

Instructional Terminology

Automation and Robotics 14.4201.00



This **Instructional Terminology** defines entry-level industry terms identified by the program's Technical Standards, Measurement Criteria, and Instructional Framework. This resource is designed for use in classroom and laboratory environments to ensure students are introduced to the essential occupational terminology relevant to their program. It supports the consistent use of terms and definitions in curriculum, instruction, and assessment and corresponds with the Technical Standards reviewed on July 13, 2025.

1,2,3

2D - Two-dimensional representation of objects using length and width

3D - Three-dimensional representation of objects showing length, width, and height

3D printing - A manufacturing process that creates a physical object from a digital model by laying down layers of material

A

Actuator - Device that converts electrical or fluid energy into mechanical motion

Additive manufacturing - Utilizes three-dimensional space and computer-aided design (CAD) to create complex items; also known as 3D printing

Algorithm - A set of rules or steps used to solve a specific problem or perform a task

Alignment - Precise positioning of parts or systems to ensure proper operation

Alternating Current (AC) power - A type of electrical current that reverses direction periodically

Amp - A unit of measure, measuring the amount of electric current

Amplifier - An electronic device that increases an electrical signal

Analog - Continuous signal that varies smoothly over time

Analog vs. digital signal conversion - The process of changing continuous analog signals into discrete digital form

Apprenticeship - A training program that combines classroom instruction with on-the-job learning

Arc flash - A dangerous electrical explosion caused by a short circuit or fault in equipment

Array - A data structure that stores multiple values in a single organized collection

Artificial Intelligence (AI) - Computer systems designed to perform tasks that typically require human intelligence

Assemblies - Groups of parts or components put together to create a complete product

Assembly fixture - A tool or device used to hold parts in place during assembly operations

Augmented Reality (AR) - Technology that overlays digital information onto the real-world view

Automated Guided Vehicle (AGV) - A mobile robot that transports materials along a predetermined path

Autonomous - Able to operate or make decisions without human control

B

Bearing - A mechanical component that reduces friction between moving parts

Belt drive - A system that transmits power between pulleys using a flexible belt

Big data analytics – The process of examining large data sets to uncover useful patterns and insights

Bill of Materials (BOM) - A list of all materials and components needed to manufacture a product

Binary values - A numbering system with two digits, typically 0 and 1

Boolean expression - A mathematical statement that evaluates to either true or false

Boolean logic - A form of algebra used to perform logical operations with binary values

Breadboard - A tool for prototyping electronic circuits without soldering

Brushless motors - Electric motors that use electronic control instead of brushes for commutation

C

Calibrate - Adjust an instrument or device to ensure accurate measurement

Calibration - Process of setting or correcting a device to ensure measurement accuracy

Capacitor - An electronic component that stores and releases electrical energy

Career pathway - Planned route of education and experience leading to a specific occupation

Center lines - Lines in technical drawings that indicate the exact center of objects or holes

Chain drive - A power transmission system using a chain and sprockets to transfer motion

Chemical properties – Characteristics of a material that describe how it reacts with other substances; examples include how easily it corrodes, oxidizes, or degrades

Circuit - Closed path through which electric current flows

Cloud computing - Delivery of computing services such as storage and processing over the internet

Code commenting - Adding notes in code to explain its purpose or function

Collaborative Robot (COBOT) - A robot designed to safely work alongside humans in a shared workspace

Components - Individual parts that combine to form a complete system or device

Computer-Aided Design (CAD) - Software used to design precision drawings or technical illustrations

Computer-Aided Manufacturing (CAM) - Software that controls machines to automate manufacturing processes

Computerized Numerical Control (CNC) - A method of automating control of machine tools via software embedded in a microcomputer

Conditional statement - A programming instruction that executes actions based on whether a condition is true or false

Conductors - Materials that allow the flow of electrical current; having low resistance

Constraints - Limits or restrictions that guide a design or process

Control circuits - Low-voltage, low-current circuits that manage and direct other separate, higher-power circuits; used to control other electronics

Corrective Action Report (CAR) - Document describing steps to fix and prevent quality issues

Coupling - A device used to connect two rotating shafts to transmit power

Current - The flow of electric charge, measured in amperes (amp)

Cutting - Material is split or cut into smaller pieces

Cyber-Physical System (CPS) - Integration of computer systems with physical processes through sensors and control

Cycle time - Total time required to complete one operation or production cycle

D

Data analytics - Examination of raw data to draw conclusions and support decision-making

Data communication protocols - Rules that govern the exchange of information between devices

Data logging - Recording of data over time for analysis and monitoring

Data storage - Methods and devices used to save digital information

Data type selection - Choosing appropriate data categories in programming for efficient processing

Debugging - Process of finding and fixing errors in code or systems

Decibel (DB) - A way to compare power or voltage levels on a scale

Decision flow chart - Diagram showing the logical steps and decisions in a process

Degrees of freedom - Number of independent movements a mechanism or robot can perform

Density - Measure of mass contained in a given volume of a substance

Design brief - Summary document outlining project goals, requirements, and constraints

Design review - Evaluation of a design's progress, quality, and compliance with goals

Design thinking - Problem-solving approach that focuses on user needs and creativity

Design validation - Process of confirming that a design meets the intended requirements

Design verification - Process of ensuring a design performs according to specifications

Dexterity - Ability to perform precise and coordinated movements

Digital - A signal or system that represents data using discrete values

Digital twin - A virtual model that mirrors a real-world system for monitoring and testing

Dimensioning - Process of adding measurements to a technical drawing

Direct Current (DC) motor - An electric motor powered by direct current that produces rotational motion

Direct Current (DC) power - Electrical current that flows steadily in one direction

Diode - An electronic component that allows current to flow in one direction only

E

Edge computing - Data processing that occurs near the source rather than in a centralized cloud

Electrical drawings - Diagrams showing the layout and connections of electrical systems

Electrical properties - Characteristics of a material that describe how it behaves when exposed to electricity; examples include conductivity, resistance, voltage, etc.

Electrical safety - Practices that prevent injury or damage from electrical hazards

Emergency button - A safety device that immediately stops machinery when pressed

End effector - Tool or device attached to the end of a robot arm to perform tasks

End effector tool changer - A device that allows a robot to automatically switch end tools

End of arm tools - Attachments mounted on the robot arm for handling or processing tasks

Engineering notebook - Official record documenting the design and development process

Engineering specifications - Detailed descriptions of a design's performance and requirements

Ergonomics - The study of designing systems to fit human abilities and comfort

Ethernet - A computer network system with established network protocol and connection methods

Ethical design - Creating products and systems that consider safety, privacy, and social impact

F

Fabrication - The process of constructing products by combining diverse, typically standardized parts

Fail-safe – A system design that ensures safety when a failure occurs

Fasteners - Hardware devices used to join or secure materials together

Feedback control loop - A system that adjusts its operation based on output measurements

Filament - The thermoplastic material used by 3D printers to form objects

Finishing - Processing a 3D printed item into its final form

Firmware - Software programmed into hardware devices to control their functions

Fixture/Jig - A tool that holds or guides parts during manufacturing or assembly

Flow controls - Devices that regulate the rate and direction of fluid movement

Flowchart - A diagram that shows steps in a process using symbols and arrows

Force sensing - Detection and measurement of physical force applied to an object

Friction - Resistance to motion when two surfaces move against each other

G

G-code - A programming language used to instruct CNC machines and 3D printers on how to move and operate

Gear ratio - Relationship between the rotational speeds of two connected gears

Gear train - Series of gears that transmit motion and torque between shafts

Geometric construction techniques - Methods used to create shapes and figures accurately using geometry

Ground (GND) - Reference point in an electrical circuit with zero voltage

Ground fault - An unintended electrical path between a power source and ground

H

Hidden lines - Lines in drawings representing edges not directly visible in a view

Home/Zero position - Default or reference point for a robot's movement calibration

Human Machine Interface (HMI) - An interface allowing operators to interact with machines or systems

Hydraulics - Technology using pressurized fluids to generate motion or force

Hysteresis - Lag between input and output in a system when conditions change

I

Impedance - The opposite of AC flow, combining both resistance and reactance

Inductance - Property of an electrical circuit that opposes changes in current flow

Inertia - Tendency of an object to resist changes in its motion

Input gear - Gear that receives power and transmits motion to another gear in a system

Input/Output (I/O) mapping - Process of assigning signals or devices to specific input and output channels

Input module - A device that receives signals from sensors and sends them to a control system

Insulators/Shielding - Materials that do not allow electrical current or prevent current leakage to flow due to tight atom bonds

Interference/Noise - Unwanted electrical signals that disrupt communication or measurements

Internet of Things (IoT) - A network of connected devices that collect and exchange data over the internet

Internet Protocol (IP) - Rules on how data packets are handled across networks

Inverse kinematics - A mathematical method used to determine the joint angles needed for a robot to reach a position

Isometric view - 3D drawing that shows an object's dimensions without perspective distortion

Iteration/Iterative process - A repeated cycle of testing and improving a design or process

J

Jig/Fixture - A tool that holds or guides parts during manufacturing or assembly

K

Kinematic chain - Series of connected links and joints that control motion in a mechanism

Kinematics - Study of motion without considering the forces that cause it

L

Ladder logic - Graphical programming language used for industrial control systems

Laser cutting - A manufacturing process that uses a laser beam to cut materials precisely

Latency - Delay between an input and the corresponding output in a system

Leverage - Mechanical advantage gained by using a lever to amplify force

Light curtains - Safety devices that use beams of light to detect objects entering hazardous areas

Limit switch - A mechanical switch that detects the presence or position of an object

Line weights - Thickness of lines used in technical drawings to represent different features

Linear motion - Movement that occurs in a straight line

Lockout/Tagout (LOTO) - A safety procedure ensuring machines are properly shut off before maintenance

Loop (While for loop) - A programming structure that repeats a set of instructions until a condition is met

Loop counter - Variable used to track the number of times a loop executes

Lubrication - Application of oil or grease to reduce friction between moving parts

M

Machine Learning (ML) - A field of AI that enables systems to learn from data and improve performance over time

Machine vision - Technology that allows machines to interpret visual information from cameras

Machining - Process of shaping material into a desired form by removing material using tools comparable to drills, lathes, or mills; a substantive process

Manufacturing - The process of transforming material into a finished product, often on a large scale and using machines

Manufacturing Execution System (MES) - Software that manages and monitors production processes in real time

Mass - Amount of matter in an object

Material properties - Characteristics such as strength, hardness, and flexibility that define a material's behavior

Mechanical advantage - Ratio of output force to input force in a mechanical system

Mechanical load - Amount of resistance or force applied to a mechanical system

Mechanical properties – Characteristics that describe how a material behaves when forces are applied; examples include how strong, flexible, hard, or tough it

Message Queuing Telemetry Transport (MQTT) - A lightweight communication protocol used in IoT systems

Metrology - Science of measurement and its application in manufacturing

Microcomputer - A small computer with a microprocessor as its central processing unit (CPU)

Modbus - Industrial communication protocol used to connect automation devices

Modeling - An item is designed on a CAD program as a specific file type, depending on the printer capabilities

Moment of inertia - Measure of an object's resistance to changes in rotational motion

Multimeter - A device used to measure voltage, current, and resistance

N

N-type semiconductor – A type of semiconductor that has been mixed with other materials, such as phosphorus, to encourage free electrons to allow the flow of electricity

Noise/Interference - Unwanted electrical signals that disrupt communication or measurements

O

Ohm - the unit of measure for electrical resistance

Ohm's law - A law stating that current (I) is equal to voltage (V) divided by resistance (R), in equation form it is written as $I = V/R$

Operation/Production cycle - A set of steps to completely create a product or finish a process

Operator - Person who controls or monitors a machine or process

Orthographic - A type of 2D drawing that shows multiple views of an object from different angles

Oscilloscope - An electronic instrument used to display and measure electrical waveforms

Output module - A device that sends control signals from a system to actuators or other devices

P

P-type n-type (P-N) junction - The boundary between p-type and n-type semiconductors, critical in diodes and transistors

P-type semiconductor - a type of semiconductor mixed with materials, such as boron or aluminum, which make openings, allowing the flow of electricity

Parametric modeling - 3D design approach that uses parameters to define and modify geometry

Path planning - Process of determining an optimal route for a robot or automated system

Payload capacity - The maximum weight a robot or machine can carry or move

Performance data - Information used to measure and evaluate system or machine efficiency

Physical properties - Characteristics of a material that can be observed or measured without changing its chemical structure; examples include its size, shape, density, color, melting point, or thermal conductivity

Plasma cutter - A tool that uses ionized gas to cut through electrically conductive materials

Pneumatics - Technology that uses compressed air to perform mechanical work

Power factor - Ratio of real power used to perform work to total apparent power in a system

Power supply regulation - Process of maintaining a constant voltage output despite input or load changes

Predictive analytics - Use of data and algorithms to predict future trends or outcomes

Predictive maintenance - A technique that uses data to forecast equipment failures before they occur

Pressure sensor - A device that measures pressure in gases or liquids

Preventive Maintenance (PM) - Scheduled maintenance to prevent equipment breakdowns

Printing - A design is sent to the 3D printer, and print time varies by the item's size and complexity

Process development - Design and optimization of manufacturing or operational processes

Production/Operation cycle - A set of steps to completely create a product or finish a process

Program flow - Order in which a computer program's instructions are executed

Program loop - A section of code that repeats instructions until a specific condition is met

Programmable Logic Controller (PLC) - An industrial computer used to control machinery and processes

Programmable Logic Controller (PLC) addressing - System of assigning unique identifiers to PLC memory locations and devices

Programmable Logic Controller (PLC) tagging - Labeling system used to identify variables and devices in PLC programming

Proportional Integral Derivative (PID) controller - A control system that adjusts outputs to maintain desired performance levels

Prototype iteration - Cycle of creating, testing, and refining a prototype to improve design

Pulley - Wheel with a grooved rim used to change the direction of force applied by a rope or belt

Pulse Width Modulation (PWM) - Method of controlling power output by varying the duration of voltage pulses

Q

Quality Assurance (QA) - Process of ensuring products meet specified quality standards

R

Rapid prototyping – A fast method of creating a model or part using digital manufacturing techniques

Raw data - data that has not been refined, formatted, or analyzed

Reactive maintenance - Repair performed after equipment has failed

Redundancy - Backup systems or components that ensure continued operation if one fails

Relay - An electrically operated switch that controls a circuit using an electromagnet

Relay logic - A control system that uses relays and wiring instead of digital programming

Repeatability vs. accuracy - Consistency of repeated actions compared to closeness to the true value

Resistance - A measure of the opposition to the flow of current in an electrical circuit, measured in ohms

Resistor - An electronic component that resists the flow of electric current

Reverse engineering - Process of analyzing a product to understand or replicate its design

Revision control - A system that manages changes to documents or code over time

Risk assessment - Process of identifying and evaluating potential hazards or failures

Robot calibration matrix - A data set used to adjust a robot's accuracy and positioning

Robot payload - Maximum load a robot can carry without losing accuracy or performance

Robot workspace envelope - Total area within which a robot can reach and operate

Robotic Process Automation (RPA) - Technology that uses software robots to automate repetitive digital tasks

Robotic work cell - Dedicated area containing one or more robots performing coordinated tasks

Root Cause Analysis (RCA) - Method used to determine the underlying reason for a problem or failure

S

Safety fences - Physical barriers that protect people from entering hazardous work areas

Safety relays - Specialized relays used to monitor and ensure machine safety functions

Schematic - A diagram that represents the elements of a system using abstract, graphic symbols

Semiconductor - A material with conductivity between conductors and insulators, commonly used in electronic devices

Sensors - Devices that detect and measure physical properties such as temperature or motion

Servos - Motors that provide precise control of position, speed, and acceleration

Shielding/Insulation - Materials used to block electrical interference or prevent current leakage

Short circuit - Unintended electrical connection allowing current to bypass the intended path

Signal conditioning - Processing signals to improve their quality before analysis or transmission

Signal flow - Path that electrical or data signals follow through a system

Simulation - The imitation of the operation of a real-world process or system over time

Simulation software - A program used to model and analyze system behavior before real implementation

Singularity - Position where a robot arm loses certain degrees of freedom or control accuracy

Software - A set of coded instructions that tells a computer or machine what to do

Speed - Rate at which an object moves or a process operates

Sprockets - Toothed wheels that engage with chains to transmit motion

Standard Operating Procedure (SOP) - Documented step-by-step instructions for completing specific tasks

Standards compliance - Adherence to established technical and safety guidelines

Static and dynamic loads - Forces that act on a structure either constantly or while in motion

Static load - Constant force applied to an object without movement

Stepper motor - A Motor that moves in fixed steps for precise control of position

Stored energy - Energy retained in a system due to position or configuration

Strength - Ability of a material to resist applied forces without breaking

Structured text - A high-level programming language used in industrial automation

Subtractive manufacturing - The process of creating items by removing material through shaping techniques such as cutting or drilling, to create a design

Supervisory Control and Data Acquisition (SCADA) - System used to monitor and control industrial processes remotely

Sustainability - The practice of minimizing environmental impact while maintaining efficiency

T

Teach Pendant - Handheld device used to manually control and program a robot

Technical Specifications (Specs) - Detailed descriptions of a product's design and performance requirements

Thermal properties – Characteristics that describe how a material responds to heat; examples include how well it conducts, stores, or resists heat, and how it changes when temperatures rise or fall

Thyristor - a type of semiconductor with multiple layers that acts like an electronic switch, controlling power with signals

Tolerance - Allowable variation in a physical dimension or measurement

Tolerance fit (Interference/Clearance) - Relationship between two mating parts based on their size difference

Torque - Rotational force that causes an object to turn around an axis

Torque arm - Lever that applies torque to a shaft or joint

Transistor - A semiconductor device used to amplify or switch electronic signals and electrical power

U

V

Vacuum - Space with pressure lower than atmospheric pressure

Variable declaration - A programming statement that defines and names a variable

Velocity - Speed of an object in a specific direction

Version control - A system that tracks and manages changes to files or code

Vibration analysis - A technique used to monitor and diagnose mechanical issues through vibration patterns

Virtual simulation - A digital model that replicates real-world systems for testing and training

Viscosity - Measure of a fluid's resistance to flow

Volt - Units measuring electrical potential difference

Voltage - The electric potential difference between two points, measured in volts

W

Welding - A joining process that fuses materials using heat or pressure

Work envelope - 3D space in which a robot or machine can operate

Workplace safety - Practices and policies designed to prevent injury or accidents at work

Workspace envelope - Physical boundary defining the area a robot arm can reach

X

Y

Z

Zero/Home position - Default or reference point for a robot's movement calibration