Gear Motor Glossary

January 14, 2015

Those of us in the fractional horsepower motor and gear motor industry tend to throw terms around without taking time to check that everyone understands what we are discussing. We've created this quick reference glossary to help those unfamiliar with many of the terms in the motor/gear motor industry.

Term	Definition
AC (Alternating Current)	A flow of electricity which changes direction on a continuous cycle or frequency.
AC Induction Motor	Motor type consisting of a wound stator and a cast aluminum rotor. This type of motor operates using AC Current, usually single or three phase.
Accelerating Torque	Another name for pull up torque. It is called accelerating torque because this is the moment at which speed transitions from starting speed to full speed.
Acceleration	The rate at which speed increases.
Amp (Ampere)	A unit of electrical current equivalent to the electron flow produced by one volt applied across a resistance of one ohm.
Armature	The rotating assembly of a universal or PM motor. Typically consists of a commutator and a laminated core with wound magnet wire. This term is now used with induction motors.
Auxiliary Winding	Secondary winding in a two phase motor.
Backlash	The play caused by loose connections between mechanical components. Backlash becomes a problem when an axis changes direction. When a motor turns, it pushes all the gears together in one direction. When the motor reverses direction the gear teeth separate from one side and meet on the other side. The distance between the separation is the backlash.
Base Speed	The speed (in rpm) at which the motor runs with full-line voltage applied to the armature and the field.
Bearing	A load bearing support in which a shaft or pivot turns.
BPM (Brushless Permanent Magnet Motor)	A motor type which consists of a rotor with permanent magnets bonded to it on a stator that is commutated electrically. It contains no brushes.
Breakdown Torque	The maximum torque a motor can produce without abruptly losing motor speed.
Brush Track	The carbon film left on a commutator by the brushes when a motor runs.
Bushing (Sleeve Bearing)	A cylindrical lining in the shaft fit opening of a motor to control the size of the opening, provide a non-rolling wear surface, and serve as an alignment guide.

Chamfer/Break	A shaft lead-in angle of transition from one diameter to another.
Commutation	The act of maintaining the correct torque angle on a motor. In brushed motors the commutation is achieved inside the motor via the commutator and brushes. In brushless motors the commutation is achieved by using feedback to determine the motor position and using commutation algorithms to output current to the correct phases.
Connection (armature)	Physical contact between winding wire and commutator bar. +
Constant Horsepower/ Variable Torque	A load that requires high torque at low speeds and low torque at high speeds. Horsepower remains constant as speed and torque are inversely proportional.
Constant Torque/ Variable Horsepower	A load that requires a constant torque throughout acceleration. If the load needs to move faster, the horsepower is increased.
Conventional Armatures	Armature design that uses a slotted commutator for magnet wire connection.
Copper Loss	A power loss due to current flowing through wire. The lost power is converted into heat.
Counter Emf	The voltage induced in the armature of a DC motor that opposes the applied voltage and limits armature current.
DC (Direct Current)	A flow of energy where direction is constant from positive to negative.
Encoder	A high precision feedback device that gives position and velocity data. Resolution ranges from just a few hundred counts per revolution to over a million counts per revolution.
ESD (Electrostatic Discharge)	The sudden flow of electricity when two objects that have different charges come into contact with each other.
ESDS (Electrostatic Discharge Sensitive)	Describes an electronic device that is susceptible to being damaged by ESD. Damaged components may immediately fail or may have latent damage which is undetectable at final test, but can affect the lifespan of the product.
Feedback	Feedback is the measurement of the parameter that is being controlled. For a positioning system to accurately compensate for an error, the actual position must be known relative to the commanded position. In this case, position feedback would be used to provide the actual position.
Field	The non-rotating assembly of a universal motor. Typically consists of two wound coils inserted into a field stack.

712.722.4135 • 712.722.1445 (fax) • 420 15th St. NE, Sioux Center, IA 51250 USA • Registered ISO 9001:2008

Frequency	A measurement of the number of complete AC cycles that occurs in one second. Frequency is measured in Hertz (Hz).
Friction	The resistance to motion between the contact surfaces of two objects. Friction generates heat and increases the wear between components.
Full Load Torque	The torque needed to produce the rated power at the full speed of the motor.
Grain	Direction of slot insulation paper fibers.
Hall Effect Rotor	A magnet with alternating poles used in conjunction with a hall effect sensor.
Hall Effect Sensor	A device that senses a magnetic field.
Hertz (Hz)	A unit of frequency in units of 1/s. 60Hertz is 60/s or 60 times per second. 20kHz is 20,000 times/second.
Horsepower	A unit of power used to describe machine strength. One horsepower equals 33,000 ft-lbs of work per minute, or 746 watts.
Inertia	The tendency of an object to stay in its state of rest or motion until acted on by an external force. Torque and braking must overcome inertia to accelerate or decelerate a motor.
Inrush Current	The initial surge of current into the windings. Inrush current can be up to ten times higher than the continuously needed current because there is low initial resistance.
Keyway (Key Seat)	A slot cut in a shaft of in the bore of a gear or pulley, into which is fitted a key.
Lead Placement (stators)	The location, as shown pictorially on the drawing of magnet wire lead exits relative to stack slot orientation.
Lead Routing (fields & stator)	The path, as shown pictorially on the drawing, that a magnet wire lead and/or lead wire follows, in order to achieve required lead lengths, exit locations and polarity.
Locked Rotor Torque	The torque that a motor produces when full power is supplied to the motor and the rotor is not yet moving.
Main Wind	Primary wind in a two phase motor.
NEMA	The National Electrical Manufacturers Association. Motor nameplates carry NEMA letter designations that indicate the design characteristics of the motor.
Parallel Wind	A winding design comprised of two identical windings.

712.722.4135 • 712.722.1445 (fax) • 420 15th St. NE, Sioux Center, IA 51250 USA • Registered ISO 9001:2008

Percent Slip	The difference between a motor's synchronous speed and its speed at full load. Percent slip is a way to measure the speed performance of an induction motor.
PM (Permanent Magnet)	A motor type which consists of a wound armature and a permanent magnet field. This type of motor uses brushes in contact with the armature commutator to provide switching to the armature coils. PM motors run on DC current and are sometimes referred to as PMDC (Permanent Magnet Direct Current) Motors.
Polarity	The magnetic alignment (north or south) of an installed coil or permanent magnet as a result of a specified magnetization or coil winding direction and placement.
Power Supply	A unit that supplies a consistent voltage.
Prototype	A product requiring special Engineering department design considerations, sent to a potential customer for evaluation.
Pull Up Torque	The torque needed to cause a load to reach its full rated speed.
Radius	The straight line distance from any point on a circle or an arc to its center.
Resistance	The opposition to current flow when voltage is applied, usually measured in ohms.
Total Resistance	The combined resistance of individual windings.
Bar to Bar Resistance	The resistance measured between two adjacent commutator bars.
Side to Side Resistance	The variation in resistance from one winding to the opposite winding.
Resolver	A high resolution feedback device that is an alternative to encoders. Resolvers are suited to harsh environments such as high temperatures and severe vibration since they do not rely on optical sensors or glass disks which can fail in these conditions. Resolvers use inductive coupling to determine rotor position. Since resolver signals are not discrete, resolution is determined by the amount of interpolation used in the interface circuitry in the drive or controller. Typical resolutions range from 1000 to 65,000 counts/revolution.
Rheostat	A continuously variable electrical resistor used to regulate current.
Rotor	The rotating assembly of an induction motor. Typically consists of either aluminum cast around a laminated core or permanent magnets bonded to a non-laminated steel core.
RPM (Revolutions Per Minute)	The speed at which a motor/armature rotates based on a per minutes standard.

712.722.4135 • 712.722.1445 (fax) • 420 15th St. NE, Sioux Center, IA 51250 USA • Registered ISO 9001:2008

Single Phase	AC power that comes from two wires. Single phase AC has more voltage ripple and less output power compared with three phase AC power.
Skeleton Motor	An assembled motor constructed using open end brackets.
Span	The number of lamination slots from one slot that the coil passes through to the other slot that it passes through.
Speed Control	The external means of varying the speed of a motor under any type of load.
Speed Regulation	The ability of a motor to maintain its speed when a load is applied. A motor's speed regulation is fixed based on its design.
Spline	Raised axial lines of material on the outside diameter of a shaft, usually four, used to create an interference fit
Square Key	A key with a flat bottom.
Starting Torque	Another name for locked rotor torque. It can be called starting torque because it is the torque applied by the motor at startup.
Stator	The non-rotating assembly of an induction motor. Typically consists of many coil sets inserted in to a stator stack.
Surge	Electrical current leakage from one magnet wire to an adjacent magnet wire.
Synchronous Speed	The speed of the rotating magnetic field of an AC induction motor.
Tachometer (Tach)	A device that measures speed of rotation (RPM)
Tach Assembly	A motor component that generates a signal used to control or display RPM
Tang Wound Armature	An armature design that uses commutators with integral copper hooks for magnet wire hook-up.
Three Phase	AC power that comes from three wires. Three phase AC power has less voltage ripple and more power compared with single phase AC power.
Torque	A force that produces rotation. Torque is measured in pounds-feet in the English system and Newton meters in the metric system.
Trapezoidal	A commutation scheme for brushless motors that can affordably provide good servo performance in most applications. Trapezoidal commutation directs current through the three motor phases in 6 steps per electrical cycle.
True Count	The number of turns of magnet wire per coil.

712.722.4135 • 712.722.1445 (fax) • 420 15th St. NE, Sioux Center, IA 51250 USA • Registered ISO 9001:2008

UL (Underwriters Laboratories)	An independent, not for profit, product safety testing and certification organization.
UM (Universal Motor)	A motor type consisting of an armature, field, commutator, and brushes that can operate on both AC and DC voltages.
Variable Frequency Drive	A device that converts incoming 60Hz AC power into other desired frequencies to allow for AC motor speed control.
Variable Torque/ Variable Horsepower	A load in which both torque and horsepower requirements can change depending on the needed speed.
Viscosity	The consistency of a liquid measured by the time it takes for the liquid to drain though a viscosity cup.
Watt	A unit used to measure power. 746 watts equals one horsepower.
Woodruff Key	A key with a radius on the bottom.

712.722.4135 • 712.722.1445 (fax) • 420 15th St. NE, Sioux Center, IA 51250 USA • Registered ISO 9001:2008