplification consisting of semiconducting material to which contact is made by three or more electrodes which are metal points or soldered junctions. In general, the resistance between two electrodes is controlled by the current supplied to another electrode.

transit time - (1) In electron tubes, the time required for an electron to travel from one electrode to another. (2) In semiconductors, the time required for the charge carrier to travel from the emitter to the collector.

translucent - Shining or glowing through; admitting and diffusing light so that objects beyond cannot be clearly distinguished.

transmission - Transfer of electric energy from one location to another through conductors or by radiation. The transfer always is accompanied by energy loss.

transmitter - A comprehensive term applying to all of the equipment used for generating and amplifying an RF carrier signal, modulating this carrier with intelligence, and radiating the modulated RF carrier into space.

transmutation - A change in the identity of a nucleus because of a change in its number of protons.

transparent - Having the property of transmitting light without appreciable scattering so that bodies lying beyond are entirely visible.

transverse electric (TE) mode - A field configuration in a waveguide in which all components of the electric field lie in a plane that is transverse, or perpendicular to the direction of propagation.

transverse magnetic (TM) mode - A field configuration in a waveguide in which all components of the magnetic field lie in a plane that is transverse, or perpendicular, to the direction of propagation.

traveling wave - Energy moving toward the termination of a waveguide or energy reflected from the termination.

trickle charge - The continuous charging of a storage battery at a low rate over a prolonger period of time.

trigger - (1) To start action in a circuit, which then functions for a period of time under its own control. (2) A short pulse, either positive or negative, which can be used to set into motion a chain of events.

trimmer - Any small capacitor inserted in parallel with a main capacitor to adjust its capacity to some predetermined level.

trivalent impurity - Any impure atom that has three electrons in its valence band.

troubleshoot - To seek the cause of a malfunction or erroneous program behavior in order to remove the malfunction.

troubelshooting tree - Flow diagram consisting of tests and measurements used to diagnose and locate faults in a product.

tropical year - The time between two successive vernal equinoxes. Our calendar is based on the tropical year. It is equal to 365 days, 5 hours, 48 minutes, and 49.7 seconds.

true power - The average value of power consumed by a circuit during one complete cycle of AC. In a DC circuit, the power is equal to the current times the voltage. In an AC circuit, the true power is equal to the current times the voltage, times the power factor. The formula, $P = I^2R$, will give the true power in <u>any</u> circuit.

true value - The value of a physical quantity that would be attributable to a material object or physical system if that value could be determined without error.

TTL - Transistor Transistor Logic. Family of digital integrated circuits that have bipolar transistor inputs and outputs.

TTY - Teletype.

tube - The word "tube," without any qualification, refers to an electronic tube.

tuning - (1) Adjusting the inductance or capacitance (or both) in a coil-capacitor circuit. (2) Adjusting all circuits in electronic equipment for optimum performance.

tuning fork - A convenient device for producing a comparatively pure harmonic vibration frequency at nearly constant value. They are usually made of steel and are designed to vibrate at their natural resonant frequency.

tunnel diode - A very heavily doped PN junction.

turn-off time (Ts and Tf) - The time required for the Ic wave to go from its maximum value to 10 percent of its maximum value. It can be expressed as the sum of the storage time and the fall time. Ts is storage time, and Tf is fall time.

turn-on-time (Td and Tr) - The sum of the delay time and the rise time. This is the time necessary for Ic to go from its minimum value to 90 percent of its maximum value. Tr is rise time, and Td is delay time.

turns ratio - The ratio of the number of turns in the primary windings to the number of turns in the secondary winding of a transformer.

twin "T" network - A network of capacitors and resistors that will provide maximum attenuation and a 180° phase shift to a selected frequency. Other harmonics will be attenuated much less and they will appear to receive a negligible phase shift.

two's complement numbers - Numbering system commonly used to represent both positive and negative numbers. The positive numbers in 2's complement representation are identical to the positive numbers in standard binary. However, the 2's complement representation of a negative number is the complement of the absolute binary value plus 1. Note that the eighth or most significant bit indicates the sign: 0 = plus, 1 = minus.

two-wire transmission line - Two metallic conductors spaced equidistant apart and separated by dielectric or metallic insulators, used for frequencies up to 200 MHz.

twisted pair - A cable composed of two insulated conductors twisted together either with or without a common covering.

UART - Universal Asynchronous Receiver Transmitter. A serial to parallel and parallel to serial converter.

C - Microcomputer.

ultraviolet - A range of invisible radiation frequencies beyond the visible spectrum at the high frequency end, and extending into the region of low frequency X-rays.

unblanking - A signal aplied to the control grid of a CRT to allow the CRT to conduct. This is also called gating.

undamped wave - A continuous wave with undamped oscillation.

unifilar - Having or using one fiber, wire or thread.

uniform line - A transmissionline that has identical electrical properties throughout its length.

unit - A value, quantity, or magnitude in terms of which other values, quantities, or magnitudes are expressed. In general, a unit is fixed by definition and is independent of such physical conditions as temperature. Examples: yard, pound, gallon, meter, liter, gram.

unity coupling - Perfect mangetic coupling between two coils, so that all the magnetic flux produced by the primary winding passes through the entire secondary winding.

μP - Microprocessor.

vacuum - Any pressure below atmospheric. In gage pressure measurement, 5 psig vacuum means 5 psi below atmospheric pressure. In absolute pressure measurements, any pressure from zero psia (perfect vacuum) up to atmospheric pressure.

vacuum tube voltmeter (VTVM) - A voltmeter that has a high input impedance and therefore only a small amount of power from the circuit. The small power input is amplified before being applied to the meter movement of the VTVM.

valence - A measure of the combining power of one element with another. It depends upon the number and arrangement of the electrons in the outermost shell of the atom.

valence band - The outermost orbit of an atom that will contain electrons at absolute zero.

valence electrons - Electrons which are gained, lost, or shared in chemical reactions.

vaproization - The production of a vapor or gas from matter in another physical state.

variable-mu tube - A vacuum tube having the control grid wires irregularly spaced so that at different points within its operating range the grid has a different amount of control over the electron stream. This shifts the operating point from one section of the characteristic curve to another. Thus, by adjusting the grid bias voltage over a comparatively wide range the amplification factor and mutual conductance can be varied.

vector interrupt - See interrupt vectoring.

vector quantity - A quantity having both magnitude and direction, as a force or a velocity.

velocity - The time rate of change of position.

velocity constant - The ratio of the velocity of propagation in a transmission line to the velocity of light.

vernal (spring) equinox - First day of spring in the northern hemisphere. It usually falls on March 21st in the northern hemisphere. There are about 12 hours of light and 12 hours of darkness every place on the Earth during an equinox.

vernier - An auxillary scale made to work in conjunction with the divisions of a graduated instrument for indicating parts of a division.

vertically polarized wave - An electromagnetic wave in which the electric field (E) is perpendicular to the horizon and the magnetic field (H) is horizontal (parallel to the Earth's surface).

Very Large Scale Integration (VLSI) - Technology by which hundreds of thousands of semiconductor devices are fabricated on a single chip.

vibration - Mechanical oscillations or motion about a reference point or equilibrium.

video frequencies - A wide range of frequencies including the audio range and frequencies as high as 4 MHz. Some video amplifiers will amplify frequencies as high as 10 MHz.

virtual image - The impression of an object as viewed by the observer. Light rays do not pass through, but only appear to come from the image.

viscosity - The internal friction of a fluid.

VLSI - See Very Large Scale Integration.

volatile - Readily vaporizable at a relatively low temperature.

volatile memory - Memory device whose stored data changes when power is removed. RAMs can be made to appear nonvolatile by providing them with back-up power sources.

volt - Unit of electric potential difference and electromotive force. The difference of electric potential between two points of a conducting wire carrying a constant current of 1 ampere, when the power is dissipated between these points is equal to 1 watt.

voltage doubler - A rectifier circuit that produces a DC output which is roughly twice the peak value of the AC input.

voltage regulator tube - A glow discharge (cold cathode) type of tube intended for use in applications where it is necessary to maintain a constant DC output voltage across a load, independent of load current and moderate line voltage variations.

volume - The amount of space which matter occupies.

walking-ones - Memory test pattern in which a signal one bit is shifted through each location of a memory filled with 0's. A walking-zero pattern is the converse.

watt - Unit of power. The power which gives rise to the production of energy at the rate of 1 joule per second.

wave front - A section of a wave which has advanced a great distance from its source and assumed essentially a zero curvature.

wave guide - A hollow metal tube or solid dielectric or dielectric filled conductor capable of propagating electromagnetic waves through their interiors or radiating them into space at frequencies of about 1,000 megacycles and higher. Widths or diameters range from 1/2 to 12 inches or more. Air-filled, gas-filled, or evacuated hollow metal tubes of circular, rectangular, or other cross-sections are in practical use. The metal wall is called the sheath of the guide; it may be as thin as practicable. Electromagnetic waves travel through guides much as sound waves travel through a speaking tube.

wave guide modes - The shape, or pattern, of the electric and magnetic fields in a waveguide.

wavelength - The distance measured along the direction of propagation, between two points which are in phase on adjacent waves.

wavetrap - A tuned circuit used to eliminate a given frequency or to keep it out of a given circuit.

weber - Unit of magnetic flux. The magnetic flux which, linking a circuit of one turn, produces in it an electromotive force of 1 volt as it is reduced to zero at a uniform rate in 1 second.

Weber-Fechner Law - An approximate law which state that the magnitude of the sensation of loudness is proportional to the logarithm of the intensity.

wedge - A weals prism, shaped like a wedge used when very small deviations of a beam are required.

weight - The force of gravity acting on an object.

Wien bridge - A type of RC bridge that is widely used in audio oscillators. The RC values in the reactive side of the bridge determine the frequency of oscillation.

winter solstice - Shortest day of the year. It usually falls on December 21st in the northern hemisphere. The sun casts its longest shadows in the winter solstice.

word - Set of characters that occupies one storage location and is treated by the computer circuits as a unit. Ordinarily a word is treated by the control unit as an instruction and by the arithmetic unit as a quantity.

work - That which is accomplished when a force acts on matter and moves it.

working (operating) voltage - This is the safe RMS voltage that may be applied continuously across a capacitor.

write - To tansfer information, usually from main storage, to an output device; to record data in a register, location, or other storage device.

zener - A PN junction diode reverse-biased into the breakdown region; used for voltage stabilization.

zenith - The point of the celestial sphere that is directly opposite the nadir and vertically above the observer.

zero drift - Refers to the change in indication at no load if a force measuring system is permitted to "relax" in the unloaded condition for a long period of time.

zero return - The return of the output from a transducer to the original zero indication after the transducer has been loaded and unloaded.

zero shift - The difference between the initial zero balance and the indication from the transducer which has been loaded and unloaded.

A - ampere

A/A - air-to-air

AC - alternating current

AC/DC - alternating current/direct current

A/D - analog to digital

ADES - automatic digital encoding system

AF - audio frequency

AFC - automatic frequency control

AFT - automatic fine tuning

AFTO - Air Force Technical Order

AGE - aerospace gound equipment

ALC - automatic level control

ANL - automatic noise limiter

APC - automatic phase control

APL - automatic phase lock

APU - auxiliary power unit

ASCII - American Standard Code for Information Interchange

ATL - artificial transmission line

AVC - automatic volume control

b - bit

B - bel

BA - buffer amplifier

BCD - binary coded decimal

BCO - binary coded octal

BCU - buffer control unit

Bd - baud

B/D - binary to decimal

BDC - binary decimal counter

BDD - binary to decimal decoder

BER - bit error rate

BF - beat frequency

BFO - beat frequency oscillator

BIT - binary digit

BN - binary number

bp - bypass

BWO - backward-wave oscillator

BWR - bandwidth ratio

CIT - computer interface terminal

CLU - central logic unit

CMD - core memory driver

CO - crystal oscillator

COL - computer oriented language

CSR - control shift register

CTU - central timing unit

D/A - digital-to-analog

DE - digital encoder

DPU - data processing unit

ESU - electrostatic unit

EV - electron volt

GMT - Greenwich Mean Time

IDA - input data assembler

IEEE - Institute of Electrical and Electronics Engineers

IOB - input-output buffer

IOR - input-output register

KBS - kilobits per second

KLO - klystron oscillator

LFS - loop feedback signal

LG - loop gain

LO - local oscillator

MAC - multiple access computer

MBB - make-before-break

MC - magnetic core

MCM - magnetic core memory

MDS - minimum discernible signal

MDT - mean down time

MIR - memory input register

MLP - machine language program

MOL - machine oriented language

MOR - memory output register

MTBF - mean time between failures

NPR - noise power ratio

PCU - power control unit

PFN - pulse-forming network

PIU - plug-in unit

PLO - pulse-locked oscillator

PRV - peak reverse voltage

S/N - signal-to-noise

TCTO - time compliance technical order

UT - Universal Time

VCO - voltage-controlled oscillator

VFO - variable frequency oscillator

XCVR - transceiver

YIG - yttrium iron garnet

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