

272-T07

MECHATRONICS ENGINEERING TECHNOLOGY

NAME: _____

START DATE: _____/_____/_____

COMPLETION DATE: _____/_____/_____

TASK: T07 Sensors

PERFORMANCE OBJECTIVE: After completing the sensor training system the student will build a circuit from a diagram and it will function with 100% accuracy

ENABLING OBJECTIVE: Complete Q01-Q24, and T03

TOOLS REQUIRED: Instructor theory lesson, training system

SAFETY FACTORS: Complete Q01-Q02, T03 and observe all school/classroom safety rules at all times

ACADEMIC ANCHORS:

M11.A.1.1.2 Express numbers using scientific notation

M11.A.2.1.1 Solve problems operations with rational numbers using rates and percentages

R11.A.1.3.5 Demonstrate after reading understanding of non-fiction text

R11.A.2.1.2 Identify meaning of content specific words used in text

CAREER & WORK ANCHORS:

13.2.11.E Demonstrate essential workplace skills.

PERFORMANCE CHECKLIST:

STUDENT CHECK	TASK TO BE COMPLETED	TEACHER SIGN OFF
_____	1. Identify academic anchors and complete learning guide AA01	_____
_____	2. View instructor theory lesson	_____
_____	3. Complete Introduction to Sensors @ www.learnamatrol.com	_____
_____	4. Review your notes and memorize components and symbols	_____
_____	5. Get quiz from instructor	_____

PERFORMANCE LEVEL:

MASTERY

SATISFACTORY

FAMILIARIZATION

INSTRUCTED/CANNOT PERFORM

BUCKS COUNTY TECHNICAL SCHOOL – June 2, 2021

INSTRUCTOR'S SIGNATURE

Electrical and electronic sensors are used everywhere! Here are some examples:

Types of sensors used in Automotive field

- Air flow meter
- Air-fuel ratio meter
- AFR sensor
- Blind spot monitor
- Crankshaft position sensor
- Curb feeler
- Defect detector
- Engine coolant temperature sensor
- Hall effect sensor
- Wheel speed sensor
- Airbag sensors
- Automatic transmission speed sensor
- Brake fluid pressure sensor
- Camshaft position sensor
- Cylinder Head Temperature gauge
- Crankshaft position sensor
- Engine crankcase pressure sensor
- Exhaust gas temperature sensor
- Fuel level sensor
- Fuel pressure sensor
- Knock sensor
- Light sensor
- MAP sensor
- Mass airflow sensor
- Oil level sensor
- Oil pressure sensor
- Omniview technology
- Oxygen sensor (O₂)
- Parking sensor
- Radar gun
- Radar sensor
- Speed sensor
- Throttle position sensor
- Tire pressure sensor
- Torque sensor
- Transmission fluid temperature sensor
- Turbine speed sensor
- Variable reluctance sensor
- Vehicle speed sensor
- Water-in-fuel sensor
- Wheel speed sensor
- ABS Sensors

Types of Chemical sensors

- Breathalyzer
- Carbon dioxide sensor
- Carbon monoxide detector
- Catalytic bead sensor
- Chemical field-effect transistor
- Chemiresistor
- Electrochemical gas sensor
- Electronic nose
- Electrolyte–insulator–semiconductor sensor
- Energy-dispersive X-ray spectroscopy
- Fluorescent chloride sensors
- Holographic sensor
- Hydrocarbon dew point analyzer
- Hydrogen sensor
- Hydrogen sulfide sensor
- Infrared point sensor
- Ion-selective electrode
- ISFET
- Nondispersive infrared sensor
- Microwave chemistry sensor
- Nitrogen oxide sensor
- Nondispersive infrared sensor
- Olfactometer
- Optode
- Oxygen sensor
- Ozone monitor
- Pellistor
- pH glass electrode
- Potentiometric sensor
- Redox electrode
- Smoke detector
- Zinc oxide nanorod sensor

Electric current, electric potential, magnetic, radio

- Current sensor
- Daly detector
- Electroscope
- Electron multiplier
- Faraday cup
- Galvanometer
- Hall effect sensor
- Hall probe
- Magnetic anomaly detector
- Magnetometer

- Magnetoresistance
- MEMS magnetic field sensor
- Metal detector
- Planar Hall sensor
- Radio direction finder
- Test light
- Voltage detector

Environment, weather, moisture, humidity

- Actinometer
- Air pollution sensor
- Bedwetting alarm
- Ceilometer
- Dew warning
- Electrochemical gas sensor
- Fish counter
- Frequency domain sensor
- Gas detector
- Hook gauge evaporimeter
- Humistor
- Hygrometer
- Leaf sensor
- Lysimeter
- Pyranometer
- Pyrgeometer
- Psychrometer
- Rain gauge
- Rain sensor
- Seismometer
- SNOTEL
- Snow gauge
- Soil moisture sensor
- Stream gauge
- Tide gauge
- Weather radar

Flow, fluid velocity

- Air flow meter
- Anemometer
- Flow sensor
- Gas meter
- Mass flow sensor
- Water meter
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Ionizing radiation, subatomic particles

- Bubble chamber
- Cloud chamber
- Geiger counter
- Geiger–Müller tube
- Ionization chamber
- Gaseous ionization detectors
- Neutron detection
- Particle detector
- Proportional counter
- Scintillator
- Scintillation counter
- Semiconductor detector
- Thermoluminescent dosimeter
- Wire chamber

Navigation instruments

- Airspeed indicator
- Altimeter
- Attitude indicator
- Depth gauge
- Fluxgate compass
- Gyroscope
- Inertial navigation system
- Inertial reference unit
- Machmeter
- Magnetic compass
- MHD sensor
- Ring laser gyroscope
- Turn coordinator
- Variometer
- Vibrating structure gyroscope
- Yaw-rate sensor

Position, angle, displacement, distance, speed, acceleration

- Accelerometer
- Auxanometer
- Capacitive displacement sensor
- Capacitive sensing
- Flex sensor
- Free fall sensor
- Gravimeter
- Gyroscopic sensor
- Impact sensor
- Inclinometer
- Incremental encoder

- Integrated circuit piezoelectric sensor
- Laser rangefinder
- Laser surface velocimeter
- LIDAR
- Linear encoder
- Linear variable differential transformer (LVDT)
- Liquid capacitive inclinometers
- Odometer
- Photoelectric sensor
- Piezoelectric accelerometer
- Position sensor
- Position sensitive device
- Angular rate sensor
- Rotary encoder
- Rotary variable differential transformer
- Selsyn
- Shock detector
- Shock data logger
- Sudden Motion Sensor
- Tilt sensor
- Tachometer
- Ultrasonic thickness gauge
- Ultra-wideband radar
- Variable reluctance sensor
- Velocity receiver

Optical, light, imaging, photon

- Charge-coupled device
- CMOS sensor
- Angle-sensitive pixel
- Colorimeter
- Contact image sensor
- Electro-optical sensor
- Flame detector
- Infra-red sensor
- Kinetic inductance detector
- LED as light sensor
- Light-addressable potentiometric sensor
- Nichols radiometer
- Fiber optic sensors
- Optical position sensor
- Thermopile laser sensors
- Photodetector
- Photodiode
- Photomultiplier
- Photomultiplier tube
- Phototransistor

- Photoelectric sensor
- Photoionization detector
- Photomultiplier
- Photoresistor
- Photoswitch
- Phototube
- Scintillometer
- Shack–Hartmann wavefront sensor
- Single-photon avalanche diode
- Superconducting nanowire single-photon detector
- Transition-edge sensor
- Visible Light Photon Counter
- Wavefront sensor

Pressure

- Barograph
- Barometer
- Boost gauge
- Bourdon gauge
- Hot filament ionization gauge
- Ionization gauge
- McLeod gauge
- Oscillating U-tube
- Permanent downhole gauge
- Piezometer
- Pirani gauge
- Pressure sensor
- Pressure gauge
- Tactile sensor
- Time pressure gauge

Force, density, level

- Bhangmeter
- Hydrometer
- Force gauge and Force Sensor
- Level sensor
- Load cell
- Magnetic level gauge
- Nuclear density gauge
- Piezocapacitive pressure sensor
- Piezoelectric sensor
- Strain gauge
- Torque sensor
- Viscometer

Thermal, heat, temperature

- Bolometer
- Bimetallic strip
- Calorimeter
- Exhaust gas temperature gauge
- Flame detection
- Gardon gauge
- Golay cell
- Heat flux sensor
- Infrared thermometer
- Microbolometer
- Microwave radiometer
- Net radiometer
- Quartz thermometer
- Resistance thermometer
- Silicon bandgap temperature sensor
- Special sensor microwave/imager
- Temperature gauge
- Thermistor
- Thermocouple
- Thermometer
- Pyrometer

Proximity, presence

- Alarm sensor
- Doppler radar
- Motion detector
- Occupancy sensor
- Proximity sensor
- Passive infrared sensor
- Reed switch
- Stud finder
- Triangulation sensor
- Touch switch
- Wired glove

Sensor technology

- Active pixel sensor
- Back-illuminated sensor
- BioFET
- Biochip
- Biosensor
- Capacitance probe
- Capacitance sensor
- Catadioptric sensor
- Carbon paste electrode

- Digital sensors
- Displacement receiver
- Electromechanical film
- Electro-optical sensor
- Electrochemical fatigue crack sensor
- Fabry–Pérot interferometer
- Fisheries acoustics
- Image sensor
- Image sensor format
- Inductive sensor
- Intelligent sensor
- Lab-on-a-chip
- Leaf sensor
- Machine vision
- Microelectromechanical systems
- MOSFET
- Photoelasticity
- Quantum sensor
- Radar
 - Ground-penetrating radar
 - Synthetic aperture radar
 - Radar tracker
- Stretch sensor
- Sensor array
- Sensor fusion
- Sensor grid
- Sensor node
- Soft sensor
- Sonar
- Staring array
- Transducer
- Ultrasonic sensor
- Video sensor
- Visual sensor network
- Wheatstone bridge
- Wireless sensor network

Speed sensor

Speed sensors are machines used to detect the speed of an object, usually a transport vehicle. They include:

- Wheel speed sensors
- Speedometers
- Pitometer logs
- Pitot tubes
- Airspeed indicators
- Piezo sensors (e.g. in a road surface)
- LIDAR

- Ground speed radar
- Doppler radar
- ANPR (where vehicles are timed over a fixed distance)
- Laser surface velocimeters for moving surfaces

Others

- Actigraphy
- Air pollution sensor
- Analog image processing
- Atomic force microscopy
- Atomic Gravitational Wave Interferometric Sensor
- Attitude control (spacecraft): Horizon sensor, Earth sensor, Sun sensor
- Catadioptric sensor
- Chemoreceptor
- Compressive sensing
- Cryogenic particle detectors
- Dew warning
- Diffusion tensor imaging
- Digital holography
- Electronic tongue
- Fine Guidance Sensor
- Flat panel detector
- Functional magnetic resonance imaging
- Glass break detector
- Heartbeat sensor
- Hyperspectral sensors
- IRIS (Biosensor), Interferometric Reflectance Imaging Sensor
- Laser beam profiler
- Littoral Airborne Sensor/Hyperspectral
- LORROS
- Millimeter wave scanner
- Magnetic resonance imaging
- Moire deflectometry
- Molecular sensor
- Nanosensor
- Nano-tetherball Sensor
- Omnidirectional camera
- Organoleptic sensors
- Optical coherence tomography
- Phase unwrapping techniques
- Polygraph Truth Detection
- Positron emission tomography
- Push broom scanner
- Quantization (signal processing)
- Range imaging
- Scanning SQUID microscope
- Single-Photon Emission Computed Tomography (SPECT)

- **Smartdust**
- **SQUID, Superconducting quantum interference device**
 - **SSIES, Special Sensors-Ions, Electrons, and Scintillation thermal plasma analysis package**
- **SSMIS, Special Sensor Microwave Imager / Sounder**
- **Structured-light 3D scanner**
- **Sun sensor, Attitude control (spacecraft)**
- **Superconducting nanowire single-photon detector**
- **Thin-film thickness monitor**
- **Time-of-flight camera**
- **TriDAR, Triangulation and LIDAR Automated Rendezvous and Docking**
- **Unattended Ground Sensors**

GRADING RUBRIC

	Instructed/Cannot 0 points	Familiarization 1 point	Satisfactory 2 points	Mastery 3 points
Safety	Student rarely follows industry standard safety rules	Student needs to be frequently reminded to follow industry standard safety rules	Follows all industry standard safety rules, but required one reminder.	Student always follows all industry standard safety rules
Task	Student is unable to complete task	Student requires frequent assistance to complete task, and/or is familiar with some parts of the task	Student requires very little assistance to complete task, or has only completed task once or twice, but completed it satisfactorily with little to no assistance	Student can perform task with no assistance and has completed the task many times with no errors.

Mastery = 6 points

Satisfactory = 4-5 points

Familiarization = 2-3 points

Instructed cannot perform = <2 points