

GLOSSARY OF TECHNICAL TERMS

In this document, unless the context otherwise requires, explanations and definitions of certain terms used in this document in connection with our Company and our business shall have the meanings set out below. The terms and their meanings may not always correspond to standard industry meaning or usage of these terms.

“actuator”	a vital component in electromechanical systems that converts energy into motion, enabling precise control and movement
“actuator joint”	a joint structure in robotic systems that achieves active motion through integration with a motion unit, such as an actuator module; in wheeled-legged robots, the actuated joint typically refers to the wheel assembly at the end of the leg linkage
“Ah”	ampere-hour, a unit of electronic charge
“algorithm”	a procedure or set of rules used in calculation and problem-solving by computer systems
“AMR(s)”	autonomous mobile robot, a robot capable of navigating its surrounding environment without human oversight
“API”	application programming interface, a type of software interface offering a service to other pieces of software
“backlash”	the lost motion or clearance that occurs in a mechanical transmission system when the direction of motion is reversed, arising from the clearance between meshing components, such as gears and lead screws
“biomimetic locomotion mechanisms”	engineered systems that emulate the movement principles, morphological adaptations, and control strategies of biological organisms to enhance the performance, efficiency, and adaptability of robotic and mechanical devices
“CAGR”	compound annual growth rate, calculated by dividing the ending value by the beginning value, raising the result to the power of one divided by the number of years, and subtracting one
“cogging torque”	the periodic torque ripple generated by the interaction between permanent magnets and stator core slots in a permanent magnet motor when no current is applied
“controller”	a component composed of power semi-conductor devices, which is responsible for controlling the motor and its electronic circuits to achieve functions such as starting, braking, speed regulation and protection of the motor

GLOSSARY OF TECHNICAL TERMS

“dB”	decibel, a logarithmic unit used to measure the ratio of two physical quantities, most commonly associated with sound intensity, electrical power, or signal strength
“encoder(s)”	electromechanical devices designed to convert mechanical motion into electrical signals, which can provide feedback on angular velocity and displacement
“Eight degree-of-freedom”	The configuration of a robotic system or manipulator that provides eight independent directions of motion, typically comprising six degrees for full spatial positioning and orientation, including three translational and three rotational positioning, plus two additional redundant degrees to enhance dexterity, avoid singularities, or enable complex task execution without altering the end-effector’s pose.
“End-effector”	the device or tool attached to the distal end of a robotic system that directly interacts with the workpiece or environment to perform the robot’s primary task
“ERP”	enterprise resource planning, an integrated software platform used to manage and automate core business processes across an organization. It consolidates data from various departments, such as finance and supply chain to enhance efficiency and provide a unified view of business operations
“ESG”	environmental, social and governance
“Field-weakening”	a control algorithm in electric motors that reduces the magnetic flux by applying negative d-axis current when voltage limits are reached, allowing operation above base speed at the expense of reduced torque
“GFA”	gross floor area
“harmonic injection techniques”	technique that actively injects precisely calculated harmonic current components through the controller, allowing them to interact with the motor’s inherent magnetic field harmonics to generate additional torque that offsets existing torque ripple, thereby enabling smooth motor operation, particularly in low-speed regions
“high-precision positioning”	a capability that enables a robot or actuator to move its end-effector to a specified point in the workspace with very small absolute error and high repeatability, thereby ensuring consistent product quality, meeting tight tolerances and supporting precision automation applications

GLOSSARY OF TECHNICAL TERMS

“mass production”	a large-scale production phase that adopts advanced manufacturing and engineering facilities to ensure product consistency, reduce labor costs, enhance utilization, and achieve cost-efficiency
“model-based control algorithm”	algorithm that uses a mathematical model to represent the motor’s physical dynamics, takes the current motor state including measured current and speed as the initial condition, predicts motor behavior over a short future horizon, evaluates alternative control actions, and selects and applies the optimal control input in real time. By accepting higher computational requirements, the algorithm achieves more accurate, reliable, and intelligent control performance than conventional proportional-integral-derivative control methods
“motor”	the core unit of the robotic actuator modules which uses the principle of electromagnetic induction to generate rotational torque through the interaction between the stator and the rotor
“multi-degree-of-freedom”	a characteristic of a mechanical or robotic system that denotes the number of independent axes or motions it can perform, enabling complex spatial manipulation, orientation and coordination required for advanced robotic tasks
“LiDAR”	light detection and ranging, a remote sensing technology that uses laser pulses to measure distances and create precise, high-resolution 3D maps of objects and environments
“modular hardware architecture”	a design principle that enables flexible robot configuration by combining standardized functional modules
“Nm”	Newton-meter, a unit of torque
“Nm/A”	Newton-meter per ampere, the torque constant of an electric motor, representing the mechanical torque generated per ampere of current supplied to the motor windings under steady-state conditions
“Nm/cm³”	Newton-meter per cubic centimeter, the torque density of an electric motor, defined as the torque output per cubic centimeter of the motor’s active volume, typically the volume enclosing the stator, rotor, windings, and magnets, under rated conditions

GLOSSARY OF TECHNICAL TERMS

“Nm/kg”	Newton-meter per kilogram, defined as the torque output per kilogram of the motor’s active mass under rated conditions
“Over-modulation”	a pulse width modulation technique in motor drives that intentionally allows the modulation index to exceed 1.0, introducing controlled distortion in output voltages to extend the available fundamental voltage beyond the linear modulation range, thereby increasing maximum speed or torque capability
“payload”	the maximum weight a robot can carry at its end effector without compromising performance or safety
“PCB”	printed circuit board, an electronic assembly that uses conductors to create electrical connections between components
“PCBA(s)”	printed circuit board assembly, the final assembled circuit board with all components mounted and tested to become a functional electronic device, ready for integration into devices
“permanent magnet synchronous motor(s)”	a type of motor that uses permanent magnets in the rotor to create a steady magnetic field. It is widely used in applications such as electric vehicles and industrial machinery
“PLM”	product lifecycle management
“rare earth permanent magnets”	powerful magnets made from rare earth elements, primarily neodymium and samarium, known for their exceptional magnetic strength
“Real2Sim”	reality-to-simulation transfer, the process of reconstructing real-world environments, objects, physics, and dynamics into simulated digital environments. This involves capturing real-world data through sensors, cameras, or other means and translating it into high-fidelity virtual representations for training, testing, or validating robotic systems
“roll-angle”	the angle of rotation around the longitudinal axis of an object in three-dimensional space, measured in degrees. It represents side-to-side tilting motion
“rotor”	the rotating part inside the stator that converts electrical energy into mechanical energy

GLOSSARY OF TECHNICAL TERMS

“rpm”	revolutions per minute, a unit of rotational speed for rotating machines
“R&D”	research and development
“servo”	a closed-loop control methodology and system that utilizes feedback to precisely regulate a motor’s position, velocity, acceleration, and torque, ensuring high repeatability and accuracy in motion control
“servo controller”	the controller for the joint motors, which enables high-precision control of position, velocity, and acceleration, ensuring that robots maintain high repeatability and accuracy when performing complex tasks. Additionally, it can precisely control output torque, allowing robots to apply appropriate force when executing tasks such as assembly and gripping
“servo driver”	a device that receives motion commands from the controller and regulates the power sent to the servo motor
“Sim2Real”	simulation-to-reality transfer, the process of transferring models, algorithms, policies, or control strategies trained in simulated environments to real-world applications. This involves bridging the “sim-to-real gap”, the discrepancy between simulated and physical environments, to enable robotic systems trained in virtual settings to perform effectively in real-world scenarios
“stator”	stationary and generates a rotating magnetic field when electric current is applied
“torque density”	a measure of the amount of torque a motor can deliver per unit of weight or volume
“torque ripple”	the phenomenon where the instantaneous torque of a motor fluctuates periodically above and below the average value during rotational power output
“voltage”	a representation of the electric potential energy per unit charge