LEVEL SENSORS AND TRANSDUCERS

LEVEL SENSORS

- LEVEL SENSORS ARE USED TO DETECT LIQUID OR POWDER LEVELS, OR INTERFACES BETWEEN LIQUIDS. THEY ARE AN IMPORTANT PART OF A FLUID SYSTEM BECAUSE THE POSITION AND DISPLACEMENT OF AN OBJECT OR MEDIA IS CRITICAL TO KNOW IN MANY APPLICATIONS. THE SUBSTANCE TO BE MEASURED COULD BE INSIDE A CONTAINER OR IN ITS NATURAL FORM SUCH AS A LAKE OR RIVER. A SENSOR IS ABLE TO DETECT A CHANGE AND COMMUNICATE THAT CHANGE WITH A USER. LEVEL SENSORS ARE GENERALLY DESIGNED FOR A SPECIFIC APPLICATION, RATHER THAN GENERAL APPLICATION.

TWO BASIC LEVEL-MEASUREMENT TYPES

- POINT LEVEL SENSOR
- CONTINUOUS LEVEL SENSOR

POINT LEVEL SENSOR

- MARK A SPECIFIC LEVEL AND COMMUNICATE TO THE USER IF THE MEDIA IS ABOVE OR BELOW THAT LEVEL. THEY ARE USED GENERALLY AS A HIGH ALARM OR SWITCH.

CONTINUOUS LEVEL SENSORS

- MEASURE LIQUID OR DRY MATERIAL LEVELS WITHIN A SPECIFIED RANGE AND PROVIDE OUTPUTS WHICH CONTINUOUSLY INDICATE THE LEVEL. THEY ARE MORE SOPHISTICATED DEVICES THAN POINT LEVEL SENSORS BECAUSE THEY MEASURE OVER A RANGE OF LEVELS INSTEAD OF AT ONE POINT TO LET THE USER KNOW THE EXACT AMOUNT OF A SUBSTANCE. THIS PRODUCES AN ANALOG OUTPUT THAT DIRECTLY CORRELATES TO THE FLUID LEVEL IN THE CONTAINER.

DIFFERENT TYPES OF POINT LEVEL SENSORS

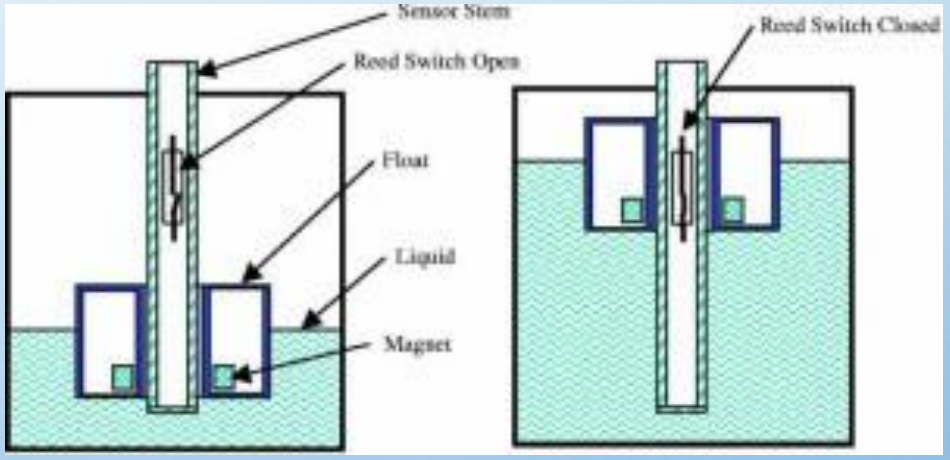
- FLOAT SENSOR
- CAPACITANCE SENSOR
- CONDUCTIVITY PROBES

FLOAT SENSOR

- A LIQUID LEVEL CONTROL SYSTEM BY USING A FLOAT SENSOR WORKS ON THE PRINCIPLE OF BUOYANCY, WHICH STATES, “A FLOAT IMMERSED IN A LIQUID IS BUOYED TOWARDS UPWARD DIRECTION BY AN APPLIED EQUAL FORCE TO THE WEIGHT OF THE DISPLACED LIQUID”. AS A RESULT, THE BODY DRIVES PARTIALLY AND GETS SUBMERGED UPON THE LIQUID SURFACE AND COVERS THE SAME DISTANCE THE LIQUID LEVEL MOVES.

CONSTRUCTION AND WORKING

- A LEVEL MEASUREMENT FLOAT SYSTEM CONSISTS OF A fIOAT, A SENSOR STEM, A MAGNET, A REED SWITCH AND A WEIGHT SUSPENDED ON THE OUTSIDE OF THE OPEN TANK. A SCALE IS FIXED ON THE OUTSIDE OF THE TANK, AND THE CONTENTS OF THE TANK'S LEVEL ARE INDICATED BY THE POSITION OF THE WEIGHT ALONG THE SCALE.



CONSTRUCTION AND WORKING

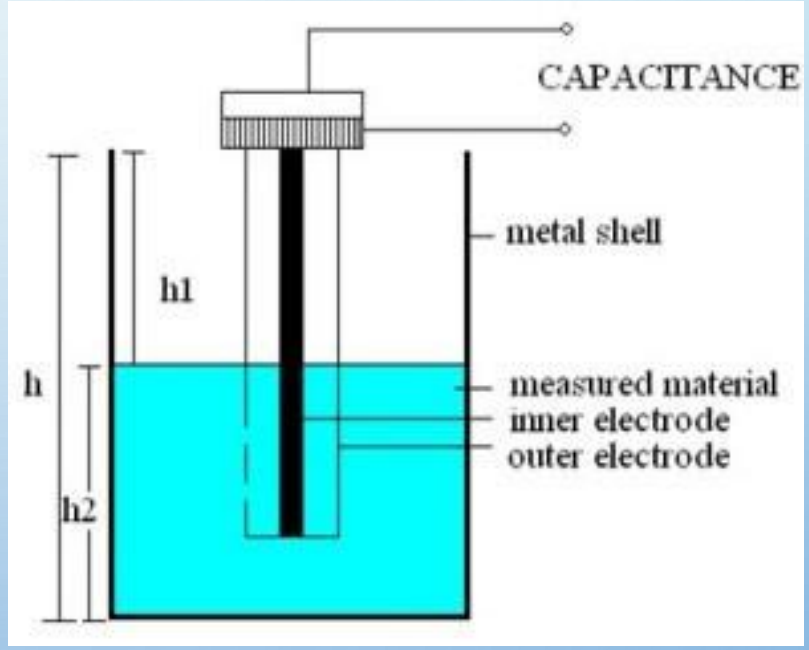
- LEVEL DETECTION OF LIQUIDS IS OFTEN DONE WITH A FLOAT-TYPE LIQUID LEVEL SWITCH. THE FLOAT TRANSFERS ON A MECHANICAL ARM OR SLIDING POLE AND ACTIVATES A SWITCH WHEN THE LEVEL MOVES TOWARDS UPWARD DIRECTION. SOMETIMES THE fIOAT ITSELF CONTAINS A SMALL MAGNET THAT VARIES THE STATE OF A SWITCH WHEN THE LIQUID LEVEL GETS MOVING UP AND MOVES INTO THE ORIGINAL POSITION. THIS TYPE OF LEVEL SENSOR COMES WITH MANY ADVANTAGES LIKE IT IS VERY SIMPLE, HIGHLY ACCURATE, AND BEST SUITABLE FOR VARIOUS PRODUCTS.

CAPACITANCE SENSOR

- THE PRINCIPLE OF CAPACITIVE LEVEL MEASUREMENT IS BASED ON THE CHANGE OF CAPACITANCE. THERE ARE TWO PLATES IN CAPACITIVE SENSOR: ONE PLATE ACTS AS AN INSULATED ELECTRODE AND THE OTHER PLATE ACTS AS A TANK WALL. THE CAPACITANCE DEPENDS ON THE LIQUID LEVEL. AN EMPTY TANK HAS LOW CAPACITANCE WHILE A FILLED TANK HAS HIGHER CAPACITANCE. A SIMPLE CAPACITOR CONSISTS OF TWO ELECTRODE PLATES SEPARATED BY A SMALL THICKNESS OF AN INSULATOR SUCH AS SOLID, FLUID, GAS, OR VACUUM.

CONSTRUCTION AND WORKING

- THE MEASUREMENT OF LIQUID LEVEL IS DONE BY APPLYING A RADIO FREQUENCY SIGNAL BETWEEN THE CONDUCTIVE PROBE AND THE VESSEL WALL. THE RADIO FREQUENCY SIGNAL RESULTS IN A VERY-LOW CURRENT WHICH FLOWS THROUGH THE DIELECTRIC PROCESS MATERIAL IN THE TANK FROM THE PROBE TO THE VESSEL WALL.



CONSTRUCTION AND WORKING

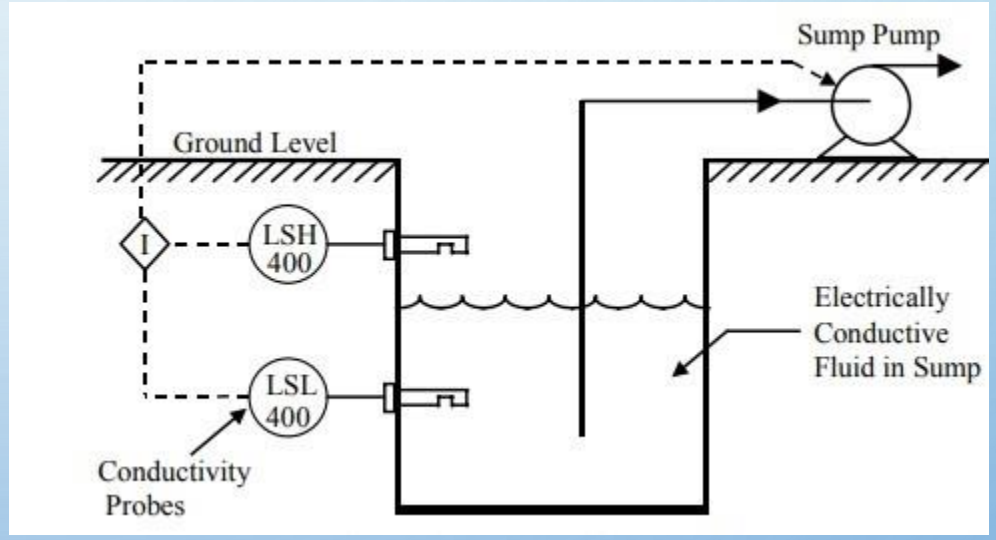
- IF THE LIQUID LEVEL IN THE TANK DROPS, THEN THE DIELECTRIC CONSTANT DECREASES, WHICH LEADS TO THE DROP IN CAPACITANCE READING AS WELL AS MINUTE DROP IN CURRENT FLOW.
- THIS CHANGE CAN BE DETECTED BY THE LIQUID-LEVEL SWITCH'S INTERNAL CIRCUITRY AND TRANSLATED INTO RELAY STATE CHANGES OF THE LEVEL SWITCH IN CASE OF A POINT LEVEL DETECTION.

CONDUCTIVITY PROBES

- CONDUCTIVITY PROBES OPERATE ON THE PRINCIPLE THAT MOST LIQUIDS CONDUCT ELECTRICITY.

CONSTRUCTION AND WORKING

- IN THE CIRCUIT IT IS OPEN AND NO CURRENT FLOWS THROUGH THE ELECTRODES OF THE LEVEL PROBE TO ENERGIZE IT. WHEN THE LIQUID LEVEL INCREASES, IT ESTABLISHES A CONDUCTIVE PATH IN THE ELECTRODE, CLOSING THE LOW LEVEL SWITCH. WHEN THE LEVEL PROBE IS ACTIVATED, CLOSES THE DRY CONTACTS ON THE INSTRUMENT.



DIFFERENT TYPES OF CONTINUOUS LEVEL SENSOR

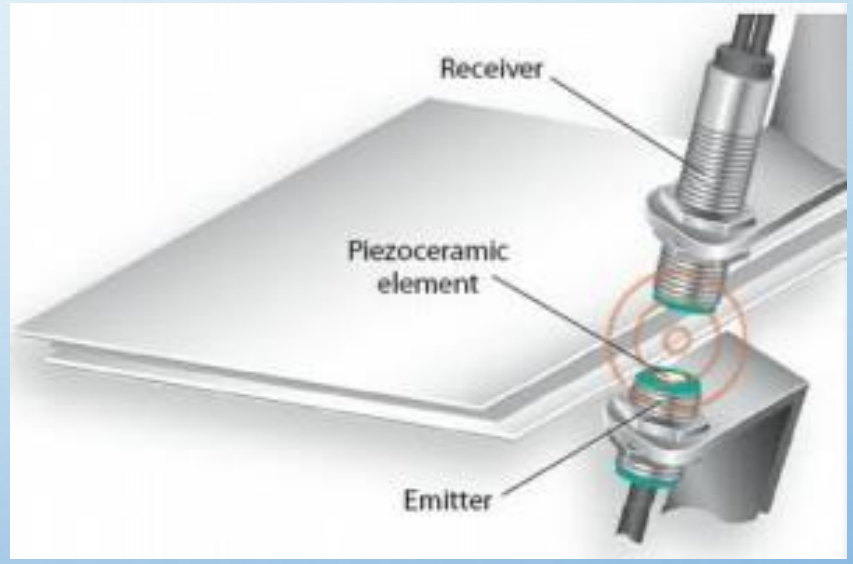
- ULTRASONIC SENSOR
- RADAR LEVEL SENSOR
- OPTICAL SENSOR

ULTRASONIC SENSOR

- ULTRASONIC LEVEL INSTRUMENTS WORKS ON THE BASIC TIME-OF-FLIGHT PRINCIPLE WHICH STATES THAT SENDING A SOUND WAVE FROM A PEIZO ELECTRIC TRANSDUCER TO THE CONTENTS OF THE VESSEL, WHICH MAY CONTAIN LIQUID, SOLID OR SLURRIES LEVEL.

CONSTRUCTION AND WORKING

- THIS LIQUID LEVEL SENSOR COMPRISES TWO ELEMENTS SUCH AS AN ASSOCIATED ELECTRONIC TRANSCEIVER AND A TRANSDUCER WITH RELATIVELY HIGH EFFICIENCY. IN CASE OF A LIQUID LEVEL CONTROLLER, THE FLUID LEVEL CAN BE DETERMINED BY MEASURING THE TRIP TIME DIFFERENCE BETWEEN A TRANSMITTED ULTRASONIC PULSE AND A REFLECTED ECHO.



CONSTRUCTION AND WORKING

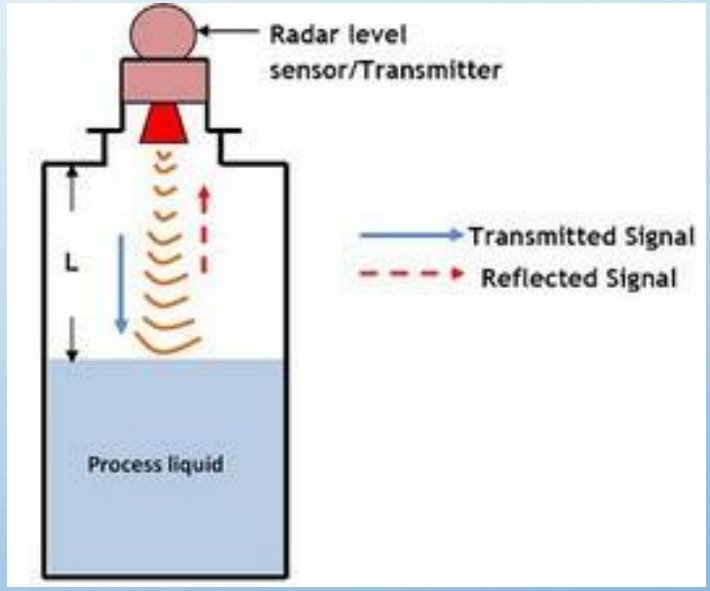
- THE FREQUENCY RANGE FOR ULTRASONIC METHODS VARIES FROM A RANGE OF 15-200 KHZ FOR TRANSMITTING AND RECEIVING ULTRASONIC WAVES. THE LOWER FREQUENCY INSTRUMENTS ARE USED FOR THE MEASUREMENT OF DIFFICULT APPLICATIONS SUCH AS LONGER DISTANCES AND SOLID-LEVEL MEASUREMENTS, AND THE INSTRUMENTS WITH HIGHER FREQUENCY ARE USED FOR SHORTER LIQUID LEVEL MEASUREMENTS.

RADAR LEVEL SENSOR

- RADAR LEVEL MEASUREMENT SYSTEM IS BASED ON THE PRINCIPLE OF MEASURING THE TIME REQUIRED FOR THE MICROWAVE PULSE AND ITS REFLECTED ECHO TO MAKE A COMPLETE RETURN TRIP BETWEEN THE NON-CONTACTING TRANSDUCER AND THE SENSED LIQUID LEVEL. THEN, THE TRANSCEIVER CONVERTS THIS ELECTRICAL SIGNAL INTO DISTANCE/LEVEL AND PRESENTS IT AS AN ANALOGUE AND/OR DIGITAL SIGNAL. THE TRANSDUCER'S SIGNAL OUTPUT CAN BE SELECTED BY THE USER TO BE DIRECTLY OR INVERSELY PROPORTIONAL TO THE SPAN.

CONSTRUCTION AND WORKING

- THE WORKING OF A RADAR LEVEL SENSOR IS EXPLAINED HERE TO MEASURE THE LEVEL OF LIQUID OR SOLID. THE RADAR SIGNALS ARE TRANSMITTED FROM THE ANTENNA PLACED AT THE TOP OF THE WATER TANK OR VESSEL AS SHOWN IN THE ABOVE FIGURE. THE RADAR SIGNAL GETS REFLECTED BY THE LIQUID SURFACE AND ECHO IS CARRIED OUT BY THE ANTENNA.



CONSTRUCTION AND WORKING

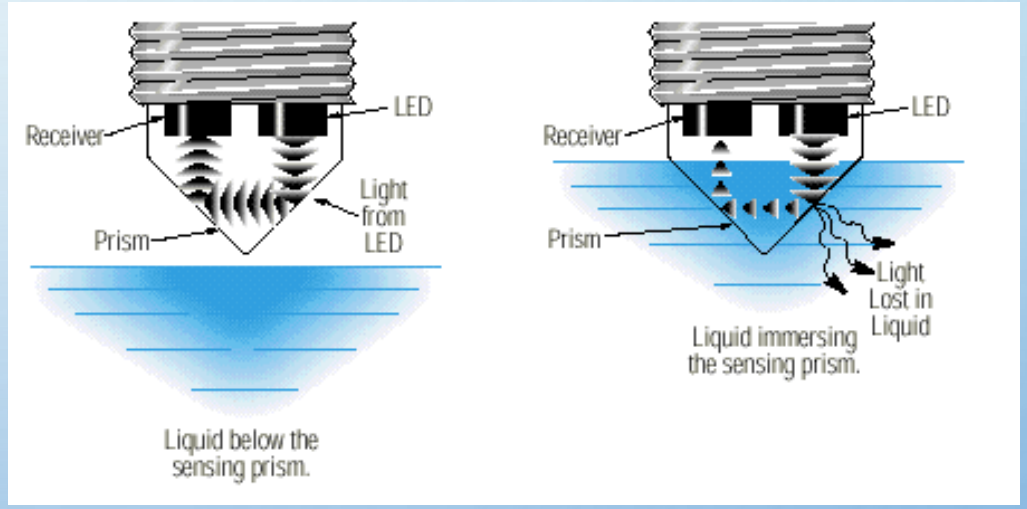
- BY VARYING THE SIGNAL, THE FREQUENCY GETS VARIED DURING THE TIME OF ECHO AND THE TIME OF THE SIGNAL TRANSMISSION COMPARISON. THE DIFFERENCE OF FREQUENCY IS PROPORTIONAL TO THE DISTANCE OF THE LIQUID, AND THIS STATEMENT IS USED TO DETERMINE THE ACCURATE LEVEL OF THE LIQUID.

OPTICAL SENSOR

- THE OPTICAL SENSOR CONSISTS OF AN INFRARED LED AND A LIGHT RECEIVER. THE LIGHT EMITTED FROM THE LED IS DIRECTED TOWARDS A PRISM WHICH FORMS THE TIP OF THE LEVEL SENSOR. IF THERE IS NO LIQUID PRESENT IN THE TANK, THEN THE LIGHT FROM THE LED IS REFLECTED WITHIN THE PRISM AND THE RECEIVER.

CONSTRUCTION AND WORKING

- WHEN THE LIQUID LEVEL RAISES AND IMMERSES THE SENSING PRISM, THE LIGHT GETS REFRACTED OUT INTO THE LIQUID, LEAVING LITTLE AMOUNT OF LIGHT OR NO LIGHT TO REACH THE RECEIVER. SENSING THIS CHANGE, THE RECEIVER ACTIVATES ELECTRONIC SWITCHING WITHIN THE LEVEL UNIT FOR OPERATING EXTERNAL ALARM OR CONTROL CIRCUIT.



MEDIA

- MEDIA IS THE MATERIAL THAT THE SENSOR NEEDS TO MEASURE. LEVEL SENSORS CAN BE RESPONSIBLE FOR MEASURING A WIDE VARIETY OF MEDIA IN FLUID LEVEL SYSTEMS IN MANY INDUSTRIES. THE TWO GENERAL MEDIA TYPES INCLUDE LIQUID AND DRY MATERIALS.

LIQUID MEDIA	DRY MATERIALS
• Water (hot or cold, clean or dirty, fresh or salt) • Gasoline (diesel fuel) • Hydraulic Fluid • Highly Viscous or Gummy Fluids	• Bulk Solids • Powders

SPECIFICATIONS

- **RANGE** - MAXIMUM MEASUREMENT DISTANCE OF THE SENSOR. MOST SENSORS ARE OFFERED IN TWO OR THREE DIFFERENT RANGES.
- **TANK HEIGHT** - THE DISTANCE FROM THE INSTALLED FACE OF THE TRANSDUCER, DOWN TO THE BOTTOM OF THE TANK.
- **RISER HEIGHT** - THE DISTANCE FROM THE FACE OF THE TRANSDUCER TO THE TOP OF THE TANK.
- **FILL HEIGHT** - THE DISTANCE FROM THE BOTTOM OF THE TANK TO THE MAXIMUM DESIRED LIQUID HEIGHT.
- **DEAD BAND** - THE MINIMUM DISTANCE FROM THE FACE OF THE TRANSDUCER FROM WHICH THE SENSOR CAN MEASURE.

APPLICATIONS OF LEVEL SENSOR

- CAN BE USED IN WATER TANKS TO CONTROL WATER LEVELS
- AUTOMATICALLY TURN ON/OFF PUMPS
- BEVERAGE AND FOOD MANUFACTURING FACTORIES
- WASTE MATERIAL HANDLING INDUSTRY
- OIL TANK LEVEL CONTROL
- HIGH & LOW-LEVEL WATER LEVEL ALARMS
- TSUNAMI WARNING AND SEA LEVEL MONITORING
- DETECTING INK LEVEL IN PRINTERS

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