

The New IEEE Standard Dictionary of Electrical and Electronics Terms

Fifth Edition
Newly Revised and Expanded



Published by the
Institute of
Electrical and
Electronics
Engineers, Inc.

The New IEEE Standard Dictionary of Electrical and Electronics Terms

[Including Abstracts of All Current IEEE Standards]

Fifth Edition

Gediminas P. Kurpis, Chair

Christopher J. Booth, Editor





The Institute of Electrical and Electronics Engineers, Inc.
345 East 47th Street, New York, NY 10017-2394, USA

Copyright © 1993 by the
Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 1993
Printed in the United States of America

ISBN 1-55937-240-0

*No part of this publication may be reproduced in any form,
in an electronic retrieval system or otherwise,
without the prior written permission of the publisher.*

January 15, 1993

SH15594

Faraday rotation (1) (radio wave propagation).

The process of rotation of the polarization ellipse of an electromagnetic wave as it propagates in a magneto-ionic medium. See: **elliptically polarized wave**. 211-1977

(2) (communication satellite). The rotation of the plane of polarization of an electromagnetic wave when traveling through a magnetic field. In space communications this effect occurs when signals transverse the ionosphere. [25]

(3) (nonreciprocal wave rotation) (nonlinear, active, and nonreciprocal waveguide components). A nonreciprocal phenomenon in which the plane of polarization of a linearly polarized electromagnetic plane is rotated clockwise for one direction of propagation, and counter-clockwise for the other direction (viewed from the source in each direction), when passing through a gyromagnetic material having a magnetostatic field component along the direction of propagation. 457-1982

Faraday rotation. The rotation of the polarization ellipse of an electromagnetic wave as it propagates in a magneto-ionic medium. 211-1990

Faraday rotator (nonreciprocal wave rotator) (nonlinear, active, and nonreciprocal waveguide components). A nonreciprocal device providing Faraday rotation, usually in waveguide of circular or square cross section. 457-1982

Faraday's law (electromagnetic induction; circuit). The electromotive force induced is proportional to the time rate of change of magnetic flux linked with the circuit. 270-1966w

faradic current (electrotherapy). An asymmetrical alternating current obtained from or similar to that obtained from the secondary winding of an induction coil operated by repeatedly interrupting a direct current in the primary. See: **electrotherapy**. [47]

faradization (faradism) (electrotherapy). The use of a faradic current to stimulate muscles and nerves. See: **electrotherapy; faradic current**. [47]

far-end crosstalk. Crosstalk that is propagated in a disturbed channel in the same direction as the direction of propagation of the current in the disturbing channel. The terminal of the disturbed channel at which the far-end crosstalk is present and the energized terminals of the disturbing channel are ordinarily remote from each other. See: **coupling**. [119]

far-field diffraction pattern (fiber optics). The diffraction pattern of a source (such as a light emitting diode (LED), injection laser diode (ILD), or the output end of an optical waveguide) observed at an infinite distance from the source. Theoretically, a far-field pattern exists at distances that are large compared with $(s^2)/\lambda$, where s is a characteristic

dimension of the source and λ is the wavelength. Example: If the source is a uniformly illuminated circle, then s is the radius of the circle. Note: The far-field diffraction pattern of a source may be observed at infinity or (except for scale) in the focal plane of a well-corrected lens. The far-field pattern of a diffracting screen illuminated by a point source may be observed in the image plane of the source. Syn: **Fraunhofer diffraction pattern**. See: **diffraction; diffraction limited**. 812-1984

far-field pattern (1) (fiber optics). See: **far-field radiation pattern**. 812-1984

(2) (radiation) (antennas). Any radiation pattern obtained in the far field of an antenna. Note: Far-field patterns are usually taken over paths on a spherical surface. See: **radiation sphere; radiation pattern cut**. 145-1983

far-field radiation pattern. See: **radiation pattern**. 812-1984

far-field region (1) (antennas). That region of the field of an antenna where the angular field distribution is essentially independent of the distance from a specified point in the antenna region. Notes: (A) In the free space, if the antenna has a maximum overall dimension, D , which is large compared to the wavelength, the far-field region is commonly taken to exist at distances greater than $2D^2/\lambda$ from the antenna, λ being the wavelength. The far-field pattern of certain antennas, such as multi-beam reflector antennas, are sensitive to variations in phase over their apertures. For these antennas $2d^2/\lambda$ may be inadequate. (B) In physical media, if the antenna has a maximum overall dimension, D , which is large compared to π/γ , the far-field region can be taken to begin approximately at a distance equal to $\gamma D^2/\pi$ from the antenna, γ being the propagation constant in the medium. 145-1983

(2) (fiber optics). The region, far from a source, where the diffraction pattern is substantially the same as that at infinity. See: **far-field diffraction pattern**. 812-1984

(3) (land-mobile communication transmitters). The region of the field of an antenna where the angular field distribution is essentially independent of the distance from the antenna. Notes: (1) If the antenna has a maximum overall dimension (D) that is large compared to the wavelength (λ), the far field region is commonly taken to exist at distances greater than $2D^2/\lambda$ from the antenna. (2) For an antenna focused at infinity, the far field region is sometimes referred to as the Fraunhofer region on the basis of analogy to optical terminology. 377-1980

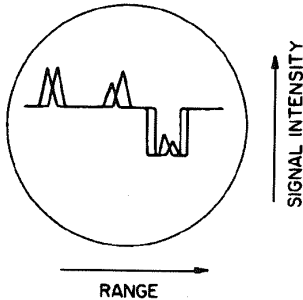
far-field region in physical media (antennas). See: **far-field region, Note (2)**. 145-1983

far field region, radiating. See: **radiating far field region**.

N-display* (radar). A K-display having an adjustable pedestal, notch, or step, as in the M-display, for the measurement of range. *Note:* This display is usually regarded as a variant of an A-display rather than as a separate type.

*Rare.

686-1982



**N-Display
(with notch)**

near-end crosstalk. Crosstalk that is propagated in a disturbed channel in the direction opposite to the direction of propagation of the current in the disturbing channel. *Note:* The terminal of the disturbed channel at which the near-end crosstalk is present is ordinarily near to or coincides with the energized terminal of the disturbing channel. *See:* **coupling**. [119]

near-field (radiation) pattern (antennas). Any radiation pattern obtained in the near-field of an antenna. *Note:* Near-field patterns are usually taken over paths on planar, cylindrical or spherical surfaces. *See:* **Fresnel pattern**; **radiation pattern cut**. 145-1983

near-field diffraction pattern (fiber optics). The diffraction pattern observed close to a source or aperture, as distinguished from far-field diffraction pattern. *Note:* The pattern in the output plane of a fiber is called the near-field radiation pattern. *Syn:* **Fresnel diffraction pattern**. *See:* **diffraction**; **far-field diffraction pattern**; **far-field region**. 812-1984

near-field pattern. *See:* **near-field radiation pattern**; **radiation pattern**.

near-field radiation pattern. *See:* **radiation pattern**.

near-field region (1) (antennas). That part of space between the antenna and far-field region. *Note:* In lossless media, the near-field may be further subdivided into reactive and radiating near-field regions. 145-1983

(2) (fiber optics). The region close to a source, or aperture. The diffraction pattern in this region typically differs significantly from that observed at infinity and varies with distance from the source. *See:* **far-field diffraction pattern**; **far-field region**. 812-1984

(3) (land-mobile communication transmitters). The region of the field of an antenna

between the reactive near field region and the far field region wherein radiation fields predominate and wherein the angular field distribution is dependent upon distance from the antenna. *Notes:* (1) If the antenna has a maximum overall dimension which is not large compared to the wavelength, this field region may not exist. (2) For an antenna focused at infinity, the radiating near field region is sometimes referred to as the Fresnel region on the basis of analogy to optical terminology. 377-1980

near-field region in physical media.* [126]
*Deprecated.

near-field region, radiating. The region of the field of an antenna between the reactive near-field region and the far-field region wherein radiation fields predominate and wherein the angular field distribution is dependent upon distance from the antenna. *Notes:* (1) If the antenna has a maximum over-all dimension which is not large compared to the wavelength, this field region may not exist. (2) For an antenna focused at infinity, the radiating near-field region is sometimes referred to as the Fresnel region on the basis of analogy to optical terminology. *See:* **radiating near-field region**. 145-1983

near-field region, reactive (1). The region of the field immediately surrounding the antenna wherein the reactive field predominates. *Note:* For most antennas the outer boundary of the region is commonly taken to exist at a distance $\lambda \approx 2\pi$ from the antenna surface, where λ is the wavelength. *See:* **radiation**. 145-1983
(2). *See:* **reactive near-field region**.

near-field scanning (fiber optics). The technique for measuring the index profile of an optical fiber by illuminating the entrance face with an extended source and measuring the point-by-point radiance of the exit face. *See:* **refracted ray method**. 812-1984

near-side (of a segment interconnect (SI) or a buffered interconnect (BI)) (FASTBUS acquisition and control). That port of an SI or BI that is electrically closer to the originating master. 960-1986

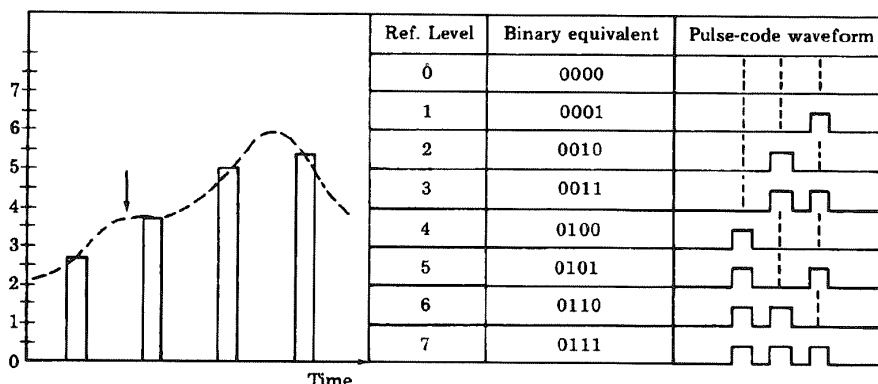
neck (cathode-ray tube). The small tubular part of the envelope near the base. *See:* **cathode-ray tube**. [45], [84]

negate (1). To perform the logic operation NOT. [20], [85]

(2) (mathematics of computing). To perform the NOT operation. 610.1

negation. *See:* **NOT**. 610.1

negative acknowledge character (NAK). A transmission control character transmitted by a station as a negative response to the station with which the connection has been set up. 610.5-1990



A form of pulse code modulation
Pulse Code Modulation (PCM) (1)

pulse broadening (fiber optics). An increase in pulse duration. *Note:* Pulse broadening may be specified by the impulse response, the root-mean-square pulse broadening, or the full-duration-half-maximum pulse broadening. *See:* **impulse response; root-mean-square pulse broadening; full width (duration) half maximum.** 812-1984

pulse burst (1) (radar). A sequence of pulses, usually generated coherently and batch-processed for Doppler resolution, and often having a total duration less than the radar echo delay time. 686-1982

(2) (pulse terms). A finite sequence of pulse waveforms. 194-1977

pulse burst base envelope (pulse terms). Unless otherwise specified, the waveform defined by a cubic natural spline with knots at (A) that point of intersection of the pulse burst top envelope and the pulse burst waveform which precedes the first pulse waveform in a pulse burst, (B) each point of intersection of the base center line and the baseline between adjacent pulse waveforms in a pulse burst, and (C) that point of intersection of the pulse burst top envelope and the pulse burst waveform which follows the last pulse waveform in a pulse burst. *See:* Pulse burst envelopes diagram, below the **knot** entry. 194-1977

pulse burst time-related definitions (pulse terms). (A) *pulse burst duration.* The interval between the pulse start time of the first pulse waveform and the pulse stop time of the last pulse waveform in a pulse burst. (B) *pulse burst separation.* The interval between the pulse stop time of the last pulse waveform in a pulse burst and the pulse start time of the first pulse waveform of the immediately following pulse burst. (C) *pulse burst repetition period.* The interval between the pulse start time of the first pulse waveform in a pulse burst and the

pulse start time of the first pulse waveform in the immediately following pulse burst in a sequence of periodic pulse bursts. (D) *pulse burst reception frequency.* The reciprocal of burst repetition period. 194-1977

pulse burst top envelope (pulse terms). Unless otherwise specified, the waveform defined by a cubic natural spline with knots at (A) the first transition mesial point of the first pulse waveform in a pulse burst, (B) each point of intersection of the top centerline and the topline of each pulse waveform in a pulse burst, and (C) the last transition mesial point of the last pulse waveform in a pulse burst. *See:* Pulse burst envelopes diagram below the **knot** entry. 194-1977

pulse capacity (metering). The number of pulses per demand interval that a pulse receiver can accept and register without loss. C12.1-1988

pulse capture (gyro, accelerometer) (inertial sensor). A technique which uses discrete quanta of torque-time (force-time) area to generate a restoring torque (force). 528-1984w

pulse carrier. A carrier consisting of a series of pulses. *Note:* Usually, pulse carriers are employed as subcarriers. *See:* **carrier.** 145-1983, 194-1977

pulse, carrier-frequency. *See:* **carrier-frequency pulse.**

pulse code. (A) A pulse train modulated so as to represent information. (B) Loosely, a code consisting of pulses, such as Morse code, Baudot code, binary code. *See:* **pulse.** 194-1977, [40]

pulse code modulation (PCM) (1) (data transmission). The type of pulse modulation where the magnitude of the signal is sampled and each sample is approximated to a nearest reference level (this process is called quantizing).

Then a code, which represents the reference level, is transmitted to the distant location. The figure above is an example of one form of PCM which has eight reference levels. It can be seen that a straight binary code would require a group of three pulses to be transmitted for each sample. The main advantage of PCM is the fact that at the receiving end only the presence or absence of a pulse must be detected.

[123]

(2) **(pulse terms)**. A modulation process involving the conversion of a waveform from analog to digital form by means of coding. *Notes:* (1) This is a generic term, and additional specification is required for a specific purpose. (2) The term is commonly used to signify that form of pulse modulation in which a code is used to represent quantized values of instantaneous samples of the signal wave.

194-1977, 270-1964w

pulse coder (navigation aid terms). A device for varying one or more of the characteristics of a pulse or of a pulse train so as to transmit information.

172-1983

pulse coincidence (noncoincidence) (pulse terms). The occurrence (lack of occurrence) of two or more pulse waveforms in different waveforms either essentially simultaneously or for a specified interval.

194-1977

pulse coincidence (noncoincidence) duration (pulse terms). The interval between specified points on two or more pulse waveforms in different waveforms during which pulse coincidence (noncoincidence) exists.

194-1977

pulse compression (radar). The coding and processing of a signal pulse of long time duration to one of short time duration and high range resolution, while maintaining the benefits of high pulse energy.

686-1982

pulse control (rotating electric machinery). Means by which the voltage applied to a machine circuit departs from being essentially constant if unidirectional, or from being essentially sinusoidal if alternating. Pulse-control devices include, but are not limited to, choppers, inverters, and rectifiers.

11-1980

pulse corner (pulse waveform feature). A continuous pulse waveform feature of specified extent which includes a region of maximum curvature or a point of discontinuity in the waveform slope.

[6]

pulse corrector (telephone switching systems). Equipment to reestablish, within predetermined limits, the make/break ratio of dial pulses.

312-1977w

pulse count (control of system electromagnetic compatibility). The number of pulses in some specified time interval.

C63.12-1984

pulse count. The number of pulses in some specified time interval.

C63.12-1987

pulse-count deviation (metering). The difference between the number of recorded pulses and the number of pulses supplied to the input of terminals of a pulse recorder (true count), expressed as a percentage of the true count. Pulse-count deviation is applicable to each data channel of a pulse recorder.

C12.1-1981

pulse counter (pulse techniques). A device that indicates or records the total number of pulses that it has received during a time interval. *See:* **pulse**.

398-1972

pulsed Doppler radar. A Doppler radar that uses pulsed transmissions. *Syn:* **pulse-Doppler radar**.

686-1982

pulse decay time (t_d) (1) (x-ray energy spectrometers) (germanium gamma-ray detectors). The interval between the instants at which the instantaneous value last reaches specified upper and lower limits, namely, 90% and 10% of the peak pulse value unless otherwise stated. (In the case of a step function applied to an amplifier that has simple capacitance-resistance to resistance-capacitance (CR-RC) shaping, the decay time is given by $t_d = 3.36CR$.)

325-1986, 759-1984

(2) (light emitting diodes) (general) (pulse fall time) (t_f). The interval between the instants at which the instantaneous amplitude last reaches specified upper and lower limits, namely, 90% and 10% of the peak pulse amplitude unless otherwise stated. *See:* **pulse**.

300-1982, 301-1976, 325-1971, [34], [127]

(3) (data transmission). The interval of time required for the trailing edge of a pulse to decay from 90% to 10% of the peak-pulse amplitude.

599-1985w

(4) (semiconductor radiation detectors) (last transition time) (t_d). The interval between the instants at which the instantaneous value last reaches specified upper and lower limits, namely, 90% and 10% of the peak pulse value unless otherwise stated. (In the case of a step function applied to an amplifier that has simple CR-RC shaping, the decay time is given by $t_d = 3.36 CR$.)

301-1976

(5) (laser-maser). The time duration of a laser pulse; usually measured as the time interval between the half-power points on the leading and trailing edges of the pulse.

586-1980w

(6) (radar). *See:* **pulsewidth**.

686-1982

pulse decoder (navigation aid terms). A device for extracting information from a pulse-coded signal. *Syn:* **constant-delay discriminator**.

172-1983

pulse delay time (t_d) (light emitting diodes). The interval between the instants at which the instantaneous amplitudes of the input pulse and output pulses first reach a specified fraction of their peak pulse amplitudes, namely, 10%.

[127]

pulse delay, transducer. *See:* **delay, pulse**.