

Absolute envelope delay. The absolute delay of an audio communications channel over the frequency band of the channel. [5057]

Advance Angle. In an automatic synchronizer, the angle in degrees prior to phase coincidence that the generator voltage waveform will change relative to the bus voltage waveform during the period of time between initiation of breaker closing and the actual closing of the circuit breaker contacts. This can be expressed by the equation:

$$\Phi_A = 360 * \Phi_S * T_B$$

Where: Φ_A is the advance angle in degrees

Φ_S is the slip frequency in Hertz

and T_B is the breaker closing time in seconds. [4019]

Arc resistance (of a fault). That component of the fault impedance caused by the current flowing through ionized air. There is no significant reactive component. The arc resistance accounts for the heating effect of the arc.

Audio-tone protective relaying. Protective relaying using a voice frequency channel. [5057]

Audio-tone. See: **voice frequency (1) data transmission.** [5057]

Automatic synchronizing system. A relaying scheme with one or more elements that: 1) takes into account the closing time of the controlled breaker to calculate when the advance angle is proper to initiate closing, 2) causes the breaker contacts to close when a zero phase difference between the sensed voltages occurs, 3) monitors and controls the frequency and voltage of the generator. See: **manual synchronizing system, semi-automatic synchronizing system, synchronizing relay, synchronism check relay.**

Breaker-and-a-half. A configuration of three circuit breakers in series between two buses with a line, transformer, generator or other circuit tapped between adjacent circuit breakers. Therefore, the number of circuit breakers in a breaker-and-a-half scheme is equal to 1-1/2 times the number of circuits. **Note:** also described as breaker-and-one-half. See: **double breaker.**

Bus transfer. The process of transferring motor bus loads from one source to another source.

Capacitive unbalance detection function. A function to detect the abnormal unbalance in capacitance between capacitor groups within a phase, such as that caused by blown capacitor fuses or faulted capacitor units or elements, and to initiate an alarm or the closing of a capacitor bypass switch, or both. (PC37.116) [6059]

Computer relay (or relay unit). See: **Digital relay**

Control diagram. A diagram which shows all of the functions that control the operation of an electrical device. [5057]

Cross-country fault. Simultaneous flash-over, generally to ground, of two different phases in different line sections. Also loosely used to describe when comparable faults occur on the same tower.

Differential bus protection. A bus protection method in which an internal fault is identified by the amount of difference between the currents entering the bus and those exiting the bus. (PC37.234) [6059]

Differential current. The sum of all currents entering and leaving a section of the electrical system; measured with consistent polarity. Also referred to as an operating current. See: restraining current. (PC37.234) [6059]

Digital fault recorder (DFR). See: **transient fault recorder.**

Digital relay (or relay unit). A static relay or relay unit in which the designed response is developed by converting the inputs into numeric form and manipulating them mathematically or logically. See: **static relay.**

Directional bus protection. A method of protection in which an internal fault is identified based on the direction of fault currents associated with the protected bus. The method can be based on absolute current directions with respect to a selected reference, or relative directions with no reference required (phase comparison). (PC37.234) [6059]

Directional comparison blocking. A pilot system in which the channel equipment (usually "on" - "off" power line carrier) is used to block tripping at the remote terminal for external faults. Tripping is accomplished by forward overreaching elements in the absence of a blocking signal from the remote terminal. See: **directional comparison protection.** [5057]

Directional comparison unblocking. A pilot system similar in all aspects to a permissive overreaching transfer trip scheme except that the unblocking scheme provides a tripping window (typically 150 - 300 msec) following loss of channel. A frequency shift carrier system is usually used, with normal transmission of the guard (blocking) frequency. External faults do not produce loss of channel. See: **directional comparison protection.** [5057]

Disc-type reactor. A high-voltage shunt reactor that is constructed of disk-type coils. These coils are wound with one or more copper straps in parallel. The first turn is wrapped around an insulating cylinder, then a number of turns is wound over this first turn, producing a disk section. A combination of these sections forms one phase of the reactor. [5057]

Distributed resources. Power sources such as small generators, photovoltaic units, fuel cells, etc., that are connected on distribution circuits and dispersed throughout the utility distribution system. (PC37.230) [6059]

Distribution automation. A technique used to limit the outage duration and restore service to customers through fault location identification and automatic switching. (PC37.230) [6059]

Distribution factor (Ds). The per unit current at a location in the power system as a per unit of fault current. [5057]

Double breaker. A configuration of two circuit breakers in series between two buses with a line, transformer, generator or other circuit tapped between the circuit breakers.

Dropout (of a relay). That level of the measured quantity at which a sensing device will just reset. See: **pickup (of a relay), reset (of a relay).**

Fast transfer. The process of transferring load from one source to another source with no intentional delay, designed so that the two source breakers are not closed at the same time during the transfer process, and the time that the breakers are simultaneously open is minimized (usually less than 10 cycles). See: **in-phase transfer, parallel transfer, residual voltage transfer, slow transfer.**

Fault impedance. The impedance at the point of the fault, which can include the impedance of the arc, the fault initiating object and the tower footing resistance. (C37.113)

Fault locator. A device, either hardware or software, that calculates fault location. [5057]

Fault recorder. See: **transient fault recorder.**

Four-reactor scheme. A shunt reactor arrangement consisting of three wye-connected reactors and a fourth connected from neutral to ground. [5057]

Ground fault (transmission & distribution protective relays). An insulation failure between an energized conductor and ground.

Ground potential rise (GPR). The difference in ground potential between a location in proximity to a point of large current injection into the ground and any remote ground point. GPR is usually caused by a short circuit of an energized power conductor to ground and is the result of the injected current flowing through the impedance of the ground circuit.

Hardware failure (relays). Inability of a relay to perform properly due to a malfunction of one or more physical components, which must be replaced to correct the malfunction. [4019]

Hybrid Relay. A protective relay in which the designed response is developed using more than one technology. [6059]

Inadvertent energizing. Accidentally energizing a generator that is off-line, with the field de-energized. [4019]

Inductive coupling (electric system). That characteristic of electric circuits in which longitudinal voltage is developed in one circuit due to its proximity to a second circuit that has current flowing in it. See: **capacitive coupling, mutual coupling.**

In-phase transfer (motor bus). The process of transferring load from one source to another source, designed so that the two source breakers are not closed at the same time during the transfer process. The load is allowed to be powered from the second source if there is an acceptable predetermined difference between the respective voltage phasors of the load voltage and the second source voltage. See: **fast transfer, parallel transfer, residual voltage transfer, slow transfer.**

Input supervision (relays). A controlling input to a protective relay by external means to permit or prevent the operation of the relay. See: **supervision (relays), output supervision (relays).**

Interrupting medium. The material used to facilitate the interruption of the arc during opening of a switching device. (PC37.230) [6059]

Key, keyed, keying ([9] protective relay telecommunications). An external signal initiating a change in state of a communications channel trip condition. [5057]

Copyright © 2010 IEEE. All rights reserved. This is an unapproved IEEE Standards Draft, subject to change.

Line outage. See: **outage**.

Linear coupler. A transformer with a non-magnetic core, having a low energy voltage output that varies linearly with the primary current.

Low-impedance scheme. A differential method of bus protection using current transformers connected to a low impedance load that maintains stability during saturation of current transformers from external faults using the concept of restraint or other means. See: high-impedance scheme. (PC37.234) [6059]

Manual synchronizing system. A control scheme whereby an operator controls the generator voltage, frequency, and breaker closing. A group of instruments provides the information required to make the closing decision. The operator's action may be supervised by additional devices that prevent incorrect closures. See: **automatic synchronizing system, semi-automatic synchronizing system, synchronism check relay**. [4019]

Matching transformer (Audio-tone relaying). A transformer for matching the impedance of the terminal equipment to the voice frequency channel. [5057]

Metal oxide varistor (MOV). An assembly of metal oxide varistor units that limits overvoltages to a given value. In the context of series capacitor banks, the MOV is typically defined by its ability to divert fault current around the series capacitor units, limiting the voltage to a specified protective level while absorbing energy. The MOV is designed to withstand the temporary overvoltages and continuous operating voltage across the series capacitor units. (PC37.116) [6059]

Microprocessor-based relay. A relay in which the designed response is developed by using one or more microprocessors. See: **digital relay**.

Motor bus. An auxiliary system bus that primarily supplies power to motor loads.

Mutual coupling (electric system). That characteristic of electric circuits in which voltage is induced in one circuit due to its proximity to a second energized circuit. See: **capacitive coupling, inductive coupling**.

Negative sequence polarization (relays). A relaying operating principle in which a reference quantity is established for a directional determination using negative sequence voltage or current.

Neutral reactor (transmission line). A reactor used in conjunction with three line-connected shunt reactors to create a high impedance, limiting the flow of secondary arc current.

Numerical relay (or relay unit). See: **digital relay**.

Operator window (operator synchronizing window). A predetermined range of voltage, phase angle and slip frequency within which an operator can safely initiate closing of a circuit breaker to synchronize a generator to the system. See: **automatic synchronizing system, manual synchronizing system, semi-automatic synchronizing system**. [4019]

Output supervision (relays). Controlling the output of a protective relay by external means to permit or prevent completion of an operation by the relay. See: **supervision (relays), input supervision (relays)**.

Parallel transfer (motor bus). The process of transferring load from one source to another, designed to have two source breakers closed at the same time during the transfer process. See: **fast transfer, in-phase transfer, residual voltage transfer, slow transfer.**

Partial cross-polarization (relays). A variation of cross-polarization in which the directional reference quantity consists of a combination of the voltage associated with the operating quantity and another voltage independent of the operating quantity. For example, “A” phase distance relay may use $V_A + jV_{BC}$ as its reference voltage. See: **cross-polarization, self-polarization.**

Partial differential scheme. A variation of a bus differential protection scheme in which some currents are excluded in the summation, typically due to the unavailability of current transformers. The natural current unbalance resulting from partial summation is taken into account at the expense of sensitivity. (PC37.234) [6059]

Percentage restraint. In a differential relay, the restraining effect of through-current on the pickup current. This effect may be expressed as the ratio of differential current to the through-current, which must be exceeded for the relay to operate. The through-current may be expressed as the lesser, greater or mean of the individual restraint currents. Alternatively, the effect may be expressed as a percentage by which the pickup current of the relay increases as the mean through-current increases.

Phantom tertiary. An apparent tertiary that some transformer core configurations manifest. [5057]

Phase angle regulator (regulating transformer). A high voltage phase shifter used for power flow control, usually equipped with an exciting winding and a series winding, requiring special relaying consideration that differs from conventional transformer relaying. [4019]

Pickup (of a relay). That level of the measured quantity at which a sensing device will just operate. See: **dropout (of a relay), reset (of a relay).**

Pole-mounted sectionalizing device. See: **automatic line sectionalizer.**

Polarizing voltage. The input voltage to a relay that provides a reference for establishing the direction of the operating current. (PC37.230) [6059]

Pole-mounted sectionalizing device. See: **automatic line sectionalizer.** [4019]

Primary arc current (single-phase tripping). The current in a phase-to-ground fault prior to single-phase tripping. See: **secondary arc current (single-phase tripping).**

Principle failure (of a relay). Inability of a relay to perform properly due to an inaccuracy or error in the relay concept or algorithm. To correct the principle failure, the relay must be conceptually redesigned. [4019]

Reporting rate. A rate in frames per second that a device, such as a Phasor Measurement Unit, periodically transfers to a data collection device. [5057]

Residual voltage transfer (motor bus). The process of transferring load from one source to another source through breaker schemes, designed so that the two source breakers are not closed at the same time during the transfer process. The voltage magnitude at the load bus must fall below a predetermined level before the load is connected to another source. See: **fast transfer, in-phase transfer, parallel transfer, slow transfer.**

Copyright © 2010 IEEE. All rights reserved. This is an unapproved IEEE Standards Draft, subject to change.

Resistor pad. A network of resistors designed to attenuate a signal by a given amount. [5057]

Restraining current. A current in a low impedance differential relay which is derived from all currents of the differential zone to make the differential function more secure when current transformers are saturated due to external faults. It is used in conjunction with a percentage differential characteristic to desensitize the effect of the differential current and reflects the severity of external faults. See: differential current. (PC37.234) [6059]

Restricted earth relay. A sensitive relay that is designed to detect ground faults within a well-defined protective zone (e.g., winding differential). [6059]

Ring bus. A closed loop configuration of two or more circuit breakers with a line, transformer, generator or other circuit tapped between adjacent circuit breakers. Therefore, a ring bus scheme has an equal number of breakers and circuits. In practice, the minimum number of circuits is three.

Sealing current. A small current, approximately one milliampere dc, introduced by the communications channel provider to prevent corrosion caused by small accumulations of oxides at splices and other connection points. [5057]

Secondary arc current (single-phase tripping). The current in a phase-to-ground fault after single-phase tripping. It is the sum of two currents derived from the electrostatic and electromagnetic coupling from the remaining energized phases and adjacent lines after the primary arc current contribution is removed by opening the line circuit breakers. See: **primary arc current (single-phase tripping)**.

Self-polarization (relays). A distance relay operating principle in which the directional reference (polarizing) voltage is the same voltage used for the distance measurement. For example, “A” phase distance relay uses V_{AG} as a reference. See: **cross-polarization, partial cross-polarization**.

Semi-automatic synchronizing system. A relaying scheme that has aspects of both the manual and automatic synchronizing systems in that either one or the other will match the generator or close the breaker, but not both. See: **automatic synchronizing system, manual synchronizing system**.

Sequential tripping. Tripping of breakers in a predetermined sequence. (PC37.234) [6059]

Sequential tripping logic. Tripping logic applied to provide security against a possible turbogenerator overspeed upon an opening of the generator breaker(s) during a tripping of the unit; such as for a “normal” (manual) unit shutdown or a “turbine trip” unit shutdown. A reverse power relay (32), monitoring the flow of real power into the unit, is used to initiate tripping of the generator breaker(s). [6059]

Single-phase tripping. Disconnecting only the faulted phase during a single-phase-to-ground fault on a polyphase power system.

Slow transfer (motor bus). The process of transferring load from one source to another source, designed so that the two source breakers are not closed at the same time during the transfer process. A time interval, usually in excess of 20

cycles, occurs before the load is powered from another source. See: **fast transfer, in-phase transfer, parallel transfer, residual voltage transfer.**

Special Protection System (Remedial Action Scheme): An automatic protection system designed to detect abnormal or predetermined system conditions, and take corrective actions other than or in addition to the isolation of faulted components to maintain system reliability. See: **System Integrity Protection Systems (SIPS Survey-WG C4)** [6059]

Spill current. The difference in two input currents that are supposed to be equal, as in a differential application. (C37.91)

Start-up source. A source of generating plant auxiliary power that is independent of the availability of the main generator.

Steel armor. See: **armored cable.**

Supervision (relays). A function that allows one or several elements of a protective device to either perform an intended action or to inhibit that action depending on the condition of an input. A supervising relay may control the supervised element(s) directly (input supervision) or it may only control the disposition of the output signal of the element(s) (output supervision). See: **input supervision (relays), output supervision (relays).**

Sympathetic tripping. The phenomena where a breaker trips for a fault on a nearby circuit, usually caused by current inrush on a circuit after the faulted feeder breaker opens and the system voltage returns to normal. (PC37.230) [6059]

Sync-check relay. See: **synchronism check relay.**

System Integrity Protection Systems (SIPS). The SIPS encompasses Special Protection Schemes (SPS), Remedial Action Schemes (RAS), as well as additional schemes such as underfrequency (UF), undervoltage (UV), out-of-step (OOS), etc. A SIPS is applied to the overall power system or a strategic part of it in order to preserve system stability, maintain overall system connectivity, and to avoid serious equipment damage during major events. (SIPS Survey-WG C4) [6059]

Theoretical phasor. The phasor value of an ac signal derived by mathematical analysis. [5057]

Three-line diagram (ac). A diagram that represents a group of three-phase power system elements with three lines (or four, including neutral) interconnecting the elements. See: **one-line diagram.**

Time Sequence Data (TSD) file. An electronic data file where each data item is identified by a time tag, such as in transient data records, event sequences and periodic data logs. [6059]

Transient fault recorder. A recorder that is used to measure electrical quantities and monitor equipment and systems. It automatically records transients when changes occur in the state of the monitored equipment or when system values change. Also called fault recorder, digital fault recorder (DFR), transient recorder or oscillograph.

Transient overreach. A tendency of a relay or relay element to reach farther than its set value due to dc offset in the input current. It is usually expressed in percent, calculated as follows:

Copyright © 2010 IEEE. All rights reserved. This is an unapproved IEEE Standards Draft, subject to change.

$$\text{Transient Overreach \%} = \left[\frac{(\text{MeasuredOperateValue} - \text{SetOperateValue})}{\text{SetOperateValue}} \right] \times 100\%$$

Transient recorder. See: **transient fault recorder.**

Triple modular redundant (TMR): A term associated with protective relaying systems that have three system processor elements working together. This system can revert to two system processor elements or one in the presence of one or two faulty components, respectively. (SIPS Survey-WG C4) [6059]

Trip window (unblocking or channel failure). A trip permission output generated by a receiver after loss of channel (usually within 4 - 6 milliseconds) of 100 - 150 milliseconds duration. This trip window is generated only on the loss of channel and not when the channel is restored. The receiver logic requires that guard be restored and stable before the trip window can again be generated.

Tripping modes. This term describes the sequence of operations of the devices that must trip in a relay scheme.

Unblocking. A form of permissive overreaching transfer trip modified so that the receiver will generate a trip time window that will permit local tripping if the local relay sees a fault and a loss of channel. See: **trip window, permissive overreaching transfer trip.** (C37.113)

Utility-grade relay (protective relay). A generic term for a relay that complies with ANSI/IEEE C37.90 and related power switchgear standards, and that usually includes additional maintenance and testing features.

Varmetric relay. A relay that responds to the quadrature (imaginary) component of current compared to the polarizing voltage. (PC37.230) [6059]

Wattmetric relay. A relays that responds to the in-phase (real) component of current as compared to the polarizing voltage. (PC37.230) [6059]

Revise Definitions Currently in IEEE Dictionary:

Capacitive unbalance detection function. A function to detect the abnormal unbalance in capacitance between capacitor groups within a phase, such as that caused by blown capacitor fuses or faulted capacitor units or elements, and to initiate an alarm, the closing of the capacitor bypass switch, or both. (PC37.116) [6059]

Pilot protection. [Add:] "Also called teleprotection."

Additions to the abbreviations section, located in the back of the IEEE Std 100-200X:

IED. intelligent electronic device

Ds. distribution factor

GPR: ground potential rise

Copyright © 2010 IEEE. All rights reserved. This is an unapproved IEEE Standards Draft, subject to change.

GSU transformer. generator step-up transformer

SER: sequence of events recorder

[4019]: AND4_Rev.019

[5057]: AND5057

[6019]: DND6_Rev.059