



10 Engineering and manufacturing control systems

Criteria	Range	Resource identified
10.1 Principles and applications of control system theory.	Input	https://www.bbc.co.uk/bitesize/guides/z4qdqhv/revision/3 https://www.electronics-tutorials.ws/io/io_1.html https://electronicsclub.info/switches.htm https://www.bbc.co.uk/bitesize/guides/zhxqmsg/revision/1 https://electronicsclub.info/other.htm
	Process (logic gates (AND, OR, NOT), timer, comparator, pulse unit, counter, latch)	https://www.bbc.co.uk/bitesize/guides/z4qdqhv/revision/3 https://electronicsclub.info/gates.htm
	Output	https://electronicsclub.info/other.htm#piezo https://www.bbc.co.uk/bitesize/guides/z4qdqhv/revision/3 https://www.bbc.co.uk/bitesize/guides/zk37hyc/revision/9
	Signal	https://www.tutorialspoint.com/electronic_circuits/electronic_circuits_signals.htm https://electronicsclub.info/acdc.htm#props https://www.tutorialspoint.com/control_systems/control_systems_block_diagrams.htm
	Feedback	https://www.electronics-tutorials.ws/systems/feedback-systems.html https://www.electronics-tutorials.ws/systems/negative-feedback.html
	Open and closed loop systems	https://www.electronics-tutorials.ws/systems/closed-loop-system.html https://www.electronics-tutorials.ws/systems/open-loop-system.html https://www.electronics-tutorials.ws/systems/electronic-system.html https://www.tutorialspoint.com/control_systems/control_systems_introduction.htm
	Transfer function	https://www.electrical4u.com/transfer-function/ https://electronicscoach.com/transfer-function-of-control-system.html





Summing points	https://www.tutorialspoint.com/control_systems/control_systems_block_diagrams.htm https://www.electrical4u.com/block-diagrams-of-control-system/
Analogue	https://electronicsclub.info/analogue.htm
Digital	https://electronicsclub.info/analogue.htm
Pulse width and amplitude modulation	https://www.electronics-tutorials.ws/blog/pulse-width-modulation.html https://learn.sparkfun.com/tutorials/pulse-width-modulation/all https://www.analogictips.com/pulse-width-modulation-pwm/
How control systems are represented in diagrams	https://electronicsclub.info/blockdiagrams.htm https://www.electronics-tutorials.ws/systems/electronic-system.html https://www.techtransfer.com/blog/basics-process-control-diagrams/ https://www.electrical4u.com/block-diagrams-of-control-system/ https://www.tutorialspoint.com/control_systems/control_systems_block_diagrams.htm
Applications - Electrical	https://www.electronicspoint.com/opinion/the-importance-of-control-systems-in-electrical-engineering/ https://www.designingbuildings.co.uk/wiki/Electrical_control_systems
Applications - Pneumatic	https://www.ekci.com/what-is-pneumatic.html https://engineeringlearn.com/pneumatic-control-system/ https://whyhs.com/applications-of-hydraulics-and-pneumatics
Applications - Hydraulic	https://whyhs.com/applications-of-hydraulics-and-pneumatics
Measured parameters (pressure flow, temperature, speed, position)	https://clippard.com/cms/wiki/pressure-control-vs-flow-control https://www.omega.co.uk/techref/flowcontrol.html https://en.wikipedia.org/wiki/Temperature_control





10.2 How sensors and actuators are used in automation control systems.	Sensors and actuators – types (analogue, digital, active, passive)	https://circuitglobe.com/difference-between-active-and-passive-components.html https://www.watelectrical.com/what-are-analog-sensors-types-and-their-characteristics/ https://www.electronics-tutorials.ws/io/io_1.html https://www.watelectrical.com/what-are-digital-sensors-types-and-their-uses/ https://www.reac-group.com/en_en/facts/actuators/what-is-an-actuator/
	Applications (switches, proximity sensors, laser, vision systems)	https://www.electronics-tutorials.ws/io/io_1.html https://electronicsclub.info/switches.htm https://en.wikipedia.org/wiki/Proximity_sensor
	Power sources	https://www.allaboutcircuits.com/textbook/reference/chpt-9/power-sources/ https://www.engineersgarage.com/articles-basic-electronics-power-supply-types/ https://en.wikipedia.org/wiki/Power_supply https://electronicsclub.info/powersupplies.htm
	Uses in automation – Position and volume of objects being processed	https://www.manufacturingtomorrow.com/article/2020/03/how-are-mechatronics-and-industrial-automation-different/14947
	Mechanised lifting and moving of objects	https://www.designingbuildings.co.uk/wiki/Lifting_device https://www.newworldencyclopedia.org/entry/crane_(machine)
	Measurement applications (electrical, mechanical, thermal, chemical, biological, optical, acoustic, radiation)	https://www.omega.co.uk/prodinfo/temperature-measurement.html https://www.thomasnet.com/articles/instruments-controls/all-about-radiation-detectors/ https://en.wikipedia.org/wiki/Acoustical_measurements_and_instrumentation

