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Common Characteristics of Transducer, Sensors and its types of applications

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ABSTRACT: This article proposed to a survey of Transducer, Sensors, types, characteristics and its applications. The transducer and sensor are the physical procedure used in electrical and electronic instruments for measuring the physical quantities. The sensor identifys the signal and modifies it into an electrical signal which is easily measured by the digital devices. The transducer transfers the energy either in the same form or another such as mechanical, electrical energy, light energy, chemical energy, thermal energy, acoustic energy, electromagnetic energy, and so on. The sensor is a mechanism that measures the physical quantity (i.e. Heat, light, sound, etc.) into an easily understandable signal (voltage, current etc.). It gives correct readings after calibration.

KEYWORDS: Transducer and Sensors, types, different, characteristics and its applications.

I. INTRODUCTION

There are different categories of sensors and transducers are presented to select from like analog, digital, input and output. This type of Input or Output transducer being used really depends upon the signal sensed or restricted. But, a sensor and transducer can be converting from one physical quantity to a new.

A device which implements an input function is called sensor, it sense a physical change in some characteristic that modifies in response to some excitation. Transducer is also a device that converts the energy from one form to another. Examples for the transducer is microphone, loudspeaker etc.

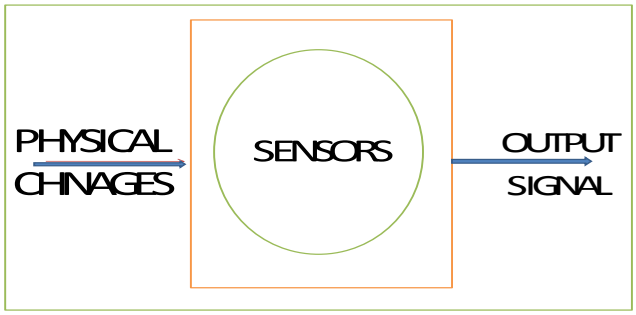


Figure1. Sensor

The transducer is completed into two steps. The transducer has three major components; they are the input device, signal conditioning or processing device and an output device. The input devices receive the measured quantity and transfer the proportional analogue signal to the conditioning device. The conditioning device changed, cleaned, or attenuates the signal is easily acceptable by the output devices.

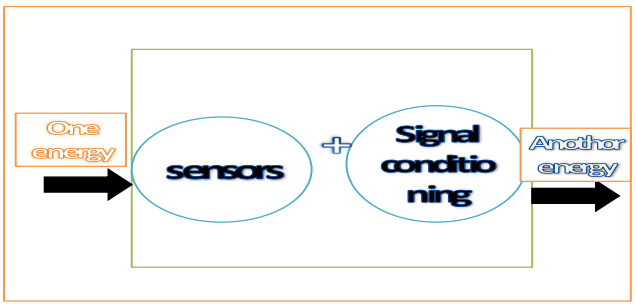


Figure2. Transducer

Sensors: A sensor is a unique kind of transducer which is used to make an input signal to a size, instrumentation or control system.

The signal produced by a sensor is an electrical analogy of a physical measure, such as temperature, distance, velocity, acceleration, pressure, light level, etc. Number of factors like precision, decision, price, and material size has to be considered while choosing the sensor for particular application.

- Based on method of Sensors into Active Sensor and Passive Sensor
- Based on their applications of Sensors into Digital and Analog Sensor

II. TYPES OF SENSORS:

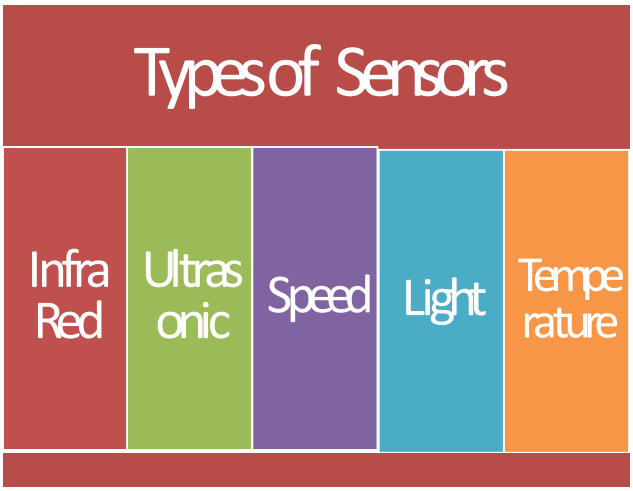


Figure4. Types of Sensors

A. Temperature Sensor

A device gives temperature measurement as an electrical signal is called as Temperature sensor. The electrical signal in the form of voltage to temperature measurement. There are different types of sensors used for measuring temperature, such as Contact type, Non-contact type temperature sensors. The British standard color code for thermocouples is given below.

Table1. Thermocouple Colour Codes

Code Type	Conductors (+/-)	Sensitivity
E	Nickel Chromium / Constantan	-200 to 900°C
J	Iron / Constantan	0 to 750°C
K	Nickel Chromium / Nickel Aluminium	-200 to 1250°C
N	Nicrosil / Nisil	0 to 1250°C
T	Copper / Constantan	-200 to 350°C
U	Copper / Copper Nickel Compensating for “S” and “R”	0 to 1450°C

B. Ultrasonic Sensor

It is similar to sonar or radar in which explanation of echoes from radio or sound effect to assess the attributes of a target by generating the high-frequency-sound waves (upto 40kHz). The transducer used for converting energy into ultrasound sound effect with ranges above human hearing range is called an ultrasonic transducer.

C. PIR Sensor

An electronic sensor used for measuring the infrared light radiation emitted from objects is called as a PIR sensor or Pyroelectric sensor. Every piece has a temperature above zero emit heat energy in the form of radiation radiating at infrared wavelengths which is invisible to the human eye. It can be identified by special purpose electronic devices such as PIR motion identifiers.

D. Proximity / Presence Sensor

The most common proximity sensors are used to identify the magnetic materials (iron and alloys).

To identify the presence of conducting materials and to operate by creating a high frequency EM field that induces eddy currents in nearby metal targets. The sensor inductance is an oscillator circuit. When the target nears the sensor, the oscillations are damped, and result change in oscillator current is made to solid-state switch. These are made of materials in which a voltage is generated showing to EM radiation. They are most commonly used in solar cells. Another sensing method is the use of optical sensors. Some common ones are Photoconductive cells & Photovoltaic cells.

E. Speed Sensor

Sensors used for identifying speed of an object or vehicle are called as Speed sensor. Different types of sensors to identify the speed such as Wheel speed sensors, speedometers, LIDAR, ground speed radar, pivot meters/logs, Doppler radar, air speed indicators, pivot tubes and so on.

III. LIGHT SENSORS

A generates an output signal representing the intensity of light by measuring the radiant energy in a very narrow range of frequencies basically called “light”, and which ranges in

frequency from "Infra-red" to "Visible" to "Ultraviolet" light spectrum.

It is a passive method that convert this "light energy" visible or in the infra-red parts of the spectrum into an electrical signal output. Light sensors are "Photoelectric Devices" or "Photo Sensors" i.e., convert light energy (photons) into electricity (electrons).

IV. SELECTION OF TRANSDUCER

Selection of a transducer is depends on the important factors which help in accurate results. It depends on the physical quantity to be measured.

- Depends on the principle of physical input.
- Depends on accuracy.

1. Based on their application.
2. Based on the method of conversion.
3. Based on the output
4. Based on the electrical parameter.
5. Based on active or passive.

V. TRANSDUCER TYPES

Diversity of transducer types like pressure transducer, piezoelectric transducer, ultrasonic transducer, temperature transducer, and so on.

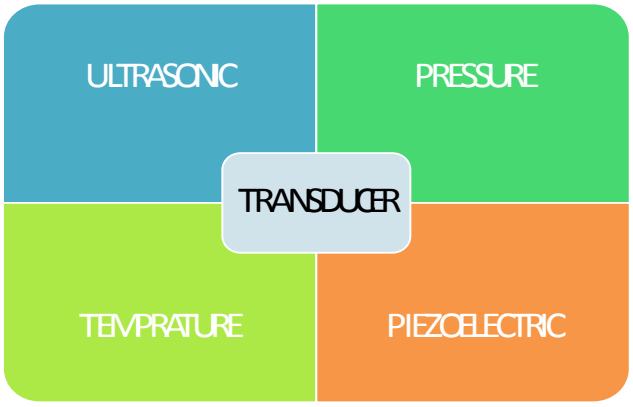


Figure3. Transducer types

Active transducer does not want to any power signal for their operations. It has effort on the theory of energy transfer. They produce an electrical signal is proportional to the input. Example of this transducer is thermocouple. Passive transducer requires an outside power source for their function. They produce an output in the form of capacitance, resistance. Example of passive transducer is a photocell.

A. Piezoelectric Transducer

It is a special kind of sensor, main purpose of this transducer is to convert mechanical into electrical energy. In the same way, electrical can be transformed into mechanical energy.

B. Pressure Transducer

It is a special kind of sensor, the pressure forced into electrical signals. It is also called as pressure indicators, nanodevices, piezo-devices, transmitters, and pressure sensors.

C. Temperature Transducer

It is an electrical device, is used to convert the temperature of a device into another quantity like electrical or pressure or mechanical energy, then the quantity will be sent to the control device for controlling the temperature of the device.

D. Ultrasonic Transducer

The main function is converting from electrical signals to ultrasound waves. It called as capacitive or piezoelectric transducers.

Table1. Common Sensors and Transducers

Measured Quantity	Sensors	Transducers
Temperature	Thermocouple, Thermistor Thermostat, Resistive Temperature Identifiers	Heater, Fan
Force / Pressure	Strain Gauge , Pressure Switch, Load Cells	Lifts & Jacks Electromagnet Vibration
Position	Potentiometer, Encoders Reflective / Slotted Opto-switch, LVDT	Motor Solenoid Panel Devices
Speed	Tacho-generator, Reflective / Slotted Opto-coupler, Doppler Effect Sensors	AC and DC Motors Stepper Motor Brake
Sound	Carbon Microphone	Bell

	Piezo-electric Crystal	Buzzer Loudspeaker
Light Level	Light Dependant Resistor (LDR) Photodiode Photo-transistor Solar Cell	Lights & Lamps LED's & Displays Fiber Optics

VI. CHARACTERISTICS OF SENSORS AND TRANSDUCERS

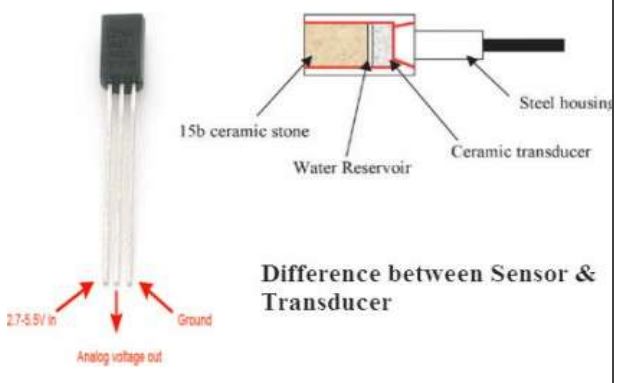
Sensor or transducer is a device which converts one type of energy to another – usually electric. It can be used for various purposes including measurement or information transfer. Generally talking sensor or transducer, it is a device that converts a signal from one to another. Important characteristics of sensors and transducers are listed:

- Input characteristics
- Transfer characteristics
- Output characteristics

Table2. CHARACTERISTICS OF SENSORS AND TRANSDUCERS

S.NO	Transducer	Sensor
1	Accuracy	Accuracy
2	Span	Span
3	Resolution	Resolution
4	Sensitivity	Sensitivity
5	Precision	Precision
6	Linearity	Linearity
7	Noise	Noise
8	Drift	full-scale drift
9	Hysteresis	Repeatability
10	Distortion	Response Time
11	Conformance	Range

Table3. Difference between Transducer and Sensor

S.NO	Transducer	Sensor
1	It helps in converting one form of energy into another form.	It senses physical quantities converts into signals which are read by instruments.
2	It converts electricity to electromagnetic waves.	It senses physical measured and converts into analogue measured.
3	Antenna is one type of transducer. Microphone and loudspeaker is also of one type.	One type of Sensor is LED. Sensors used in automobiles to identify touch and activate siren.
4	It converts the measured quantity into a standard electrical signal like -10 to +10V DC	It is used to measure voltage, capacitance, inductance, ohmic resistance.
5		

VII. CONCLUSION

It is variety types of sensors available and used for remote sensing, example such as the motion sensor which are used in numerous systems such as automatic doors, security lights. These send some kind of signals like ultrasonic waves, microwaves or light beams and senses when there is a interruption in the flow. The type of input or output transducer being used depends upon the kind of signal sensed or controlled. Sensors and transducers are defined based on their conversion of physical quantity. It converts from electricity to electromagnetic waves. A sensor converts one form of energy to another, means it senses a bodily quantity and converts it into an electrical signal. The main difference between sensor and transducer is, the sensor is a physical device, senses a physical quantity and then converts it into signals which can be read by an instrument or the user. The transducer is also a physical device that converts one form of energy into another form.

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