

# Glossary

## **AC:**

Alternating Current (AC) is electric current that alternates between a positive maximum value and a negative maximum value at a characteristic frequency, usually 50 or 60 cycles per second (Hertz).

## **ANSI:**

American National Standards Institute.

## **Acoustic Material:**

Acoustic material is any material considered in terms of its acoustic properties, especially its properties of absorbing or deadening sound.

## **Active Power:**

Active power is the real power (kW) supplied by the generator set to the electrical load. Active power creates a load on the generator set's engine and is limited by the horsepower of the engine. Active power does the work of heating, turning motor shafts, etc.

## **Air Circuit Breaker:**

An air circuit breaker automatically interrupts the current flowing through it when the current exceeds the trip rating of the breaker. Air is the medium of electrical insulation between electrically live parts and grounded (earthed) metal parts.

## **Alternator:**

Alternator is another term for AC generator.

## **Amortisseur Windings:**

The amortisseur windings of a synchronous AC generator are the conductors embedded in the pole faces of the rotor. They are connected together at both ends of the poles by end rings or end plates. Their function is to dampen waveform distortion during load changes.

## **Ampacity:**

Ampacity is the safe current-carrying capacity of an electrical conductor in amperes as defined by code.

## **Ampere:**

The ampere is a unit of electric current flow. One ampere of current will flow when a potential of one volt is applied across a resistance of one ohm.

## **Annunciator:**

An annunciator is an accessory device used to give remote indication of the status of an operating component in a system. Annunciators are typically used in applications where the equipment monitored is not located in a portion of the facility that is normally attended. The NFPA has specific requirements for remote annunciators used in some applications, such as hospitals.

## **Apparent Power:**

Apparent power is the product of current and voltage, expressed as kVA. It is real power (kW) divided by the power factor (PF).

## **Armature:**

The armature of an AC generator is the assembly of windings and metal core laminations in which the output voltage is induced. It is the stationary part (stator) in a revolving-field generator.

## **Authority Having Jurisdiction:**

The authority having jurisdiction is the individual with the legal responsibility for inspecting a facility and approving the equipment in the facility as meeting applicable codes and standards.

## **Automatic (Exciter) Paralleling:**

Automatic (Exciter) Paralleling describes a system where two or more generator sets can be started and paralleled while coming up to rated frequency and voltage. Because the generator excitation system is not turned on until the generator set is started (thus the term "dead field"), the generator sets automatically synchronize as they come to rated speed and voltage.

## **Backup Protection:**

Backup protection consists of protective devices, which are intended to operate only after other protective devices have failed to operate or detect a fault.

## **Bandwidth:**

The amount of data that can be transmitted in a fixed amount of time. For digital devices, it is expressed as bits per second, or bytes per second. For analog devices, it is usually expressed as cycles per second, or Hertz.

## **Base Load:**

Base load is that portion of a building load demand which is constant. It is the "base" of the building demand curve.

## **Baud Rate:**

The speed of data transmission in serial data communications approximately equal to the number of code elements (bits) per second (BPS). Bits per second are also termed BPS, with the prefix (k) denoting thousands.

## **Binding:**

The process of making the logical connections to the network (also called connecting). This involves connecting network variable outputs to network variable inputs using LonWorks software.

## **Bit:**

Binary Digit.

## **Black Start:**

Black Start refers to the starting of a power system with its own power sources, without the assistance from external power supplies.

## **Boolean:**

A logical system used to express one of two states, such as on or off (yes or no, 1 or 0, etc.)

## **Bound:**

A network communication technique whereby a node automatically receives a network variable from a sender node whenever the sender node sends it out. Whenever this condition exists, the node is said to be "bound".

**Bumpless Transition:**

Bumpless transition is make-before-break transfer of an electrical load from one source to another where voltage and frequency transients are kept to a minimum.

**Bus:**

Bus can refer to the current-carrying copper bars that connect the AC generators and loads in a paralleling system, to the paralleled output of the AC generators in a system or to a feeder in an electrical distribution system.

**Bus Bars:**

Bus Bars are rectangular copper or aluminum bars that connect the output of the generator set circuit breakers to the transfer switches, circuit breakers, or fusible switches that transfer power to the load. The bus bars are sized and assembled in multiples according to the current they must carry under load. A typical sizing criteria for copper bus bars rated from 500-5,000 amps is to maintain a current density of 1,000 amps per square inch of cross-sectional area. This results in a bus temperature rise at full load that is within acceptable limits.

**Bus Capacity:**

Bus capacity is the maximum load that can be carried on a system without causing degradation of the generator frequency to less than a prescribed level (usually 59 Hz in a 60 Hz system).

**CT (Current Transformer):**

Current transformers are instrument transformers used in conjunction with ammeters, control circuits and protective relaying. They usually have 5 ampere secondaries.

**Cellular:**

Refers to a communication system that divides geographic regions into sections called cells. The purpose of this division is to make the most use of the limited number of transmission frequencies.

**Channel:**

A Channel is the physical communications media that connects the devices and the properties of these media (such as transmission speed). Most PowerCommand network installations will have only one channel (UTP cable and 78 KBPS transmission speed). In a large network, there may be multiple channels and each channel may or may not be of the same media type. Typically, channels are linked together using routers.

**Channel Terminator:**

This is used to terminate networks on devices that do not have terminate switches. These are devices such as Gateways, RCI's, Routers, etc. that do not terminate circuits built into their design.

**Circuit:**

A circuit is a path for an electric current across a potential (voltage).

**Circuit Breaker:**

A circuit breaker is a protective device that automatically interrupts the current flowing through it when that current exceeds a certain value for a specified period of time. See Air Circuit Breaker, Main Breaker, Molded Case Circuit Breaker and Power Circuit Breaker.

**Circulating Harmonic Currents:**

Circulating Harmonic Currents are currents that flow because of differences in voltage waveforms between paralleled power sources, or induced by operation of non-linear loads.

**Comma Separated Value (CSV):**

A record layout that separates data fields with a comma and usually surrounds character data with quotes. PowerCommand for windows uses the CSV record format.

**Connecting Devices:**

Connecting to refers to the process of assigning connections--linking an output variable of one device to an input variable of another device. This process is also called "binding".

**Contactors:**

A contactor is a device for opening and closing an electric power circuit.

**Continuous Load:**

A continuous load is a load where the maximum current is expected to continue for three hours or more (as defined by the NEC for design calculations).

**Cross Current:**

Cross currents are currents that circulate between paralleled generator sets when the internal (excitation) voltage of one genset is different from the other genset(s). The genset with the higher internal voltage supplies reactive power (kVAR) to the other genset(s). The amount of cross current that flows is a measure of this reactive power. Cross currents are 90 degrees out of phase (lagging) compared to the current that the generator would supply at 1.0 (unity) power factor.

**Cross Current Compensation:**

Cross current compensation is a method of controlling the reactive power supplied by AC generators in a paralleling system so that they share equally the total reactive load on the bus without significant voltage droop.

**Cross Current Transformer (CCT):**

Cross Current Transformers are used to step down the higher line current to a lower current that the control system was designed for.

**Current:**

Current is the flow of electric charge. Its unit of measure is the ampere.

**Current Limiting Fuse:**

A current limiting fuse is a fast-acting device that, when interrupting currents in its current-limiting range, will substantially reduce the magnitude of current, typically within one-half cycle, that would otherwise flow.

**Cycle:**

A cycle is one complete reversal of an alternating current or voltage from zero to a positive maximum to zero again and then from zero to a negative maximum to zero again. The number of cycles per second is the frequency.

**Dead Bus:**

Dead Bus refers to the de-energized state of the power connections between outputs of paralleled generator sets. The term bus in this usage can either be rigid solid bus bars or insulated flexible cables.

**Dead Field Paralleling:**

Automatic (Exciter) Paralleling

**Delta Connection:**

Delta connection refers to a three phase connection in which the start of each phase is connected to the end of the next phase, forming the triangle-shaped Greek letter Delta. The load lines are connected to the corners of the triangle.

**Demand Mode Standby Unit(s) (DMSU):**

Demand Mode Standby Units are generator sets that can be shut down by the system when there is a low load level on the system.

**Deviation Factor:**

The deviation factor is the maximum instantaneous deviation, in percent, of the generator voltage from a true sine wave of the same RMS value and frequency.

**Dielectric Strength:**

Dielectric strength is the ability of insulation to withstand voltage without breaking down.

**Differential Relay:**

A differential relay is a protective device that is fed by current transformers located at two different series points in the electrical system. The differential relay compares the currents and picks up when there is a difference in the two, which signifies a fault in the zone of protection. These devices are typically used to protect windings in generators or transformers.

**Digital Master Control (DMC):**

This device is designed to control the power systems in a facility. It is offered as an option on Cummins switchgear.

**Direct Current (DC):**

Direct current is current with no reversals in polarity.

**Distributed Control System:**

A collection of nodes that interact to control a system whose components are spread out over some distance. Each node has intelligence for operating its own particular component of the system. Different parts of the system communicate status and control information with one another to form a distributed control system. Typically, they communicate on a peer-to-peer level. This is different from a type of system where all control and interaction between components is dictated by one central control. This is a common master/slave arrangement.

**Distribution Circuit Breaker:**

A distribution circuit breaker is a device used for overload and short current protection of loads connected to a main distribution device.

**Distribution Switchgear:**

Distribution switchgear may include automatic transfer switches, drawout air frame circuit breakers, fusible switches, or molded case breakers.

**Domain:**

A domain is a network concept that allows independently functioning networks to share resources such as transmission media. A domain designation provides an ID number to identify the devices that can communicate within that domain. A network must have at least one domain. PowerCommand Network installations will usually have only one specified domain.

**Draw Out Unit:**

A draw out unit is a structure that holds a circuit breaker in an enclosure. It has a movable carriage and contact structures that permit the breaker to be removed from the enclosure without manually disconnecting power cables and control wires.

**Droop Load Sharing:**

Droop load sharing is a method of making two or more parallel generator sets share a system kW load. This is accomplished by having each governor control adjusted so that the sets have the same droop (reduction of speed). Typical droop is two cycles in frequency from no load to full load.

**Earth Fault Protection:**

A grounding bar is a copper bar that electrically joins all the metal sections of the switchgear. This bar is connected to the earth or ground connection when the system is installed. The grounding or earthing protects personnel from stray currents that could leak to the metallic enclosures.

**Efficiency (EFF):**

Efficiency is the ratio of energy output to energy input, such as the ratio between the electrical energy input to a motor and the mechanical energy output at the shaft of the motor.

**Electrical Operator:**

An electrical operator is the electric motor driven closing and tripping (opening) devices that permit remote control of a circuit breaker.

**Emergency Bus:**

An emergency bus is the silver-plated copper bus bars or flexible cable used to connect the paralleling breakers to the emergency system feeder breakers, and ultimately to automatic transfer switches or other distribution devices.

**Emergency System:**

An emergency system is independent power generation equipment that is legally required to feed equipment or systems whose failure may present a life safety hazard to persons or property.

**Energy:**

Energy is manifest in forms such as electricity, heat, light and the capacity to do work. It is convertible from one form to another, such as in a generator set, which converts rotating mechanical energy into electrical energy. Typical units of energy are kW/h, Btu (British thermal unit), Hp/h, ft/lbf, joule and calorie.

**Exciter:**

An exciter is a device that supplies direct current (DC) to the field coils of a synchronous generator, producing the magnetic flux required for inducing output voltage in the armature coils (stator). See Field.

**Exciter Paralleling Control:**

An exciter paralleling control initiates the start of generator excitation in generator sets used in automatic paralleling systems.

**Fault:**

A fault is any unintended flow of current outside its intended circuit path in an electrical system.

**Feeder Circuit Breaker:**

See Distribution Circuit Breaker.

**Fiber Optic Cable:**

A technology using glass or plastic threads (fibers) to transmit data. A fiber optic cable is a bundle of either glass or plastic threads capable of transmitting messages modulated into light waves. Typically, fiber optic cable has greater bandwidth allowing them to carry more data than metal wires. Fiber optic cable is lighter and less susceptible to interference than metal wires. Also, data can be transmitted digitally rather than being transformed into analog data for transmission as is the case with metal wires when used for computer data transmission. Fiber optics are becoming increasingly more common for use with Local-Area Networks (LANs).

**Field:**

The generator field (rotor) consists of a multi-pole electromagnet which induces output voltage in the armature coils (stator) of the generator when it is rotated by the engine. The field is energized by DC supplied by the exciter.

**Field Breaker with Auxiliary Switch:**

This is the circuit breaker (usually mounted in the generator control panel) that monitors the alternating current input to the automatic voltage regulator. If a malfunction occurs in the excitation system, the circuit breaker trips on overcurrent-closing the auxiliary switch, shutting down the generator set, and energizing the alarm circuit.

**First Start Sensor:**

A first start sensor is an electronic device within some paralleling equipment that senses generator set and bus voltage and frequency, and determines whether or not a generator set is the first unit ready to close to the bus following a call to start under "black start" conditions.

**Free Field (Noise Measurements):**

In noise measurements, a free field is a field in a homogeneous, isotropic medium (a medium having the quality of transmitting sound equally in all directions) which is free of boundaries. In practice, it is a field in which the effects of the boundaries are negligible in the region of interest. In the free field, the sound pressure level decreases 6 dB for each doubling of the distance from a point source.

**Frequency:**

Frequency is the number of complete cycles per unit of time of any periodically varying quantity, such as alternating voltage or current. It is usually expressed as (Hz) Hertz or CPS (cycles per second).

**Frequency Adjust Potentiometer:**

A frequency adjust potentiometer is used to manually bring the frequency (speed) of the incoming set to that of the bus for synchronizing purposes. When the generator set is paralleled, operation of this potentiometer will adjust the kW load assumed by the generator set.

**Frequency Regulation:**

Frequency regulation is a measure that states the difference between no-load and full-load frequency as a percentage of full-load frequency.

**Fusible Switch:**

A fusible switch is an isolating switch and overcurrent protective device used for feeder or transfer switch isolation and protection. It is typically a manually operated, stored energy opening and closing, bolted compression blade switch, with provisions for installing current limited fuses.

**Gateway:**

A device that acts as an interface between two different communication protocols. The Network Gateway Module (NGM) provides a communication protocol that a PC can understand. Other gateway devices may be used to interface between our Lontalk protocol and other systems such as a SCADA or Building Automation System. Typically, a gateway becomes necessary when a SCADA or BAS does not have a driver developed for Lontalk.

**Generator:**

A generator is a machine which converts rotating mechanical energy into electrical energy.

**Genset Communication Module (GCM):**

The GCM provides a communication gateway between the Model 3100 PowerCommand Control (PCCI) and the network. The GCM communicates with the PCCI control over a serial data link. The GCM gets data from the PCCI controls such as voltage, current, engine speed, oil temperature, etc. and then sends it out on the network if another network node is bound to it or requesting data.

**Governor:**

A governor is a device on the engine which controls fuel to maintain a constant engine speed under various load conditions. The governor must have provision for adjusting speed (generator frequency) and speed droop (no load to full load).

**Grid:**

The utility-owned power distribution system.

**Ground:**

A ground is a connection, either intentional or accidental, between an electrical circuit and the earth or some conducting body serving in place of the earth.

**Ground Fault Protection:**

This function trips (opens) a circuit breaker or sounds an alarm in the event that there is an electrical fault between one or more of the phase conductors and ground (earth). This ground fault protection function may be incorporated into a circuit breaker.

**Ground Return:**

Ground return is a method of ground fault detection that employs a single sensor (CT) encircling the main bonding jumper between the power system neutral and ground. This device in itself is not capable of locating the faulted circuit but when used in conjunction with ground fault sensors on all feeders and source connections, can provide bus fault protection when properly coordinated (delayed).

**Grounded Neutral:**

A grounded neutral is the intentionally grounded center point of a Y-connected, four-wire generator, or the mid-winding point of a single phase generator.

**Harmonic Distortion (Total Harmonic Distortion):**

Total harmonic distortion is an expression of the total harmonic content of a voltage waveform. The harmonic distortion (or harmonic content) of a waveform is usually expressed as the square root of the sum of the squares of each of the harmonic amplitudes (with amplitudes as a percent of the fundamental voltage amplitude).

**Harmonics:**

Harmonics are voltage or current components which operate at integral multiples of the fundamental frequency of a power system (50 or 60 Hertz). Harmonic currents have the effect of distorting the shape of the voltage wave form from that of a pure sine wave.

**Hertz (Hz):**

The term Hertz is the preferred designation for cycles per second (CPS) and is used to describe frequency.

**Hub:**

A common connection point for devices or nodes in a network or sub-network. Hubs are commonly used to connect segments of a LAN and contain multiple ports.

**Hunting:**

Hunting is a phenomenon that can occur upon load changes in which the frequency or the voltage continues to rise above and fall below the desired value without reaching a steady-state value. It is caused by insufficient damping.

**Incoming Set:**

This is the generator set that is about to be connected to (paralleled with) the energized bus.

**Insulated Case Circuit Breaker:**

An insulated case circuit breaker is a power circuit breaker that is provided in a preformed case, similar to a molded case breaker.

**Insulation:**

Insulation is non-conductive material used to prevent leakage of electric current from a conductor. There are several classes of insulation in use for generator construction, each recognized for a maximum continuous-duty temperature.

**Internal Voltage:**

The internal voltage is the voltage a generator would develop at no load if it were not connected in a parallel operation. Excitation of the generator field controls internal voltage.

**Interoperability:**

Design to allow one product to work with another product without modification.

**Interruptible:**

This refers to the practice of operating on-site power systems, at the request of a utility, to reduce electrical demand on the utility grid during periods of high consumption. Interruptible facilities may also be disconnected from all electrical service in the event of high demand on the utility grid, even if no on site power system is available.

**Interrupting Capacity:**

Interrupting capacity is the magnitude of electrical current that a device can safely interrupt (open against), without failure of the component.

**kW Load Sensor:**

The kW load sensor is an electronic device provided to sense kW level at various points in a system, for use in control functions within the system, such as kW load alarms, or load demand.

**kVA (kilo-Volt-Amperes):**

kVA is a term for rating electrical devices. A device's kVA rating is equal to its rated output in amperes multiplied by its rated operating voltage. In the case of three-phase generator sets, kVA is the kW output rating divided by 0.8, the rated power factor. kVA is the vector sum of the active power (kW) and the reactive power (kVAR) flowing in a circuit.

**kVAR:**

kVAR (kilo-Volt-Amperes Reactive) is the product of the voltage and the amperage required to excite inductive circuits. It is associated with the reactive power which flows between paralleled generator windings and between generators and load windings that supply the magnetizing currents necessary in the operation of transformers, motors and other electromagnetic loads. Reactive power does not load the generator set's engine but does limit the generator thermally.

**kW:**

This is an abbreviation for kilowatt, an alternate term for rating electrical devices. Generator sets in the United States are usually rated in kW. Sometimes called active power, kW loads the generator set engine.

**kW-h(kilo-Watt-hour):**

This is a unit of electric energy. It is equivalent to one kW of electric power supplied for one hour.

**Lagging Power Factor:**

Lagging power factor in AC circuits (a power factor of less than 1.0) is caused by inductive loads, such as motors and transformers, which cause the current to lag behind the voltage. See Power Factor.

**Lead Unit:**

In a paralleling system that has a load demand feature, the lead unit is the last unit to be shut down in the event that load demand mode is in operation.

**Leading Power Factor:**

Leading power factor in AC circuits (0.0 to -1.0) is caused by capacitive loads or overexcited synchronous motors which cause the current to lead the voltage. See Power Factor.

**Leg:**

A leg is a phase winding of a generator, or a phase conductor of a distribution system.

**Line-To-Line Voltage:**

Line-to-line voltage is the voltage between any two phases of an AC generator.

**Line-To-Neutral Voltage:**

In a 3-phase, 4-wire, Y-connected generator, line-to-neutral voltage is the voltage between a phase and the common neutral where the three phases are tied together.

**Load Demand:**

Load Demand is a paralleling system operating mode in which the system monitors the total kW output of the generator sets, and controls the number of operating sets as a function of the total load on the system. The purpose of load demand controls is to reduce fuel consumption and limit problems caused by light load operation of reciprocating diesel generator sets.

**Load Factor:**

The load factor is the ratio of the average load to the generator set power rating.

**Load Management:**

Load management is the overall control of load connected to match available generator capacity. Priority control and load shedding are the two features required for load management.

**Load Shedding:**

Load shedding is the process by which the total load on a paralleling system is reduced, on overload of the system bus, so that the most critical loads continue to be provided with reliable electrical service.

**Local Loop:**

A method of branching out or creating a stub on the network. The maximum distance this stub can be is 10ft. (3m) from the main network bus. Effectively the node is "daisy-chained" into the network. This involves two wires, one that goes to the node and another that returns to the main network bus. The total local loop distance must be added to the total network length. This becomes important when the main network bus nears the 4,600 ft. length and requires the use of Routers.

**Local-Area Network (LAN):**

A computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings.

**Locations:**

Locations are subdivisions of a network that can be selected for easier organization. Locations may designate physical places, but are not required to do so. For example, network devices in one location may communicate with network devices in another location when requested to do so.

**Low Voltage:**

AC system operating voltages from 120 to 600 VAC.

**Main Breaker:**

A main breaker is a circuit breaker at the input or output of the bus, through which all of the bus power must flow. The generator main breaker is the device, usually mounted on the generator set, that interrupts the genset's power output. Main breakers provide overcurrent protection and a single disconnect point for all power in a switchboard or device.

**Mains:**

Mains is a term used extensively outside of the United States to describe the normal power service (utility).

**Master Control:**

A control section in a typical paralleling system that provides total system metering and the interface point between the paralleling system and the facility.

**Media:**

The main network bus defined by two characteristics: 1) The electrical signal level and 2) the characteristics of the wiring they will travel over. Typically, our standard PowerCommand Network uses 22 AWG Unshielded Twisted-Pair (UTP) wire operating at 78 KBPS.

**Medium Voltage:**

AC system operating voltages from 601 to 15000 VAC.

**Modbus:**

An industrial networking system that uses RS-232 serial master-slave communications at data transfer rate of up to 19.2 KBPS.

**Modbus II:**

An industrial networking system that uses token-passing peer-to-peer communications at data transfer rates of five megabits per second (MBPS). The network medium is coaxial cable.

**Modbus Plus:**

An industrial networking system that uses token-passing peer-to-peer communications at data transfer rates of one megabit per second (MBPS). The network media is shielded twisted-pair cable.

**Modules:**

Modules are also called nodes or devices. These are devices such as Genset Communication Modules (GCMs), Control Communication Modules (CCMs), and Digital Input/Output Modules (DIMs).

**Molded Case Circuit Breaker:**

A molded case circuit breaker automatically interrupts the current flowing through it when the current exceeds the trip rating of the breaker. Molded case refers to the use of molded plastic as the medium of electrical insulation for enclosing the mechanisms, and for separating conducting surfaces from one another and from grounded (earthed) metal parts. Molded case circuit breakers usually contain thermal-magnetic trip units, although larger sizes can be equipped with solid state trip sensors.

**Motoring:**

In paralleling applications, unless a generator set is disconnected from the bus when its engine fails (usually as a result of a fuel system problem), the generator will drive (motor) the engine, drawing power from the bus. Reverse power protection which automatically disconnects a failed set from the bus is essential for paralleling systems. Also, in certain applications such as elevators, the load can motor the generator set if insufficient additional load is present.

**Multi-drop Bus Topology:**

The wiring arrangement used for the network data. The bus starts at one point and ends at another. Both the start and end of a network must be terminated through the use of a terminate switch. The maximum stub length (See Definition of Local Loop) must not exceed 10ft. and must be included in the total length of the main network bus.

**NEC (National Electrical Code):**

This document is the most commonly referenced general electrical standard in the United States.

**NEMA:**

National Electrical Manufacturers Association

**NEMA 1 Enclosure:**

This enclosure designation is for indoor use only-where dirt, dust, and water are not a consideration. Personnel protection is the primary purpose of this type of enclosure.

**NFPA:**

National Fire Protection Association

**NFPA 110:**

National Fire Protection Agency Section 110 (NFPA 110) deals with the regulations concerning Emergency Power Systems (EPS). This section deals with regulations on installation, operation, and monitoring of EPS.

**Network:**

A collection of Nodes that communicate with one another over a common medium.

**Network Annunciator Module (NAM):**

A device providing LED indication in the event of an alarm condition on a PowerCommand Network device. For example, we can provide NFPA 110-alarm annunciation for gensets with the use of a NAM.

**Network Bus:**

The main "backbone" of the network data wire. It must be terminated at both the start and end of the network. Stubs off the main bus wire cannot exceed 10ft. (3m.). The wire is "daisy-chained" from one node to the next. The bus cannot exceed 4,600ft. without the use of a router. Bus can also refer to the devices that connect the generators and loads to a system.

**Network Data:**

A signal that carries messages between nodes. PowerCommand Networks use Manchester Encoding that makes the signal insensitive to polarity. The signal is transformer-coupled to the network data wire at a rate of 78 KBPS.

**Network Data Wire:**

Unshielded-Twisted Pair (UTP) cable that carries the network data over the main network bus. The maximum network length is 4,600 ft. without the use of routers.

**Network Gateway Module:**

A device acting as an interface between a modem or PC and the network wire. The Gateway takes the UTP wire and then provides an RS-232 port for connection to either a modem or PC.

**Neutral:**

Neutral refers to the common point of a Y-connected AC generator, a conductor connected to that point or to the mid-winding point of a single-phase AC generator.

**Neutral Current:**

Neutral current is the current that flows in the neutral leg of a paralleling system. Often, this term is used in reference to circulating currents or cross currents.

**Node:**

A module that can communicate over the network data to other modules. A module contains a Neuron Chip. Certain devices are nodes such as Genset Communication Modules (GCMs) and Control Communication Modules (CCMs). Other devices are not nodes, as they cannot communicate with other devices, but only receive messages. An example is the Network Annunciator Module (NAM).

**Nonlinear Load:**

A nonlinear load is a load for which the relationship between voltage and current is not a linear function. Some common nonlinear loads are fluorescent lighting, SCR motor starters and UPS systems. Nonlinear loads cause abnormal conductor heating and voltage distortion.

**Normal Standby Mode:**

In the normal standby mode, power to the load is supplied by the utility. The paralleling system is ready to provide power to the load in the event of utility failure.

**Octave Band:**

In sound pressure measurements (using an octave band analyzer), octave bands are the eight divisions of the measured sound frequency spectrum, where the highest frequency of each band is twice that of its lowest frequency. The octave bands are specified by their center frequencies, typically: 63, 125, 250, 500, 1,000, 2,000, 4,000 and 8,000 Hz (cycles per second).

**Ohm:**

The ohm is a unit of electrical resistance. One volt will cause a current of one ampere to flow through a resistance of one ohm.

**On-Set Paralleling:**

On-set paralleling is a manual paralleling system that is built onto the generator set, no additional switchboards are required.

**One-Line Diagram:**

A one-line diagram is a schematic diagram of a three-phase power distribution system which uses one line to show all three phases. It is understood when using this easy to read drawing that one line represents three.

**Operating Source:**

An operating source is a source of electrical power that is delivering power to a load. The operating source can be either a generator set or a commercial (utility bus) power line.

**Out-Of-Phase:**

Out-Of-Phase refers to alternating currents or voltages of the same frequency which are not passing through their zero points at the same time.

**Overcrank:**

Overcrank is an alarm function provided with most generator sets that indicate that the generator set has failed to start.

**Overload Rating:**

The overload rating of a device is the load in excess of the nominal rating the device can carry for a specified length of time without being damaged.

**Overshoot:**

Overshoot refers to the amount by which voltage or frequency exceeds the nominal value as the voltage regulator or governor responds to changes in load.

**Parallel Operation:**

Parallel Operation is the operation of two or more sources of AC electrical power whose output leads are connected to a common load. Connection of the power sources is made so that the sources electrically function as a single source of power. Parallel Operation requires that the two sources of electrical power must match in voltage, frequency, and number of phases.

**Paralleling Breaker:**

A paralleling breaker is the circuit breaker that connects the generator set to the emergency bus, and across which all the individual generator synchronizing functions occur.

**Paralleling Control:**

A paralleling control contains the electrical equipment provided in a paralleling system for control of a single generator set.

**Paralleling Suppressers:**

Paralleling suppressors are semiconductor devices that protect the silicon diodes on a brushless excitation system from damaging overvoltages. Overvoltages, usually of short duration, occur when a generator is paralleled out of phase with the energized bus.

**Parity:**

In error detecting schemes, a Bit (even or odd) that represents the binary sum of the data transmitted. Primarily used when transmitting data over a long distance. For example, when transmitting information using modems.

**Pass Thru:**

Refers to a junction box connection where the network bus comes to a connector and then continues straight on through. In most Pass Thru connections, very little input and output is done. An example of this connection is the Junction Box/Terminator (JBT).

**Peak Load:**

Peak load is the highest point in the kilowatt demand curve of a facility. This is used as the basis for the utility company's demand charge.

**Peer-To-Peer:**

A network operating system where any device on the main network bus can initiate communication.

**Phase:**

Phase refers to the windings of an AC generator. In a three-phase generator there are three windings, typically designated as A-B-C, R-S-T or U-V-W. The phases are 120 degrees out of phase with each other. That is, the instants at which the three phase voltages pass through zero or reach their maximums are 120 degrees apart, where one complete cycle is considered 360 degrees. A single-phase generator has only one winding.

**Phase Angle:**

Phase angle refers to the relation between two sine waves which do not pass through zero at the same time. Considering one full cycle to be 360 degrees, the phase angle expresses how far apart the two waves are in relation to each other in degrees.

**Phase Rotation:**

Phase rotation (or phase sequence) describes the order (A-B-C, R-S-T, or U-V-W) of the phase voltages at the output terminals of a three-phase generator. The generator phase rotation must match the facility phase rotation. This must be checked prior to operation of the electrical loads in a facility with an on-site generator.

**Pitch:**

Pitch is a mechanical design characteristic of a generator that indicates the ratio of the number of winding slots per generator pole to the number of slots enclosed by each coil. The generator designer may use the pitch of a machine to optimize the generator cost versus the quality of the voltage waveform generated.

**Pole:**

Pole is used in reference to magnets, which are bipolar. The poles of a magnet are designated North and South. Because magnets are bipolar, all generators have an even number of poles. The number of poles determines how fast the generator will have to be turned to obtain the specified frequency. For example, a generator with a 4-pole field would have to be run at 1800 rpm to obtain a frequency of 60 Hz (1500 rpm for 50 Hz). Pole can also refer to the electrodes of a battery or to the number of phases served by a switch or breaker.

**Port:**

The external connector on a device at which the network cable or medium is attached.

**Power:**

Power refers to the rate of performing work or of expending energy. Typically, mechanical power is expressed in terms of horsepower and electrical power in terms of kilowatts. One kW equals 1.34 hp.

**Power Circuit Breaker:**

A power circuit breaker is a circuit breaker whose contacts are forced closed via a spring-charged, over-center mechanism to achieve fast closing (5-cycle) and high withstand and interrupting ratings. A power circuit breaker can be an insulated case or power air circuit breaker.

**Power Factor:**

Power factor is the cosine of the angle between the active power (kW) and apparent power (kVA) in a circuit.

**Prime Power:**

Prime Power describes an application where the generator set(s) must supply power on a continuous basis and for long periods of time between shutdowns. No utility service is present in typical prime power applications.

**Priority Control:**

Priority control is the process by which the total loads on the bus is limited to the most critical loads in the system until adequate generation capacity is available to serve all loads.

**Protocol:**

A set of rules used mutually by two or more devices to communicate. Also, known as the "language" used in a network.

**Pulse Alarms:**

Pulse alarms are alarm logic systems that allow all alarms to be annunciated, even if a previous alarm has been silenced but is still present in the system.

**RMS(Root Mean Square):**

The RMS values of a measured quantity such as AC voltage, current and power are considered the "effective" values of the quantities. See Watt.

**RPM:**

Revolutions Per Minute.

**Radio Frequency (RF):**

Any frequency within the electromagnetic spectrum associated with radio wave propagation.

**Radio Interference:**

Radio interference refers to the interference with radio reception caused by a generator set.

**Radio Interference Suppression:**

Radio interference suppression refers to the methods employed to minimize radio interference.



**Random Access Paralleling:**

Random access paralleling is a paralleling operation where any generator may be the first unit to close to the bus on startup of the system. Random access systems use active synchronizing to force the second and all subsequent generator sets to close to the bus as fast as possible.

**Reactance:**

Reactance is the opposition to the flow of current in AC circuits caused by inductances and capacitances. It is expressed in terms of ohms and its symbol is X.

**Reactive Differential Compensation:**

Reactive differential compensation (also called cross current compensation) is a method of controlling the reactive power supplied by generators in a paralleling system so that they equally share the total reactive load on the bus, without inducing significant voltage droop in the system.

**Reactive Droop Compensation:**

Reactive droop compensation is one method used in paralleled generator sets to enable them to share reactive power supplied to a load. This system causes a drop in the internal voltage of a set when reactive currents flow from that generator. Typically, at full load, 0.8 PF, the output voltage of a set is reduced by 4% from that at no load when reactive droop compensation is used.

**Reactive Power:**

Reactive power is power that flows back and forth between the inductive windings of the generator and the inductive windings of motors, transformers, etc., which are part of the electrical load. This power does no useful work in the electrical load nor does it present load to the engine. It does apply load to the generator and limits the capacity of the generator.

**Reactor:**

A reactor is an electrical device that applies only reactive load to a system.

**Real Power:**

Real power is the product of current, voltage and power factor (the cosine of the angle by which current leads or lags voltage) and is expressed as W (watts).

**Resistance:**

Resistance is the opposition to the flow of current in DC and AC circuits. It is expressed in ohms and its symbol is R.

**Reverse Power Relay:**

A reverse power relay is a relay with a wattmeter movement that senses the direction of power flow. In paralleled sets, a flow of reverse power (i.e., power flow into set) will actuate the reverse power relay and disconnect the set from the system. If one set stops and reverse power protection is not provided, the set still running will drive the set that has stopped. The generator on the set that has stopped will act as a motor.

**Risers:**

Risers are rectangular copper or aluminum bars that connect circuit breakers, fusible switches, and transfer switches with the main system bus. As with bus bars, they are sized and assembled in multiples according to the current they must carry.

**Rotor:**

A rotor is the rotating element of a motor or generator.

**Router:**

A device for passing network messages over another media and sometimes protocol. Our network router is programmed as a "repeater" to create another channel on the main network bus. Each channel can have a 4,600 ft. network bus and is capable of having 44 nodes. The PowerCommand Network can have up to twenty (20) channels.

**SCR:**

Silicon Controlled Rectifier -- a three-electrode solid-state device which permits current to flow in one direction only, and does this only when a suitable potential is applied to the third electrode, called the gate.

**Selective Coordination:**

Selective coordination is the selective application of overcurrent devices such that short circuit faults are cleared by the device immediately on the line side of the fault, and only by that device.

**Separately Derived:**

A separately derived on-site power system has no direct neutral connection with the neutral of the normal electrical service.

**Sequential Paralleling:**

Sequential paralleling is a type of automatic paralleling system where the generators in a system close to the bus in a prescribed order, typically by use of a single synchronizer.

**Service Entrance:**

The service entrance is the point where the utility service enters the facility. In low voltage systems the neutral is grounded at the service entrance.

**Short Circuit:**

A short circuit is generally an unintended electrical connection between current carrying parts.

**Shunt Trip:**

Shunt trip is a feature added to a circuit breaker or fusible switch to permit the remote opening of the breaker or switch by an electrical signal.

**Sine Wave:**

A sine wave is a graphical representation of a sine function, where the sine values (usually the y axis) are plotted against the angles (x axis) to which they correspond. AC voltage and current wave shapes approximate such a curve.

**Site:**

A single instance where a network has been installed.

**Slave:**

A networked device that is controlled by another device. Slave devices do not initiate data transmission. They respond to commands or requests initiated by a master device.

**Soft Loading:**

Soft loading refers to the ramping of load onto or off of a generator in a gradual fashion for the purpose of minimizing voltage and frequency transients on the system.

**Sound:**

Sound is considered both in terms of the sound pressure waves travelling in air (pressures superimposed on the atmospheric pressure) and the corresponding aural sensation. Sound can be "structure-borne", that is, transmitted through any solid elastic medium, but is audible only at points where the solid medium "radiates" the pressure waves into the air.

**Sound Level Meter:**

A sound level meter measures sound pressure level. It has several frequency-weighted decibel (dB) scales (A, B, C) to cover different portions of the range of measured loudness. Sound level meters indicate RMS sound, unless the measurements are qualified as instantaneous or peak sound level.

**Sound Pressure Level (SPL):**

Sound pressure level is a measurement of the pressure fluctuations of a sound wave as it propagates through the air. Because of the wide range of pressures to which the ear responds, a logarithmic scale is used and is expressed as a ratio of the measured pressure referenced to a pressure of  $2 \times 10^{-5}$  N/m<sup>2</sup> (20 m Pa) which is the threshold of human hearing at 1000 Hz. The measure is expressed in decibels (dB). The Bel unit is named after Alexander Graham Bell.

**Standby System:**

A standby system is an independent power system that allows operation of a facility in the event of normal power failure.

**Star Connection:**

See Wye Connection.

**Star Topology:**

A topology where all the devices must connect to a central hub. Star topologies are relatively easy to install and manage, but can have bottlenecks occur as all the information must pass through the hub.

**Starting Current:**

The initial value of current drawn by a motor when it is started from standstill.

**Stator:**

The stator is the stationary part of a generator or motor. See Armature.

**Steady State Rating:**

Steady state rating is the maximum load that a generator set or paralleling system can carry, on a continuous basis, for the duration of a utility power outage.

**Surge:**

Surge is the sudden rise in voltage in a system, usually caused by load disconnect.

**Surge Rating:**

Surge rating is the rating of a machine, usually in excess of its normal operating level, for which it can provide power for a very short time.

**Surge Suppressor:**

Surge suppressors are devices capable of conducting high transient voltages. They are used for protecting other devices that could be destroyed by the transient voltages.

**Switching Hub:**

Short for port-switching hub, a special type of hub that actually forwards information to the appropriate port based on the IP address assigned. Conventional hubs simply rebroadcast information to every port. Switching hubs forward information only to the required port.

**Sync Check Relay:**

A sync check relay is an electrical device that monitors the phase relationship between two voltage sources and provides a signal when the voltage sources are within specific preset parameters.

**Synchronization:**

In a paralleling application, synchronization is obtained when an incoming generator set is matched with and in step to the same frequency, voltage, and phase sequence as the operating power source.

**Synchronizer:**

A synchronizer is an electronic device that monitors the phase relationship between two voltage sources and provides a connection signal to an engine governor, to force the generator set to synchronize to the system bus.

**Synchronizing Lights:**

Synchronizing lights are lamps connected across the line contactor of the incoming generator set. The lights indicate when the voltage waveforms of the incoming and operating power sources coincide and paralleling can be completed.

**Synchronous Generator:**

A synchronous generator is an AC generator having a DC exciter. Synchronous generators are used as stand-alone generators for emergency power and can also be paralleled with other synchronous generators and the utility system.

**Synchroscope:**

A synchroscope is a meter that indicates the relative phase angle between an incoming set voltage and the bus voltage. The synchroscope pointer indicates whether the set is faster or slower than the bus and allows the operator to adjust the frequency (speed) accordingly before manually paralleling to the bus.

**Telephone Influence Factor (TIF):**

The higher harmonics in the voltage wave shape of a generator can cause undesirable effects on telephone communications when power lines parallel telephone lines. The telephone influence factor is calculated by squaring the weighted RMS values of the fundamental and the non-triple series of harmonics, adding them together and then taking the square root of the sum. The ratio of this value to the RMS value of the no-load voltage wave is called the Balanced TIF. The ratio of this value to three times the RMS value of the no-load phase-to-neutral voltage is called the Residual Component RIF.

**Termination:**

Both ends of the main network bus must be terminated to avoid transmission reflections. The effective network data bus may be made up of several different physical buses. The Terminator is a RC circuit that matches the impedance of the physical media.

**Terminator:**

A resistive load placed at the end of a cable to prevent data signals from reflecting back into the data path.

**Token:**

In data transmission, a frame passed on a network that gives a networked device the current authority to transmit.

**Token-Ring Topology:**

All of the devices or nodes are connected to one another in the shape of a closed loop. Ring topologies are relatively expensive to install, but they offer high bandwidth and can span larger distances.

**Topology:**

The physical shape of a network. There are three principal topologies: multi-drop bus, token-ring, and star.

**Transfer Switch:**

A transfer switch is an electrical device for switching loads between alternate power sources. An automatic transfer switch monitors the condition of the sources and connects the load to the alternate source if the preferred source fails.

**Undershoot:**

Undershoot refers to the amount by which voltage or frequency drops below the nominal value as the voltage regulator or governor responds to changes in load.

**Utility:**

The utility is a commercial power source that supplies electrical power to specific facilities from a large central power plant.

**Volt:**

The volt is a unit of electrical potential. A potential of one volt will cause a current of one ampere to flow through a resistance of one ohm.

**Voltage Control:**

The voltage control is a rheostat that sets the operating point of the voltage regulator and therefore controls the output voltage of the generator set, within its design limits.

**Voltage Dip:**

Voltage dip is the dip in voltage that results when a load is added, occurring before the regulator can correct it, or resulting from the functioning of the voltage regulator to unload an overloaded engine-generator.

**Voltage Regulation:**

Voltage regulation is a measure that states the difference between maximum and minimum steady-state voltage as a percentage of nominal voltage.

**Watt:**

The watt is a unit of electric power. In direct current (DC) circuits, wattage equals voltage times amperage. In alternating current (AC) circuits, wattage equals effective (RMS) voltage times effective (RMS) amperage times power factor times a constant dependent on the number of phases. 1,000 watts equal one kW.

**Watt-Hour Demand Meter:**

A watt-hour demand meter is similar to a watt-hour meter except that it also provides an indication of the highest kW load level achieved during operation.

**Watt-Hour Meter:**

A watt-hour meter records the total power output at a specific point in a system. Typical recording increment is in kW-hours.

**Wattmeter:**

A wattmeter records power being delivered from a source to the load. Wattmeters for paralleling systems are calibrated in kilowatts (kW).

**Wide-Area Network:**

A system of LANs connected over a large distance via a fiber optic line, telephone line, or radio wave.

**Wye Connections:**

A Wye connection is the same as a star connection. It is a method of interconnecting the phases of a three-phase system to form a configuration resembling the letter Y. A fourth (neutral) wire can be connected at the center point.

**Zero Sequence:**

Zero sequence is a method of ground fault detection that utilizes a sensor (CT) that encircles all the phase conductors as well as the neutral conductors. The sensor will produce an output proportional to the imbalance of ground fault current in the circuit. This output is then measured by a relay to initiate circuit breaker tripping or ground fault alarm.

**Zones of Protection:**

Zones of protection are defined areas within a distribution system that are protected by specific groups.