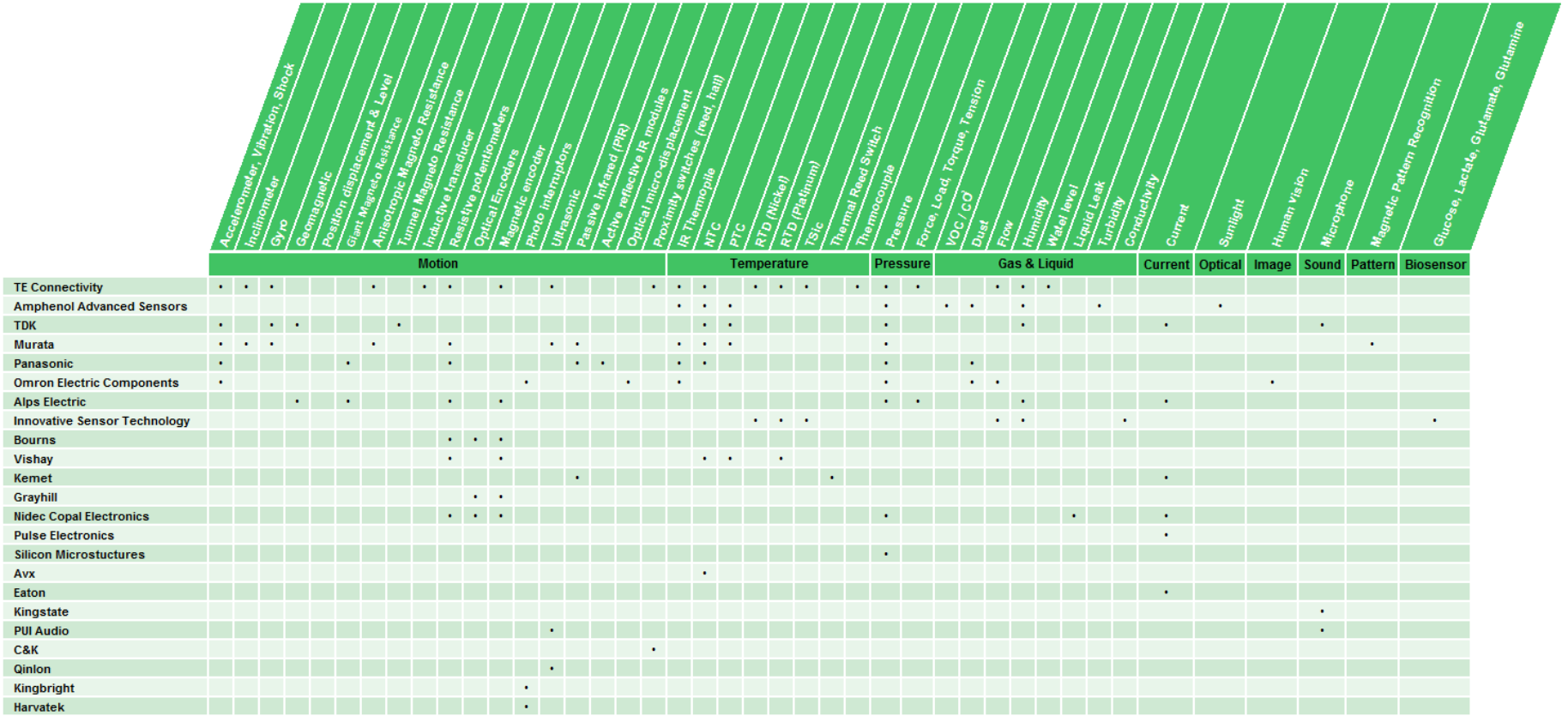
A complete end-to-end IOT Hardware Offering: Sensors, Devices, Gateways, Servers

AVNET
Reach Further™

Sensors linecard



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Pressure sensors

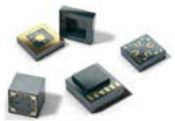
Basic principles:

A pressure sensor is a device that senses pressure, pressure differentials and pressure fluctuations in gaseous and liquid media and on solid bodies and converts it into an electric signal where the amount depends upon the pressure applied. Many different technologies are available to measure pressure like for example piezoresistive strain gauge, capacitive, electromagnetic, piezoelectric and optical.

Applications

- Pneumatic control systems
- Medical equipment
- Environmental monitoring
- HVAC
- Automotive
- Aerospace and defense
- Factory automation
- Altimeter
- Barometer
- Fitness equipment
- Vacuum switch
- Leak detection
- GPS systems
- Weather balloons
- Watches

MEMS Die



PCB components

capsules, transmitters, transducers

TE connectivity, SMI PRESSURE SENSORS, Amphenol Advanced Sensors, Nidec NIDEC COPAL ELECTRONICS, OMRON, Panasonic, muRata, TDK, ALPS

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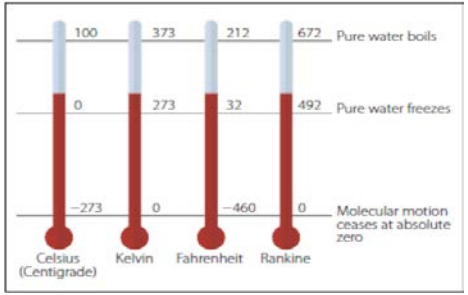
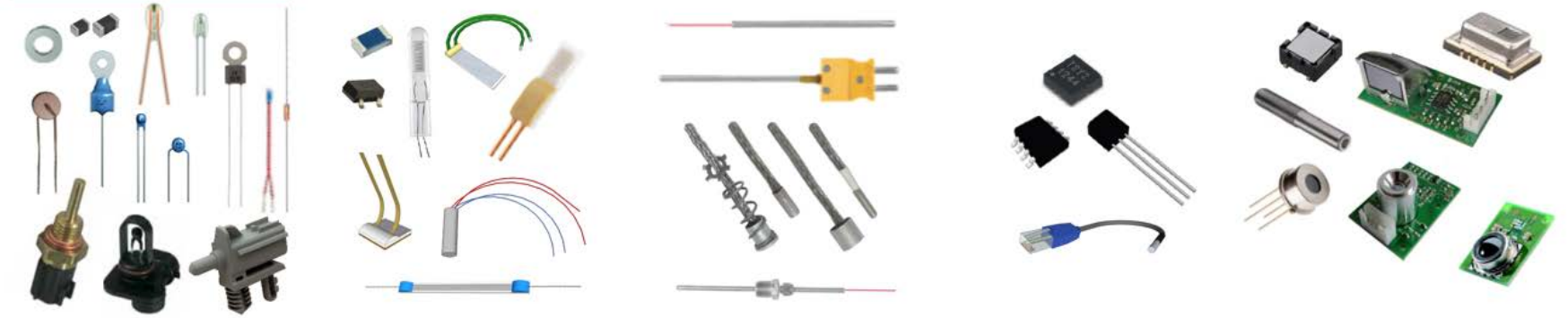
Temperature sensors

Basic principles:

A temperature sensor is a device, that provides for temperature measurement through an electrical signal. As it is impossible to measure the kinetic state of molecules directly parameters that vary proportionally with the kinetic state of molecules (thermometric variables) are measured, for this reason there are different techniques to measure temperature depending on the thermometric variable, responsiveness, position and environment.



NTC and PTC | **RTD** | **Thermocouple** | **TSIC** | **IR Thermopile**



Temperature sensors

	NTC	RTD	Thermocouple	TSIC	Thermopile
Temperaruture range [°C]	-150 to +325	-200 to +1000	-270 to +1800	-50 to +150	-270 to >2000
Accuracy	Good	Very good	Medium (+/-1°C)	Good (+/-0.1°C)	Good
Linearity	exponential	fairly linear	non-linear	linear	non-linear
Excitation or power	Needed	Needed	Not needed	Needed	Needed
Self-heating	Yes	Yes	No	Yes	No
Output	Resistive	Resistive	mV	Digital	Analog (V/I) and Digital
Strenghts	High accuracy High sensitivity Durable Small size	Superior long term stability Ruggedness Accurate	Extremely small size Wide temperature range Ruggedness	Ease of use (digital output) Board mounting Small size High digital accuracy	Non contact object sense High temperature measurement Moving objects measurement
Weaknesses	Suscepticle to moisture (requires good engineering design) Aging drift	Low sensitivity (requires better electronics)	Weak signal Higher cost special wire Relative temperature measure needs compensation	Temperature is limited to +150°C Suscepticle to electrical noise of board layout	Complex to use (best to use modules) Optical path interference
Some applications	Dialysis, HVAC, Calorimetry, Cooking stove, Industrial reference	Calorimetry, Oven, Soldering iron, Cooking stove, Independent vehicle heater	Cryogenics, Oven, Soldering iron, exhaiust gas, independent vehicle heater	Dialysis, HVAC, Calorimetry, Industrial reference	Ear and forehead thermometer

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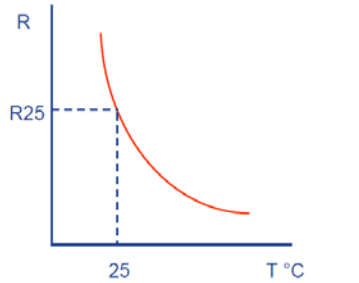
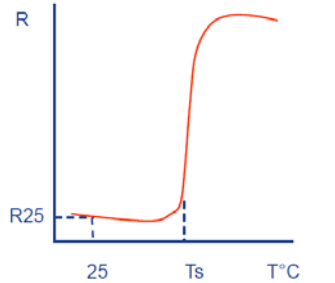
Negative and positive temperature coefficient thermistors

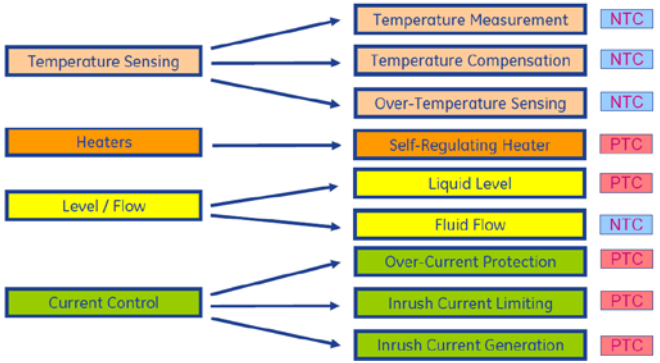
						
Type	**Leadless chips / SMD**	**Epoxy coated leaded**	**Glass coated**	**High reliability (ESA / NASA)**	**Assemblies**	**Medical probes**
Temperaruture range [°C]	-40 / +85	-80 / +150	-80 / +325	-55 / +160	various	-0 / +50
Unique features	Wire bond or end band SMD	Wide range of resistance values	Hermetical seal, moisture resistant, ultra stable, high temperature stability	Qualified for space use ESCC (ESA), Goddard (NASA)	Engineered to specific applications	FDA / CE / MDD approved, autoclavable, disposable
Applications	Laser diode compensation, IR measurement compensation, battery packs, sensing at board level	General temperature sensing, medical equipement, refrigeration control	Temperature control for engine, hot water boiling systems, air conditioning systems, refrigeration control	Solar panels and instrumentation control in aerospace	Flow sensing, thermal control, HVACR	Patient monitoring and thermo dilution

NTC:
Negative **T**emperature **C**oefficient



PTC:
Positive **T**emperature **C**oefficient





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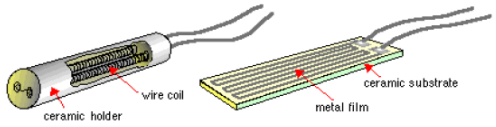
Resistance temperature detector (RTD)

Basic principles and features:

- Resistance of metal conductors increases as temperature increases (positive temperature coefficient / lower resistance than NTC).
- Platinum is the metal that is most commonly used for sensor elements Pt 100 (100 ohms), Pt1000 (1000 ohms)
- Nickel is also used, has higher temperature coefficient
- Temperature range is typically -100 / +800°C up to +1000°C (glass versions)
- Approximately linear response.



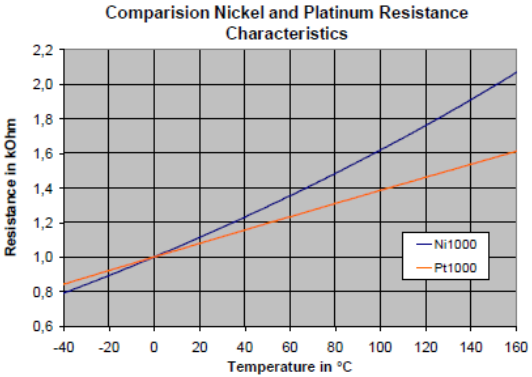
Wire RTD Construction Film RTD Construction

Applications

- Motors and generators
- HVAC-R systems
- Hair dryers
- Medical machines
- Weather Stations & Meteorology
- Industrial Boilers & Ovens
- Counter top appliances
- Large home appliances

Factors to define platinum RTD

- Resistance at 0°C. Typical values 100, 200, 500 or 1000 Ω
- Temperature Coefficient: 3850 ppm/C most common
- Accuracy: Subject to standards (DIN EN 69751 for Pt sensors)
  - Class B = +/-0.3°C at 0°C
  - Class A = +/-0.15°C at 0°C
  - 1/3 DIN = +/-0.10°C
  - 1/10 DIN = +/-0.03°C
- Temperature range:
  +400°C most economical (silver lead wires)
  +600°C common or oven applications (Pt or Ni lead wires)
  +1000°C in special cases
- Size



α = temperature coefficient or slope

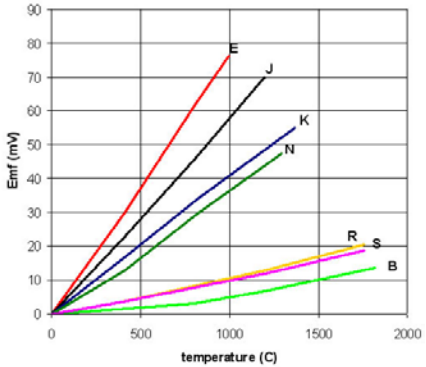
Thermocouples

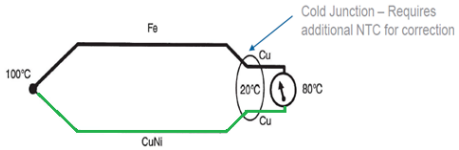
Basic principles and features:

- Two dissimilar conductors that contact each other at one or more points. It produces a voltage when the temperature of one of the points differs from the reference temperature at other parts of the circuit.
- Non linear characteristic. Positive temperature coefficient.
- Sensitivity of the order of millivolts per °C, voltage output proportional to temperature.
- Accuracy up to +/-1.0°C
- Capable of measuring very high temperatures up to 1800°C.
- Wide variety of configurations (wire types) possible to meet environmental and temperature range requirements. Very rugged technology can be packaged in hermetic housing.

Applications

- Industrial products
- Appliances
- Furnaces and ovens
- Medical
- High reliability





Thermocouple type	Positive Thermoelement	Negative Thermoelement
B	Pt-30%Rh	Pt-6%Rh
R	Pt-13%Rh	Pt
S	Pt-10%Rh	Pt
K	Ni-10%Cr	Ni-5% other elements
N	Ni-14%Cr-1.5%Si	Ni-4.5%Si-0.1%Mg
E	Ni-10%Cr	45%Ni-55%Cu
J	Fe	45%Ni-55%Cu

Thermopiles

Basic principles and features:

- A number of thermocouples joined in series convert thermal energy (IR radiation) into electrical energy to detect and measure temperature without contact.
- Output is hundreds to thousands of millivolts and is proportional to a local temperature difference or gradient, not absolute temperature, therefore requires temperature compensation usually using an NTC thermistor or RTD device.

Applications

Energy/Water/Gas
- Monitoring of power station
- Search for fluid leaks
- Control of storage reservoirs
- Detection of occupants room

Materials
- Control of chimney stacks, shafts and pipes
- Monitoring of high temperature kilns and furnaces
- Contol of castin of fusion material

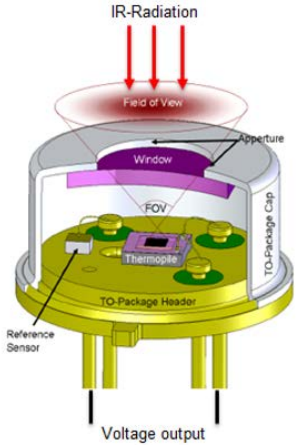
Automotive Industry
- Temperature reliability test of electric parts
- Control of heating and thermal isolation of the passenger compartment and occupancy
- Control of windscreen deicing and air conditioning

Household Electrical appliances
- Control of ovens, cooking appliances, electrical iron, coffee machines
- Control of refrigerators, freezers and air conditioners,

Transport/Navigation
- Detection of obstacles
- Driving at night or in difficult conditions (fog, mist, etc)

Farming
- Detection of plant and farmland diseases

Medical
- Measurement of surface temperatures of the human body
- Control of blood flow



Panasonic OMRON TE connectivity Amphenol Advanced Sensors AVNET

Temperature sensors IC

TSic sensors are semiconductor temperature sensors that feature highly accurate measurements (+/-0.1°C) within a limited operating temperature range. They are ideal for battery operated applications due to their low power consumption and possibility to set sleep modes. The TSic is offered as a calibrated temperature sensor with an integrated signal converter for analog or digital output. Easily to integrate in the application due to its compact size and various interfaces (I2C, PWM, SPI, SDM, ZacWire, analog, ratiometric). Offer long-term stability.

Applications

Vehicle subsystems
- Climate control
- Seat heater/cooler
- Infotainment
- Power distribution unit

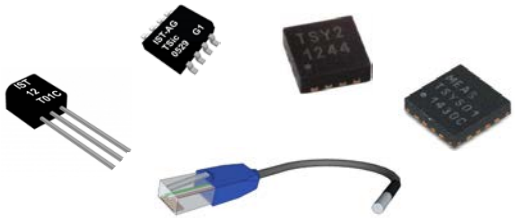
Building automation
- Solar systems
- HVAC
- Thermostats

Wearables
- Fitness watch

Food and drug
- Monitoring transporatation and storage history
- Wireless cooking and serving probes

Medical
- Wireless patient monitoring systems
- Patient environment monitoring system

Intelligent Factories
- Workplace condition
- Machine health



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Humidity sensors

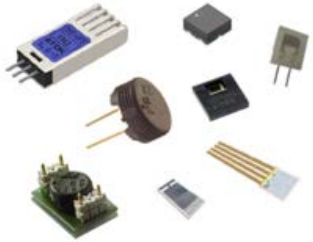
Basic principles:

A humidity sensor senses relative humidity this means that it measures both air temperature and moisture. Relative humidity, as a percentage, is the ratio of actual moisture in the air to the highest amount of moisture air at that temperature can hold (the warmer the air the more moisture it can hold). The most common humidity sensors use capacitive measurement where two conductors separated by a non-conductive polymer film, moisture causes minute changes in the voltage between the 2 plates. The changes in voltage can be converted in other output signals like I2C, PWM, LIN and CAN.

Applications

- HVAC
- Refrigerators
- Printers
- Dryers
- Dishwashers
- Smart homes
- Humi/Dehumidifiers
- Clean room controls
- Cabin Climate Control
- Defogging Control
- Condensing Preventive Device
- Nebulizers
- Sleep apnea devices
- Weather station

Elements, PCB Products



Assemblies

Transmitters

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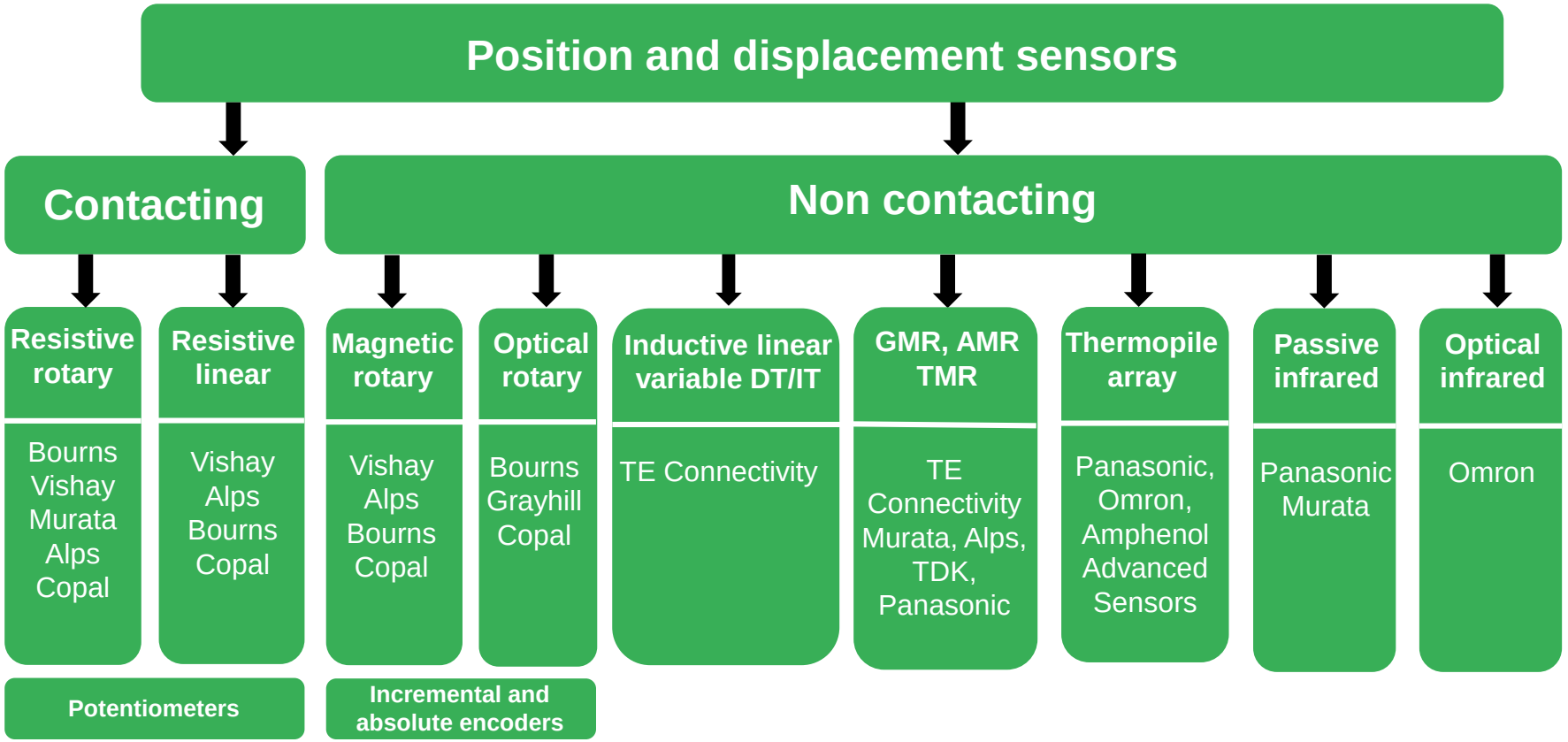
Position and displacement sensors



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Resistive rotary and linear sensors (potentiometers)

Basic principles and features:

A resistive layer (cermet, conductive plastic, wirewound, carbon) is used with a wiping contact connected to the actuator, the movement can be linear or rotary. The output is analog. The operating life depends on the resistive layer material and mechanics, this last one is influencing the sealing level (if any). Rotary sensors can be single or multiturn.

Applications

Transportation

- Aircraft systems
- Aerospace guidance systems
- Agriculture & construction equipment
- Traffic control system
- Training and simulation equipment
- Locomotive braking systems
- Forklifts
- Joystick controls
- Automotive comfort controls
- Motorized golf carts

Medical

- Dental equipement
- Electric wheelchairs
- Analystical & diagnostic equipment
- Hospital bed controls
- Positioning controls for X-Ray

Industrial controls

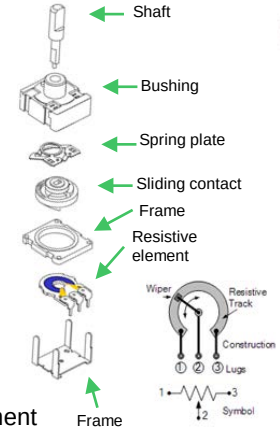
- HVAC equipement
- Illumination and Theater controls
- Meteorological equipment
- Robots/Robotic equipment
- Food processing equipment
- Automatic doors/gates
- Speed/Adjustment controls

Professional audio

Studio recording equipment
Broadcast equipment
Sound effects pedal

Instrumentation

- Oscilloscopes
- X-Y Plotters
- Fluid level sensors
- Test & measurement equipment



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Magnetic encoders

Basic principles and features:

A magnetic encoder usually consists of a rotating gear that contains a permanent magnet and a sensing element (hall, AMR, GMR). The shaft rotation moves the magnet which changes the status of sensing element generating digital or pulse signal output. The output are usually 2 square waves for digital incremental output but can also be analog voltage, current voltage, binary for absolute output. Rarely the operation is linear.

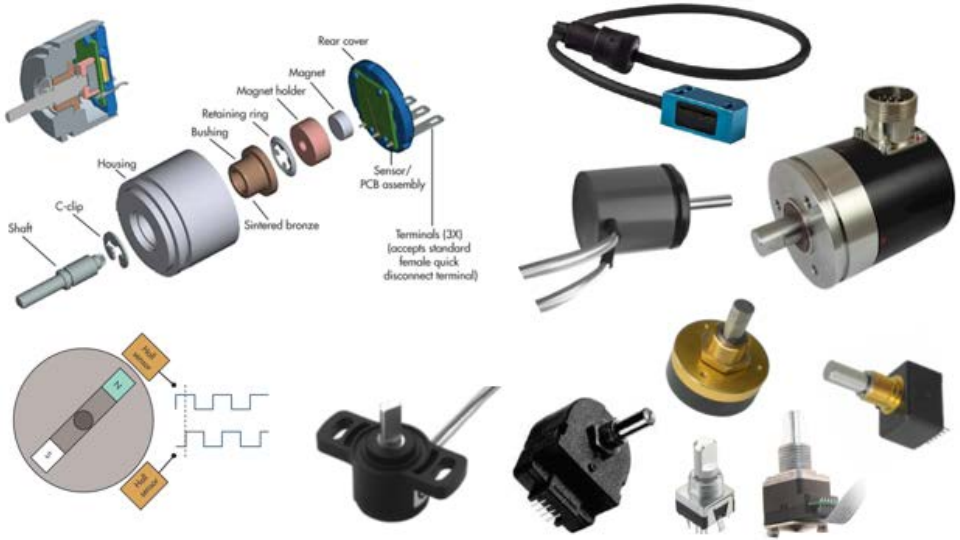
Applications

Professional and Consumer Audio
- Studio recording equipment
- Digital mixing consoles
- Digital broadcast equipment
- Professional sound systems

Test & Measurement Equipment
- Oscilloscopes
- Digital analyzers
- Measurement instruments
- Weather instruments
- Medical diagnostic equipment
- Chart recorders
- Digital monitors

Industrial / Factory Automation
- Robotics
- Material handling
- Forklift trucks
- Machine tools
- Automated Gates/Doors
- Fluid measurement
- XYZ table

Medical
- Medical diagnostic equipment
- Syringe pump



Optical encoder

Basic principles and features:

An optical encoder usually consists of a rotating disc with transparent and opaque areas connected to a shaft, a light source and a photo detector or an array of photo detectors. The shaft rotation changes the status of the photo detector/s which generate a digital incremental output (usually 2 square waves), absolute binary output or analog. Rarely the operation is linear.

Applications

Professional and Consumer Audio
- Studio recording equipment
- Digital mixing consoles
- Digital broadcast equipment
- Professional sound systems

Test & Measurement Equipment
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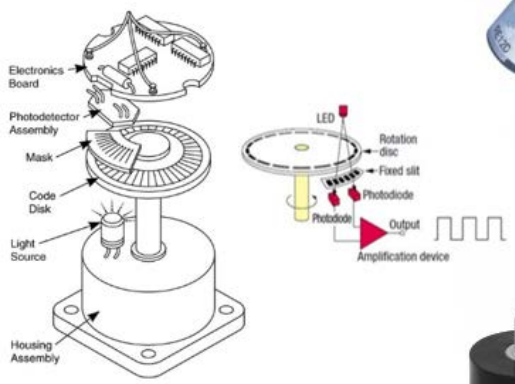


BOURNS Grayhill Nidec NIDEC COPAL ELECTRONICS AVNET

Inductive linear variable DT

Basic principles and features:

- An LVDT is an electromechanical sensor converting mechanical motion or vibrations into a variable electrical current, voltage or electric signals, and the reverse. Typically a LVDT sensor has three solenoid coils lined end-to-end, surrounding the tube. Movement of the core triggers the linkage from primary to both the secondary coils, which changes the induced voltages.
- Friction-free operation, infinite resolution, unlimited mechanical life, single axis sensitivity, environmentally robust, null point repeatability, fast dynamic response, absolute output (analog or digital).

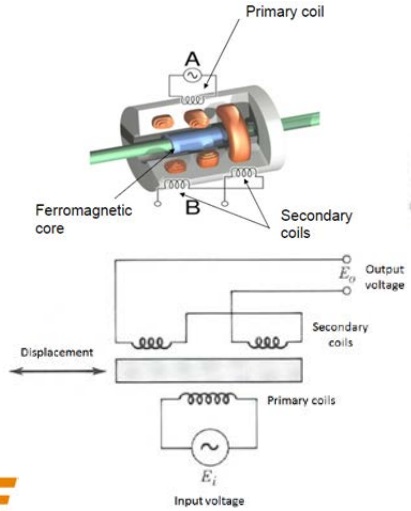
Applications

Manufacturing

- Measuring final height placement for automotive wheel trim
- Measuring injection height for diesel engines
- Thickness measuring in multiple locations of fly-wheel to insurance balance
- Controlling depth of hole during machine operations in a rotary transfer machine
- Providing indication and feedback position of rocker engine nozzle actuators during testing
- Tensile tester

Power Generation

- Conditioning valves for large and medium steam turbines
- Reheat and stop valves for large and medium steam turbines
- Feed water boiler pump valve positioning
- Natural gas fuel valve position for gas turbines for throttle control
- Monitoring hydraulic fluid level in reservoir of feed water pumps in nuclear reactor core.

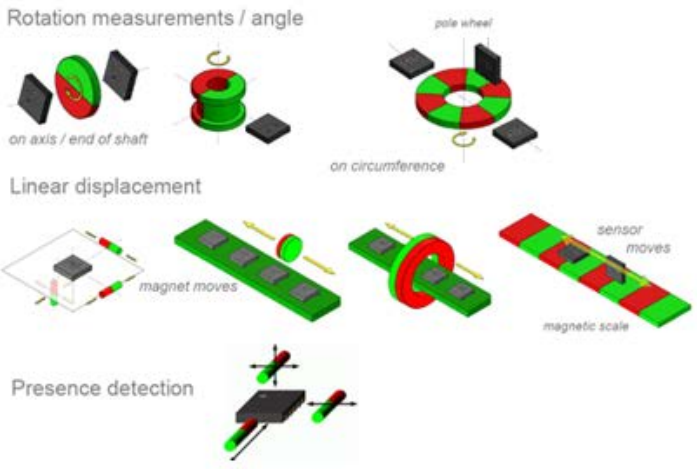


AMR, GMR, TMP sensors

Magnetic sensors detect changes and disturbances in a magnetic field like flux, strength and direction. Common technologies used to measure or detect these changes are based hall effect, anisotropic magnetoresistance (AMR), giant magnetoresistance (GMR) and more recently tunnel magnetoresistance (TMR). Sensors based on these technologies can detect or measure rotation, angles, direction, displacement, presence and electrical current.

Applications

- Position switch
- Reed switch replacement
- Door, window position
- Steering position
- Throttle valve opening
- Flowmeters
- Rotary encoders
- Motor motion control
- Robotics
- Dish washer spray arm detection
- Magnetic imaging
- Brake pedal position
- Gear revolutions
- Roller conveyors
- Metering
- Anti-tamper



Panasonic TDK muRata ALPS TE connectivity VISHAY Greyhill BOURNS AVNET

Ultrasonic sensors

Basic principle and features:

An ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object.

Applications

- Object detection
- Distance measurement
- Dynamic body detection
- Parking aid system
- Double feed detection of scanner, printer and ATM
- Lighting

muRata QINLON pui audio inc AVNET

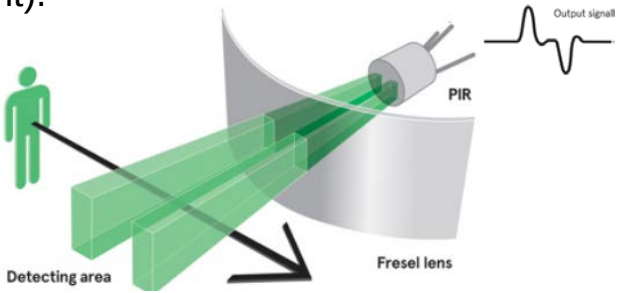
Passive infrared sensors (PIR)

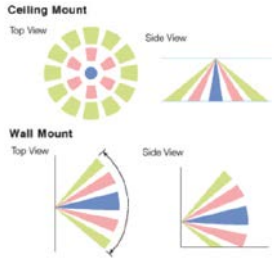
Basic principles:

A passive infrared sensor is an electronic sensor that detects infrared (IR) light radiating from objects in its field of view (it is not measuring “heat”). The core of a PIR sensor is a solid state sensor or set of sensors which is made from pyroelectric materials which generate energy when exposed to IR, for this reason these sensors are also called pyroelectric infrared sensors. The PIR sensor has at least 2 slots sensitive to IR, when a warm object like a human body moves in front of the sensor one of the 2 pyroelectric elements will first intercept the change (positive differential), when the object is moving away a negative differential change will occur, these change pulses are what is detected (movement).

Applications

- Smart lighting
- HVAC systems
- TV / Montitor backlight control
- Alarm systems
- Automatic doors
- Digital signage
- Vending machines
- Automatic toilets
- Security equipement for IP cameras
- Multi-function printers





Panasonic muRata Electronic Components KEMET CHARGED

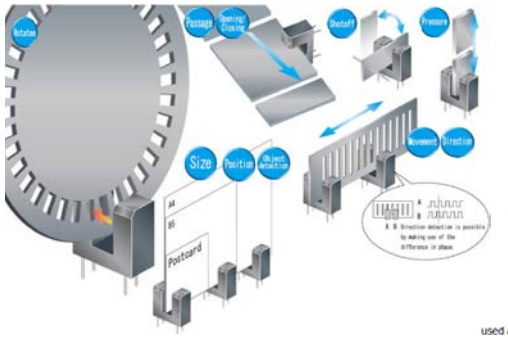
Photo interrupters

Basic principle:

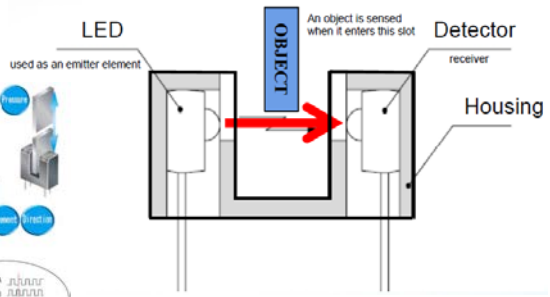
A photointerrupter is a transmission-type photosensor, which typically consists of a light emitting elements and light receiving elements aligned facing each other in a single package, that works by detecting light blockage when a target object comes between both elements, acting as an optical switch.

Applications

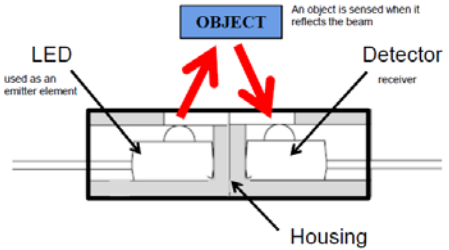
- HVAC systems
- Coffee machine
- Vending machines
- Building automation
- Metering
- Fitness machine
- POS printer
- Bill counter
- 3D printer
- Professional lighting
- Money changer
- Ticket for transportation print
- Water pump
- Metering
- Sewing machine



Transmissive



Reflective



OMRON Kingbright HARVATEK AVNET

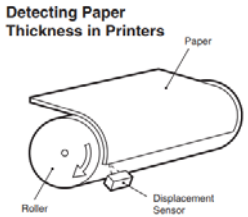
Optical micro-displacement sensor

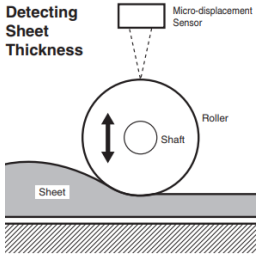
Basic principle:

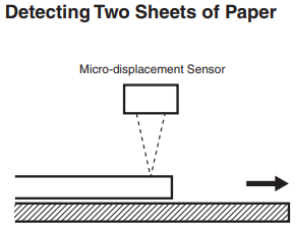
An optical micro displacement sensor integrates a position sensitive detector (PSD) that can measure a position of a light spot in one or two-dimensions on the sensor surface that enables to detect minute changes in the position of the target object (±10 µm).

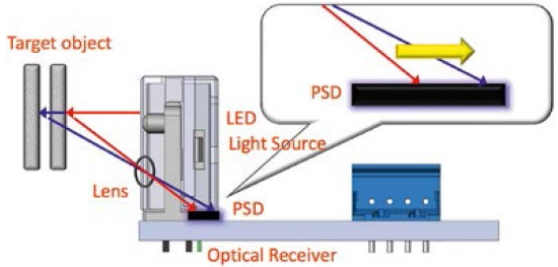
Applications

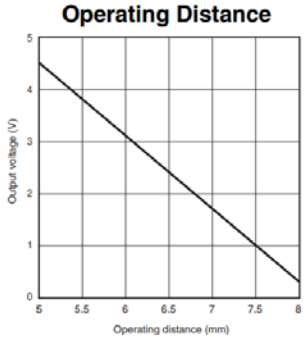
- Detecting paper thickness
- Detecting sheet thickness
- Detecting two sheets of paper











OMRON

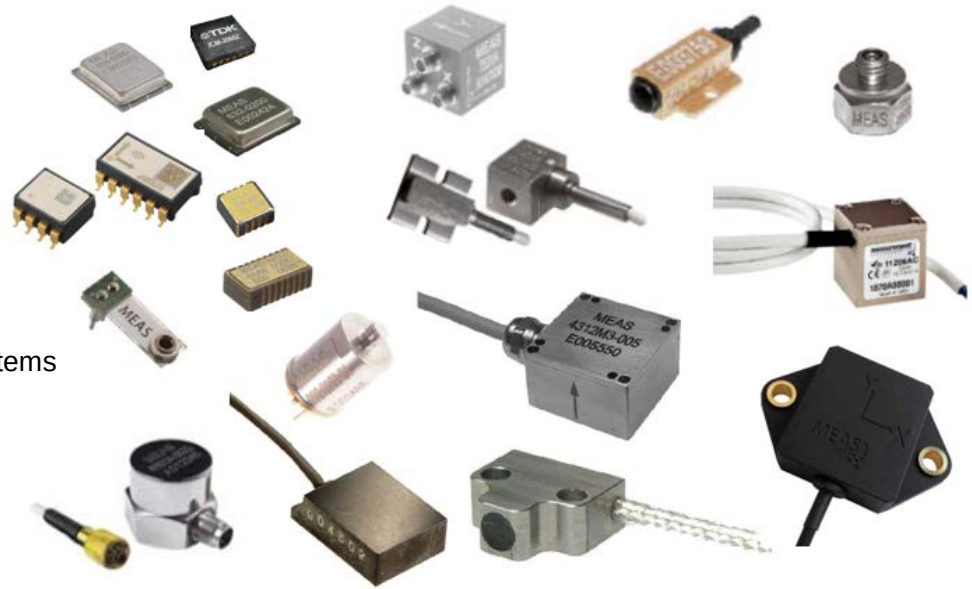
AVNET

Acceleration, vibration, shock, gyros, inclination

Applications

- Asset monitoring
- Impact detection
- Crash testing
- Data loggers
- System wake-up switch
- Antitheft devices
- Vibration/shock monitoring
- Motion control
- Tilt application
- Machine health monitoring
- Permanent structural study
- Gaming controller
- Virtual reality headset
- Drones
- Mobile phones
- Wearables

- Fitness monitoring devices
- Pedometers
- Seismic array
- Road/bridge testing
- Off-road equipment
- Commercial aircrafts
- Load imbalance
- Vital signs monitoring
- Optical image stabilization
- Outdoor/indoor navigation systems



TE connectivity TDK muRata Panasonic OMRON AVNET

Force sensors

Basic principle and features:

A force sensor is defined as a transducer that converts an input mechanical force into an electrical output signal. The most common technology used is strain gauge. It is used to measure compression, tension, and torque.

Applications

- Load measurement and monitoring
- White goods (payload weight)
- Liquid level by weight
- Dry level by weight
- Exercise equipment
- Car occupancy
- Medical infusion pumps
- Hoist load
- Hospital beds
- Robotics (grip force)
- Physical therapy (hand rehab)
- Assembly equipment
- Seed planter dept management
- Emergency vehicle stability monitor
- Scales

TE connectivity ALPS AVNET

Current sensors

Basic principles:

A current sensor is a device that detects electric current in a wire, and generates a signal proportional to that current. The generated signal could be analog voltage or current or even a digital output. Current sensing techniques include shunt resistor, current transformers and Rogowski coils, magnetic-field based transducers (hall effect, flux gate, GMR, AMR, TMR) and others.

Applications

- Microcontroller-based equipment
- Refrigerators
- Air conditioners
- Inductive heating
- Servo motors
- Inverters
- UPS
- SMPS
- Energy management systems
- Power conditioners
- High performances distribution boards
- Industrial machinery
- Circuit breakers
- Earth-leakage detection
- Ground fault circuit interrupters

TDK Pulse Electronics Electronic Components KEMET CHARGED. VISHAY Nidec NIDEC COPAL ELECTRONICS EATON Powering Business Worldwide ALPS AVNET

Solar sensor

Basic principle and features:

- The solar sensor module has one or two photo diode cells to measure the intensity of light.
- Fast response time, easy to install, linear response with sunlight intensity, horizon to horizon visibility, high current output, tight signal tolerances, operating temperature -30°C to +100°C.

Applications

- Dual air conditioner and HVAC systems for automobiles

Amphenol
Advanced Sensors

AVNET

CO_2 / VOC sensor

Basic principle a features:

A carbon dioxide (CO_2) sensor is measuring the level of carbon dioxide gas in air. The most common principles are infrared gas sensors (NDIR) and chemical gas sensors.
Digital output (UART, I2C or Modbus) and analog output, Single and Dual wavelength, modules and transmitters.

Applications

- Indoor air quality measurement systems
- Capnograph device
- Industrial processes
- Stowaway detection
- Greenhouses
- Ventilation management
- Mining
- Rebreathers (scuba)
- Incubators
- Buses
- Refrigerators
- Subway stations and railway carriages
- Agricultural livestock housing ventilation control
- Automotive HVAC – Safety sensor for CO2 refrigerants
- Automotive HVAC – Automatic fresh air control

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Advanced Sensors

AVNET

Dust sensors

Basic principle and features:

- Dust sensors modules detect dust particle concentration in air by using an optical sensing method like for example an IR LED or laser LED and photo sensor to detect the reflected light of the dust particles in the air of the measuring chamber. It can distinguish small particle (from 0,3 µm) such as smoke from large house dust by the pulse pattern of the signal output.
- Output can be PWM, UART or I2C

Applications

- Air purifiers
- Air conditioners
- Indoor air quality management

Amphenol Advanced Sensors Panasonic OMRON AVNET

Flow sensors

Flow sensors quantify the fluid or gas movement. Depending on the application different technologies can be used like for example reed switches, thermal mass flow, magnetic sensors and ultrasound.

Applications

- Mains water control
- Power shower
- Central heating systems
- Circulation pump protection
- Cooling systems
- Leak detection
- Fire sprinkler flow detection
- Air intake of combustion engine
- Spirometer
- Industrial gas flow

Flow switches

MEMS flow sensor

Mass air flow sensors element

TE connectivity

OMRON

IST INNOVATIVE SENSOR TECHNOLOGY

AVNET

Fluid level sensors

Level sensors detect the level of liquids, fluidized solids, granular materials and powders that exhibit an upper free surface. The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place, while point-level sensors only indicate whether the substance is above or below the sensing point. Generally the latter detect levels that are excessively high or low.

Applications

- Water storage tanks
- Water treatment facilities
- Waste water control
- Fuel storage tanks
- Irrigation systems and storage
- Process control
- Medical liquid level measurements
- Chemical process control

Reed switch point level sensors

Ultrasonic continuous level sensors

Turbidity sensors

Basic principle:

A turbidity sensor is measuring the degree of cloudiness or haziness of a fluid caused by large numbers of individual particles. An optical transistor and optical diode is used to measure the refraction of wavelength caused by the concentration of particles to calculate water turbidity.

Applications

- Detecting the turbidity degree of water
- Washing Machines
- Dishwashers

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Advanced Sensors

AVNET

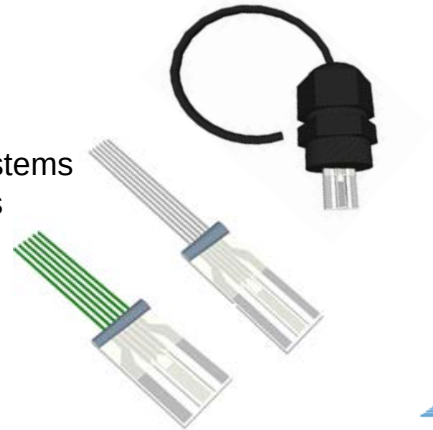
Conductivity sensor

Basic principle a features:

- A conductivity sensor measure the electrical conductivity in a solution. When a voltage is connected accross a conductor a current will flow, which is dependent on the resistance conductor. Conductivity is defined as the reciprocal of the resistance of a solution between two electrodes. Often used to monitor the amount of nutrients, salts or impurities in the water.
- Operating temperature range -30/+100°C (up to +130°C on request), fast response time, excellent long term stability, resistant to various chemicals, sterilizable (gamm/beta radiation, autoclaving), integrated Pt1000 for temperature compensation, 4-electrode measurement.

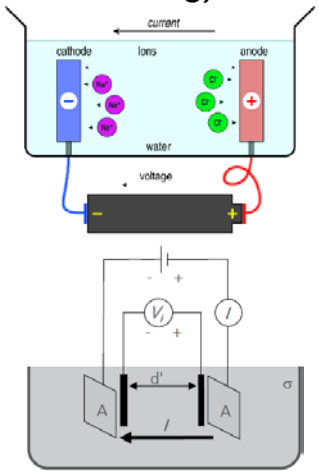
Applications

- Hydroponics
- Acquaculture
- Freshwater monitoring systems
- Water purification systems
- Steam boilers
- Laboratory research



Electrolyte	Electrical conductivity µS/cm	Sensor
Ultra pure Water	0.05–0.1	2-wire
Tap water	300-800	2-wire, 4-wire
NaCl (0,2 gram/litre)	4000	4-wire
NaCl (2 gram/litre)	38600	4-wire
Seawater	~56000	4-wire

INNOVATIVE SENSOR TECHNOLOGY



4 electrodes measurement

- To avoid errors due to deposition on electrodes
- Ideal for solution where free ions is large

Biosensor

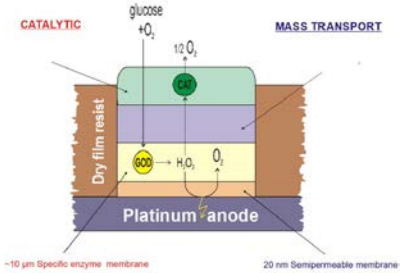
Basic principle and features:

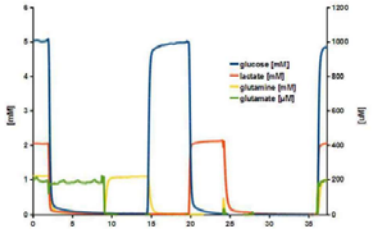
- Biosensors allow the analysis of complex biological media. It uses the enzymatic-amperometric measurement principle. They rely on immobilized enzymes to detect the target analytes with high specificity and reliability. Designed to measure the concentration of glucose, lactate, glutamine and glutamate in aqueous media.
- Unique features: Continuous monitoring, operational stability, multi-analyte, biocompatible materials, factory calibration, fats response time, quick hydration, whole blood / native broth, dry storage, compatible with gamma and beta irradiation.

Applications

- Medical diagnosis and monitoring
- Patient monitoring
- Subcutaneous and in vivo monitoring
- Process control of nutrients in food industry
- Process control in the chemical industry
- Scientific research
- Biotechnology
- Monitoring of lactate in artificial pancreas, liver, lung

INNOVATIVE SENSOR TECHNOLOGY





Independent response of a flow through biosensor-array to glucose, lactate, glutamine & glutamate

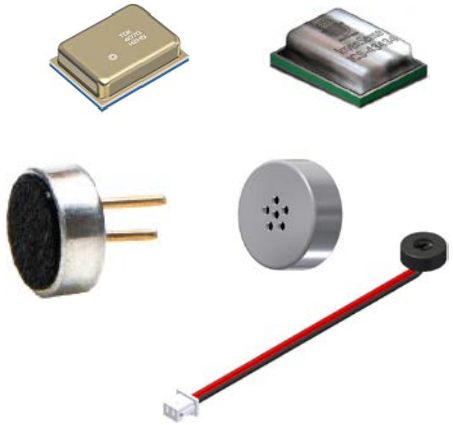
Microphone

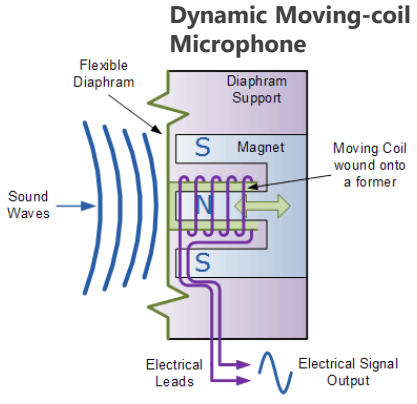
Basic principle:

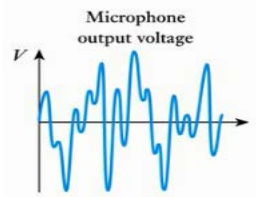
A microphone is a transducer that convert the pressure variations of a sound wave to an electrical signal. The most common are the dynamic microphone which uses a coil of wire suspended in a magnetic field, the condenser microphone which uses the vibrating diaphram as a capacitor plate and the piezo microphone which uses a piezoelectric material.

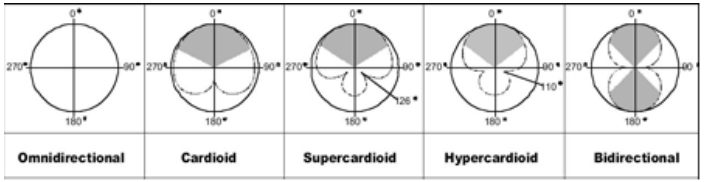
Applications

- Handsfree
- Mobile phone
- Tablet
- Notebook
- Home security systems
- Audio microphones
- Intercom
- Hearing aids
- Portable media players
- VoIP systems
- Speech recognition systems
- A/V eLearning devices
- Gaming and virtual reality input devices









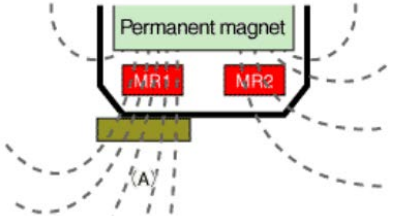
Magnetic Pattern Recognition Sensors

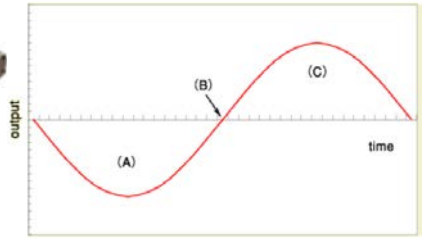
Basic principle and features:

Magnetic pattern recognition sensors use a bias-type circuit that fixes elements to a permanent magnet. While a magnetic medium is passing over the sensor's detecting surface, the magnetoresistive sensors detect a change in the magnetic flux density which is then converted into an electrical signal. The elements detect the magnetic flux perpendicular to the element surface.

Applications

- Detection of bank note types
- Reading of ferromagnetic threads
- Recognition of E13B code characters
- Detection of passage of ferromagnetic objects
- Recognition of patterns printed with magnetic ink
- Reading of characters or marks printed with magnetic ink





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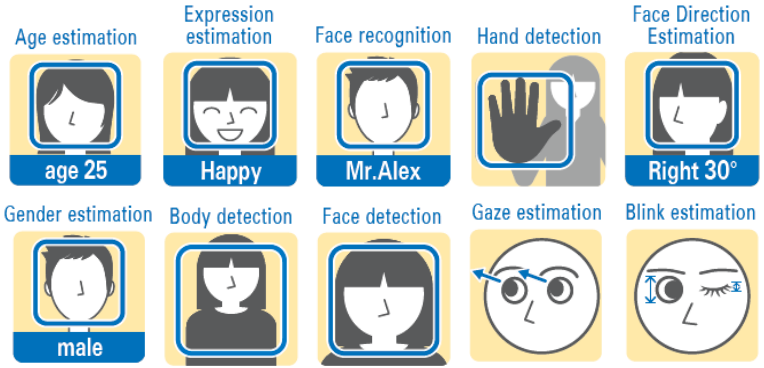
Human vision

HVC-P2 is a camera module with integrated proprietary software enabling up to handle up to 10 feaures at the same time (Body Detection, Face Detection, Hand Detection, Face Direction Estimation, Gaze Estimation, Blink Estimation, Age Estimation, Gender Estimation, Expression Estimation and Face Recognition). Viewing angle can be 50 or 90 degree, output is USB or UART. All internal processing is done internally. As the module uses RAW data there are no privacy issues.

Applications

- Vending machines
- Digital signage
- Retail customer analysis
- Robots
- Lighting
- Domotics
- Safety and security
- Retail
- Access control
- People counter



Finger Print Sensors

AVNET

Introducing a new category: Meta Sensing

META SENSING is a new approach in IoT market, a Hardware and Software combo:

+

Hardware

/SMARTEDGE AGILE

End-to-end Software

BRAINIUM

Intelligence in a real world

AVNET

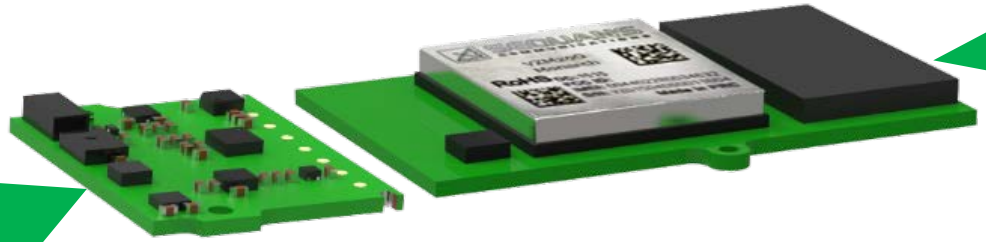
AGILE, A modular meta sensor

- Agile is a ready-to-use IoT meta sensor
- World class security built in – TLS connection from Edge to Cloud
- Modular design for flexibility and expansion
- Rugged yet compact enclosure is water- and dust-proof
- Complete, global certification
- USB socket allows data, control, expansion, auxiliary power and charging functions
- Push-button power switch
- **Take it out of the box. Power it up. Get started.**

AGILE, A modular meta sensor

SENSOR Module
Included
- Accelerometer
- Gyroscope
- Magnetometer
- Pressure
- Temperature
- Humidity
- Proximity
- Ambient Light
- Microphone

Also planned
- NFC Tag antenna
- Display
- Touch sensitive caps
- Buzzer

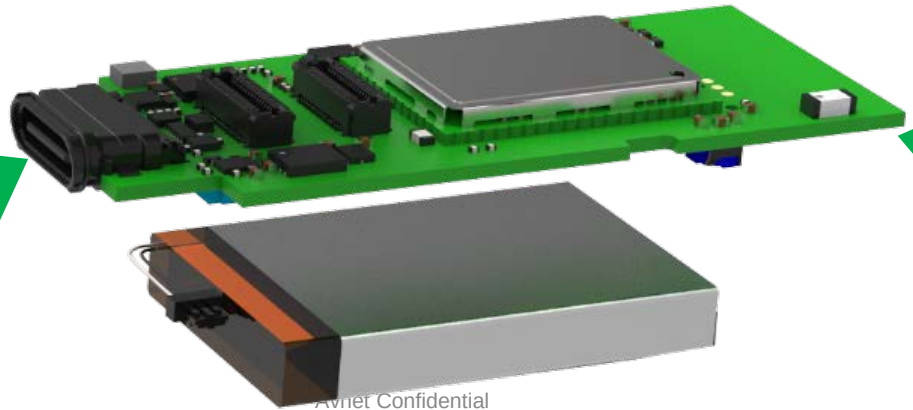


CONNECTIVITY Module
Included -
- BLE 5.0

Coming soon
- LoRaWAN
- 3G/4G

Also planned
- Sigfox
- Wi-Fi
- NB-IoT
- LTE-M

USB-C Connector
- Charging
- External battery extension
- Supplying external devices
- Data exchange (normal & debug mode)
- Extensions I2C, I/O, UART … (alternate mode) allowing customised extensions



BRAIN Module
- Captures data to enable a **machine learning** model to be built
- **AI at the Edge** allows decisions to be taken quickly, locally and autonomously. Therefore, less data is transmitted to the cloud, cutting cost and increasing flexibility
- Built-in **rechargeable battery** for long-term, standalone use
- **Best in class security** is built-in with a hardware secure element, enabling secure boot, device-to-cloud TLS and secure firmware upgrades
- **USB-C interface** allows expansion to include more specialised sensors or actuators, for example

Edge Gateways

Edge computing portfolio

Edge Gateway 3000

Small and low cost

Target uses: Building automation, transportation, energy monitoring, surveillance

Processor: Intel Atom

Environment: -30C - +70C

Edge Gateway 5000

High I/O and expandable

Target uses: Industrial monitoring, oil and gas, marine, building automation

Processor: Intel Atom

Environment: up to -30C - +70C

Embedded Box 3000

Supports Win7 Pro

Target uses: Manufacturing, medical device controller, managed security

Processor: Intel Atom

Environment: 0C - +50C

Embedded Box 5000

Powerful and supports Win7

Target uses: Manufacturing, utilities, surveillance, building management

Processor: Intel Core i

Environment: 0C - +50C

10.00 x 5.63 in

DELL EMC

Rugged Edge Gateways for Industrial IOT applications

Servers, Storage & Networking

Servers

Storage

Switches

Racks

AVNET

We can help your business reach further

A comprehensive suite of capabilities

Communities	The largest engineering community in the world
Design Services	Comprehensive turnkey & custom design solutions
Manufacturing Support	Oversight & management of the entire manufacturing process
Logistics & Post-Sales	Reliable logistics services & cost-effective post-sales support
Supply Chain	Best-in-class supply chain services
Integrated Solutions	Fully integrated hardware & software solutions
Internet of Things	Connected devices that run safer, smarter & more efficiently
Digital	World-class digital capabilities that integrate your online & offline business

Ready to get started?

Guiding today's ideas into tomorrow's technology

We help you reach further