

## GLOSSARY OF DRIVE TERMS

**AC (Alternating Current)** - The commonly available electric power supplied by an AC generator and is distributed in single- or three-phase forms. AC current changes its flow (current).

**AC Motor** - A motor operating on AC current that flows in either direction. There are two types: induction and synchronous.

**Accelerating Torque** - An increase in torque (force) generated by a motor in order to achieve running speed.

**Adjustable Speed** - The concept of varying the speed of a motor, either manually or automatically. The desired operating speed (set speed) is relatively constant regardless of load.

**Adjustable Speed Drive (Electrical)** - The adjustable speed drive is comprised of the motor, drive controller, and operator's controls (either manual or automatic). See also Inverter.

**Altitude** - The atmospheric altitude (height above sea level) at which the motor or drive will be operating.

**Ambient Temperature** - The temperature of the surrounding cooling medium, such as gas or liquid, which comes into contact with the heated parts of the motor or drive.

**Ampere** - The rate of flow of charge in a conductor of one coulomb per second.

**Armature** - The moving part of a magnetic circuit, such as the rotating part of a motor or generator.

**Base Frequency** - The motor nameplate frequency rating.

**Base Speed** - The manufacturer's nameplate rating at which point the motor will develop rated horsepower at rated load and voltage. With DC drives, it is commonly the point where full armature voltage is applied with full-rated field excitation. With AC drives, it is commonly the point where 60 Hz is applied to the induction motor.

**BAUD** - A unit of signaling speed, equal to the number of discrete conditions or signal events per second. Where one bit is encoded on each signaling event, the number of baud is the same as the number of bits.

**Braking** - A method of stopping or reducing the time required to stop an AC or DC motor, accomplished in several ways:

**dc-injection braking (ac drives)** - A method which produces electromagnetic braking forces in the motor by removing two ac motors (stator) phases and injecting dc current. The result is a linear braking characteristic (ramp) that does not diminish with motor speed. Application is normally limited to 10 - 20% of rated motor speed due to increased heating in the rotor.

**dynamic braking (ac drives) - DB** - A method which produces electromagnetic braking forces in the motor by dissipating generated power into the dc bus through a resistive load. Braking force remains constant and is only limited by the thermal capacity of the resistors. The result is a linear braking characteristic (ramp) that does not diminish with motor speed.

**dynamic braking (dc drives) - DB** - A method which produces electromagnetic braking forces in the motor by dissipating generated power from armature / shunt field reaction into a resistive load. Braking force is determined by the field strength, armature voltage, and thermal capacity of the resistors. The result is a logarithmic braking characteristic (curve) that diminishes with motor speed.

**regenerative braking** - The technique of slowing or stopping a drive by regeneration.

**Braking Torque** - The torque required to bring a motor down to a standstill. The term is also used to describe the torque developed by a motor during dynamic braking conditions.

**Breakaway Torque** - The torque required to start a machine from standstill. It is always greater than the torque needed to maintain motion.

**Cascade Drive System** - Two or more drives connected to a master speed setting potentiometer.

**Capacitor** - A device which, when connected in an alternating-current circuit, causes the current to lead the voltage in time phase. The peak of the current wave is reached ahead of the peak of the voltage wave.

**CE** - This designation shows that a product such as a drive

or motor meets European Standards for safety and environmental protection. A CE mark is required for products used in most European countries.

**Chassis** - A hardware assembly that houses devices such as I/O modules, adapter modules, processor modules, and power supplies.

**Configurable** - Input parameter whose values can only be modified while the drive is stopped (not running or jogging).

**ControlNet** - An open producer/consumer communication network with features such as redundant media and deterministic I/O timing, designed for high-performance or time-critical requirements.

**Current** - The time rate of flow of electrical charge. Current is measured in amps (amperes).

**Current Feedback** - A current signal used by the regulator to control the operating current of the drive.

**Custom View** - A collection of parameters that you select. Parameters from different products and modules can be included in the same custom view so that you can monitor them on the same screen (using VS Utilities software). A custom view can be saved and opened at a later time.

**DC (Direct Current)** - A current that flows only in one direction in an electric circuit. It may be continuous or discontinuous and it may be constant or varying.

**DC Bus** - A drive's power structure that transmits rectified ac line power from the bridge rectifier to the output transistors.

**DC Motor** - A motor using either generated or rectified DC power. A DC motor is usually used when variable speed operation is required.

**Decelerating Torque** - The torque (force) generated by the decrease in motor and load kinetic energy which the motor and load requires to reach its final (slower) speed condition.

**Default Value** - Parameter values that are stored in the drive's read-only memory (ROM).

**Device** - A module or product.

**DeviceNet** - A producer/consumer Control Area Network (CAN) that connects controllers and devices such as drives.

**Diode** - A solid-state, unidirectional conductor.

**DPI** - A peripheral communication interface used by various Reliance Electric drives and power products.

**Drive Controller** - An electronic device that can control the speed, torque horsepower, and direction of an AC or DC motor. Also called Variable Speed Drive.

**Dynamic Braking** - See Braking.

**Efficiency** - The ratio of mechanical output to electrical input. It represents the effectiveness with which the motor converts electrical energy to mechanical energy.

**EIA** - Electronics Industries Association. An American agency that sets electrical / electronic standards.

**Electrostatic Discharge (ESD)** - A static-electricity discharge that may damage drive components. Follow appropriate precautions to guard against damage to drive components.

**EMF** - Electromotive Force, another term for voltage or potential difference. In dc adjustable speed drives, voltage applied to the motor armature from a power supply is the emf and the voltage generated by the motor is the counter-emf or cemf.

**EMI** - Electromagnetic Interference. Any electromagnetic disturbance that interrupts, obstructs, or otherwise impairs the performance of electronic equipment.

**Enclosure** - The housing or frame of the drive.

**Ethernet/IP** - An open producer-consumer communication network based on the Ethernet standard (IEEE 802.3), TCP/IP, UDP/IP, and CIP.

**Fault** - Any malfunction that interferes with normal system operation.

**Field** - A term commonly used to describe the stationary (stator) member of a DC motor. The field provides the magnetic field with which the mechanically rotating (armature or rotor) member interacts.

**Firmware** - Logic stored in read-only memory.

**Flash Update** - The process of updating firmware in a device.

**Flux** - The magnetic field which is established around an energized conductor or permanent magnet. The field is represented by flux lines creating a flux pattern between opposite poles. The density of the flux lines is a measure of the strength of the magnetic field.

**Force** - The tendency to change the motion of an object with an exertion of energy from a separate source. Force is measured in pound-feet, ounce-inches, Newton-meters, or gram-centimeters.

**Frame** - The supporting structure of the drive. The frame also determines mounting dimensions.

**Frequency** - The rate at which alternating current makes a complete cycle of reversals. It is expressed in cycles per second. In the U.S., 60 cycles (Hz) is the standard while in other countries 50 Hz (cycles) is common. The frequency of the AC current will affect the speed of a motor.

**Frequency Setpoint** - The frequency value stored in memory (either by local or remote means) within a given frequency range of the drive's output voltage. This sets the speed of the motor.

**Gain** - The ratio of the magnitude of the output signal with respect to that of the input signal.

**GND Sense** - A current transducer that detects an unequal or imbalanced current in the three-phase ac line or dc bus of the drive. The imbalance indicates an output ground fault condition.

**Hertz (Hz)** - One cycle per second (as in 60 Hz which is 60 cycles per second).

**Horsepower** - The measure of the rate of work. One horsepower is equivalent to lifting 33,000 pounds to a height of one foot in one minute. The horsepower (HP) of a motor is expressed as a function of torque (T, measured in lb-ft) and RPM (revolutions per minute). For motors, you can approximate horsepower using this formula:  $HP = T \times (RPM/5250)$ .

**Host** - 1. A central controlling computer in a network system.

2. Any device on a network system that provides a controlling function to another device on the network.

3. Any intelligent device for which another device is providing a communication interface to a network.

**Host Interface** - The communication interface to the host computer.

**Identification Protocol (IDP)** - An extended application layer protocol used by Reliance Electric intelligent sensing devices to communicate with other devices and host processors. IDP commands and responses are inserted as data within the PCCC layer.

**Inductance** - The characteristic of an electric circuit by which varying current in it produces a varying magnetic field which causes voltages in the same circuit or in a nearby circuit.

**Inertia** - A measure of a body's resistance to changes in velocity, whether the body is at rest or moving at a constant velocity. The velocity can be either linear or rotational.

**Inertial Load** - A load (such as a flywheel or fan) that tends to cause the motor shaft to continue to rotate after power has been removed (stored kinetic energy). If this continued rotation cannot be tolerated, some mechanical or electrical braking means must be applied. This application might require a special motor due to the energy required to accelerate the inertia.

**Ingress Protection (IP) Rating** - The IP designation is a numeric rating used to specify the degree of environmental protection provided by an enclosure based on specific tests. The IP rating consists of two numbers, although a third number describing the degree of protection from mechanical impact can also be included but is commonly omitted. For example, IP 56. A higher number represents better protection.

**First Number** - The first number describes the degree of protection from solid objects and with respect to human access to hazardous parts.

**0** - No protection.

**1** - Protection against solid objects 50 mm in diameter or greater

**2** - Protection against solid objects 12.5 mm in diameter or greater

**3** - Protection against solid objects 2.5 mm in diameter or greater

**4** - Protection against solid objects 1.0 mm in diameter or greater

**5** - Dust protected (quantities of dust will not accumulate)

**6** - Dust tight

## Ingress Protection (IP) Rating Con't

**Second Number** - The second number describes the degree of protection from liquids.

**0** - No protection.

**1** - Protection against vertically falling drops of water

**2** - Protection against vertically falling drops of water when enclosure is tilted up to 15 degrees

**3** - Protection against spraying water when the enclosure is tilted up to 60 degrees on the vertical

**4** - Protection against splashing water from all directions

**5** - Protection against water jets from all directions

**6** - Protection against powerful water jets or heavy seas

**7** - Protection against the effects of temporary immersion in water

**8** - Protection against the effects of continuous submersion in water

**Instantaneous Electronic Trip (IET)** - A fault condition that occurs while the drive is running resulting in a motor coast-to-rest stop. The drive senses a condition that could result in equipment damage.

**Input Parameter** - A parameter whose value can be changed through the OIM.

**Input Power Factor** - The ratio of the input inverter AC effective power to the input AC apparent power.

**Inverter** - 1. An ac adjustable-frequency drive  
2. A particular section of an ac drive. This section uses the dc voltage from a previous circuit stage (intermediate dc circuit) to produce a pulse-width modulated or stepped ac current or voltage waveform that has characteristics similar to the desired sine-wave frequency.  
3. A circuit whose output signal is the inverse of its input.

**I/O**- Input(s) and/or Output(s)

**I/O Block** - An assembly containing a chassis, a power supply, an adapter, and I/O in a single integral package.

**I/O Channel** - A channel of a data transmission link between a processor scanner module and an I/O adapter module.

**I/O Chassis** - A chassis for I/O modules and either a processor to control the I/O modules,

or an adapter to interface a scanner to the I/O modules.

**IR Compensation** - A way to compensate for the voltage drop across resistance of the ac or dc motor circuit and the resultant reduction in speed. This compensation also provides a way to improve the speed regulation characteristics of the motor, especially at low speeds. Drives that use a tachometer generator for speed feedback generally do not require an IR compensation circuit because the tachometer will inherently compensate for the loss in speed.

**Jogging** - 1. In a numerical control system, an operator manually generating motion (continuous or incrementally) by closing a switch.  
2. An operator generating motion incrementally by closing a switch.

**Joule** - 1. The work done by the force of 1 Newton acting through a distance of 1 meter.  
2. The energy required to transport 1 coulomb between two points having a potential difference of 1 volt.

**k** - An abbreviation used as a multiple for bits, bytes, or words denoting size of a block of data or memory. 1 k = 1024.

**Kilowatt (kw)** - Equals 1,000 watts and is used where larger units of power measurement are desired because the watt is a relatively small unit of power.

**Kinetic Energy** - The energy of motion of a moving body.

**Ladder Diagram** - An industry standard for representing relay control logic.

**LED** - Light Emitting Diode.

**LEM** - A hall-effect current transducer that senses drive output current and generates a signal for the control logic.

**Line Dip** - A short duration, low input voltage condition.

**Liquid Crystal Display (LCD)** - A reflective, visual readout device often used in digital watches and laptop computers.

**Load** - The burden imposed on a motor by the driven machine. It is often stated as the torque required to overcome the resistance

of the machine it drives. "Load" is sometimes synonymous with "required power."

**Load Torque** - The motor torque required to keep the load rotating at nearly constant speed.

**Local I/O** - I/O connected to a processor across a backplane or a parallel link, thus limiting its distance from the processor.

**Logic Diagram** - A diagram that represents logic elements and their interconnections.

**Master** - A device used to control secondary devices.

**Modulated LED Control** - A photoelectric control that operates on light pulses, rather than on constant light intensity.

**Module** - A device that provides an interface between a product and a network. It is often referred to as a peripheral.

**Module Addressing** - The method of identifying the I/O modules installed in chassis.

**Motor** - A device that converts electrical energy to mechanical energy to turn a shaft.

### Motor Identification:

- Frame designation (actual frame size in which the motor is built)
- Horsepower, speed, design and enclosure Voltage, frequency and number of phases of power supply
- Class of insulation and time rating
- Application

**Motor Nameplate** - The plate on the outside of a motor that describes the motor, horsepower, voltage, revolutions per minute, efficiency, design, enclosure, etc.

**NEMA (National Electrical Manufacturer's Association)** - A non-profit organization organized and supported by manufacturers of electric equipment and supplies. NEMA has set standards for: horsepower ratings, speeds, frame sizes and dimensions, standard voltages and frequencies with allowable variations, service factors, torque, starting current, and enclosures.

**Network** - A series of stations (nodes) connected by some type of communication medium. A network may be made up of a single link or multiple links.

**Node** - The connection point at which media access is provided.

**Non-Retentive** - Changes to the parameter value are not saved when power is removed.

**Non-Volatile Storage (NVS)** - NVS is the permanent memory of a device. Devices such as the converter store parameters and other information in NVS so that they are not lost when the device loses power. NVS is sometimes called EEPROM.

**Output Parameter** - Provides output information. Value cannot be changed through the OIM.

**Overcurrent** - A current greater than a specified maximum current value.

**Overload Capacity** - The ability of the drive to withstand currents beyond the system's continuous rating. It is normally specified as a percentage of full load current for a specified time period.

**Peripheral Equipment** - In a programmable controller system, units that communicate with the programmable controller, but are not part of the programmable controller. For example, a programmable device or printer.

**Phase** - Indicates changing values of the recurring cycles of AC voltages and currents. The most common power supplies are either single- or three-phase (with 120 electrical degrees between three-phases).

**Potentiometer** - A resistor with one or more adjustable sliding contacts that function as an adjustable voltage divider.

**Power** - Work done per unit time. Measured in horsepower or watts: 1 hp = 33,000 ft-lb/min = 746 watts.

**Power Factor** - A measurement of the time phase difference between the voltage and current in an AC circuit. Power factor is the ratio of real power (kW) to total KVA or the ratio of actual power (W) to apparent power (volt-amperes).

**Preset Speed** - Describes one or more fixed speeds at which a drive operates.

**Program** - A set of instructions used to control a machine or process.

**Programmable Controller** - A solid-state control system that has a user-programmable memory for storage of instructions to implement specific functions such as I/O control, logic, timing, counting, report generation, communication, arithmetic, and data file manipulation. A controller consists of a central processor, input/output interface, and memory.

**Programmable Controller Communications Command (PCCC)** - The protocol used by some controllers to communicate with devices on a network. Some software products also use PCCC to communicate.

**Pulse** - A momentary, sharp change in voltage, current, or light from its quiescent condition.

**Pulse-Width-Modulation (PWM)** - A technique used to eliminate or reduce unwanted harmonic frequencies when inverting dc voltage to sine wave ac.

**Queue** - A logical structure that keeps track of items waiting for processing whenever the system is unable to process each item immediately. It controls the order in which the waiting items are ultimately processed.

**Rated Input Voltage** - The specified AC line voltage connected to the drive.

**Rated Output Current** - The total maximum current delivered from a drive or to a motor under full load conditions.

**Rated Output Voltage** - The total maximum output voltage while delivering rated current under full load conditions.

**Rectifier** - A device that conducts current in only one direction, thereby transforming alternating current to direct current.

**Regeneration** - 1. For dc drives, the characteristic of a motor to act as a generator when the counter emf is larger than the drive's applied voltage.  
2. For ac drives, the point at which rotor synchronous frequency is greater than the applied frequency.

**Regenerative Braking** - See Braking.

**Regenerative Control** - A regenerative drive contains the inherent capability and/or power semiconductors to control the flow of power to and from the motor.

**Remote I/O** - I/O connected to a processor across a serial link. With a serial link, remote I/O can be located long distance from the processor.

**Revolutions Per Minute (RPM)** - The number of times per minute the shaft of the motor (machine) rotates.

**Service Factor (SF)** - When used on a motor nameplate, a number that indicates how much above the nameplate rating a motor can be loaded without causing serious degradation. For example, a 1.15 SF can produce 15% greater torque than a 1.0 SF rating of the same motor.

**Slave** - In a communication link, a station that cannot initiate communication. Only a master can initiate communication.

**Speed Range** - The speed minimum and maximum at which a motor must operate under constant or variable torque load conditions.

**Stall** - A motor state in which the motor remains motionless although the motor is generating torque.

**Stator** - The part of an AC induction motor's magnetic structure which does not rotate.

**Status** - The condition at a particular time of any of numerous entities within a system.

**Status Indicators** - LEDs that are used to report the status of a device.

**Surge Suppressor** - Circuit protection that suppresses the peak value of any unusual input voltage to the drive. It is sometimes used to lighten the leading edge of voltage.

**Tachometer** - Normally used as a rotation sensing device. Tachometers are typically attached to the output shaft of a motor requiring close speed regulation. The tachometer feeds its signal to a control loop, which adjusts its input to the motor accordingly.

**Throughput** - The rate at which equipment processes or transmits data.

**Top Speed** - The highest speed a drive can achieve. Top speed equals base speed when there is no field weakening.

**Torque** - Turning force delivered by a motor or gearmotor shaft, usually expressed in pounds-feet or newton-meters:

$lb\text{-ft} = HP \times (5250/RPM) = \text{Full Load Torque};$   
 $Nm = P(kW) \times (9550/RPM) = \text{Full Load Torque};$

**Torque Compensation** - The increase of the volts/frequency ratio of the drive in the low frequency area to compensate for the reduced torque of the motor at low speeds. Reduced torque at low speeds is due to the resistance of the motor stator windings.

**Transducer** - A device that converts one energy form to another. When a transducer is actuated by signals from one system or medium, it can supply a related signal to the other system or medium.

**Tunable** - Input parameter whose value can be modified at any time (when the drive is stopped, running, or jogging).

**Type 0/Type 1/Type 2 Control** - When transmitting I/O, the module can use different types of messages for control. The Type 0, Type 1, and Type 2 events help Reliance Electric personnel identify the type of messages that a module is using.

**U.L. (Underwriter's Laboratory)** - An independent testing organization, which examines and tests devices, systems and materials with particular reference to life, fire and casualty hazards.

**Variable Torque** - A multi-speed motor used on loads with torque requirements, which vary with speed as with some centrifugal pumps and blowers. The horsepower varies as the square of the speed.

**Voltage** - The force that causes a current to flow in an electrical circuit. Analogous to pressure in hydraulics, voltage is often referred to as electrical pressure. The voltage of a motor is usually determined by the supply to which it is attached. NEMA requires that the motor be able to carry its rated horsepower at nameplate voltage plus or minus 10% although not necessarily at the rated temperature rise.

**Voltage Feedback** - A voltage signal which the regulator uses to control the operation of the drive.

**Volts per Hertz (V/Hz)** - The ratio of output voltage (in volts) to output frequency (in hertz) in the output frequency range of the drive to achieve constant torque in the motor.

**VS Utilities Software** - A Windows-based software tool for monitoring and configuring Reliance Electric products and modules.

**Watt (W)** - The amount of power required to maintain a current of one ampere at a pressure of one volt. One horsepower is equal to 756 watts.

**Word** - A grouping or a number of bits in a sequence that is treated as a unit.

**Work** - A force moving an object over a distance.  $Work = Force \times Distance.$