
Installation of instruments and sensors in control panel and its performance testing

Objectives: At the end of this lesson you shall be able to

- **state the sensor main specification, application necessity and types**
 - **state the specification and types of sensors required in panel board**
 - **explain the performance testing of panel control board.**
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Instruments in panel board

Industrial operation for any process requires many machines, apparatus for usual supply and maintain continuous production. Some machines requires operator always to operate many control on process for example a lathe machine is required always its operator assistance to do different job, turning, shaping etc, but in some cases the machine not required continuous manual operator for single job operations.

In a workshop AC motor or DC motor is to operate for many of its intended job. Once the machine starts it will continue to work for its assigned job and requires only ON and OFF operation. This operation may need many job completion in different places located in the work shop. This operation has to be controlled and monitored in time intervals and a constant watch also may require.

The instruments are used to measure the electrical quantities, which in turn gives the feed back of load conditions and performance. A motor draws a constant current, which can monitor by a ammeter connected to them similarly the rated voltage, frequency, power factor etc, are also to be checked through the meters. If number of machines and meters are more it is difficult to watch the parameters individual places. A panel board having this meters are installed helps to collect the data at one place where different machines are working.

Selection of meters are in accordance with the machine ratings and working voltage limits. A low range meter cannot be connected in a heavy load machine for its readings it may damage the meter and its wiring.

Sensors types, classification and its application

Sensors is a device that detects/measures a physical quantity. A motor is running with its rated rpm but some cases load variations on motor affects the rpm. The quality of the product may depend on the machine accuracy, then it is very important to run the motor at its rated rpm. Automatic rpm correction is possible with relevant circuits but a sensor has to feed back the working rpm to the control circuit. In this case a Tacho generator is the device to produce the feed back of rpm of motor. Tacho generator can be fixed on the shaft of the motor and the resultant feed back quantity(V or I) can be brought to the control panel board.

Similarly, the temperature measurement also can be done by suitable sensors. Since the temperature is the big problem for all electrical applications, a constant watch on the temperature helps to increase the life of the machine and a uniform production with specified quality. In this way temperature can be controlled by installing suitable sensor preferably with a thermistor-PTC or NTC will help to control the temperature within safe limits. The sensor element will kept in the winding and the cable is brought up in the control panel, to connect the temperature indicating unit for indication.

A sensor is a special kind of transducer which is used to generate an input single to a measurement, instrumentation or control system. The signal produced by a sensor in an electrical analogy of a physical quantity, like acceleration, temperature, pressure, distance, velocity, light, level etc.

Types of sensors: There are two types of sensors

- a) Passive sensor
- b) Active sensor.

a) Active sensor: Self generating sensor is that one can generate a signal without any external power source. Eg. photovoltaic cell, thermo couple, piezoelectric device .

b) Passive sensor: It requires external power supply to generate the signal. Eg. Diaphragm used to convert pressure or velocity, oscillations, or sound wave's into movements of a solid sheet.

Classification of sensors: It is classified into many categories according to the output, application etc. It is mainly divided into two groups, they are; a) Digital sensor and b) Analog sensor.

Digital sensor: The resolution of this sensor is most accurate and maximum speed. Its ability to detect a change in the sensed quantity is excellent. The output is always taken as 180, high and low, or yes or no.

Analog sensor: The resolution of this sensor is less accurate compare to digital and it records very small changes or variations resulting more error. It is usually used to record very small changes, or variations.

Further, the sensors are mainly used to measure temperature and RPM in the electrical circuits. The following sensors are used to measure temperature. They are;

- Thermo couple
- RTD (Resistance Temperature Detector)
- Thermistor
- IR sensors (Infra Red)
- Semi conductor sensors - VDR, LDR, Photo diode etc.,

The sensors used to measure RPM of motor; are in different types; they are

- Shaft encoders (rotary type) 1-5000 pulses
- Photoelectric (optical type)
- Magnetic rotational speed (proximity type) - medium or low RPM.
- Photo sensor reflection target- Tachometer - 20-20,000 range

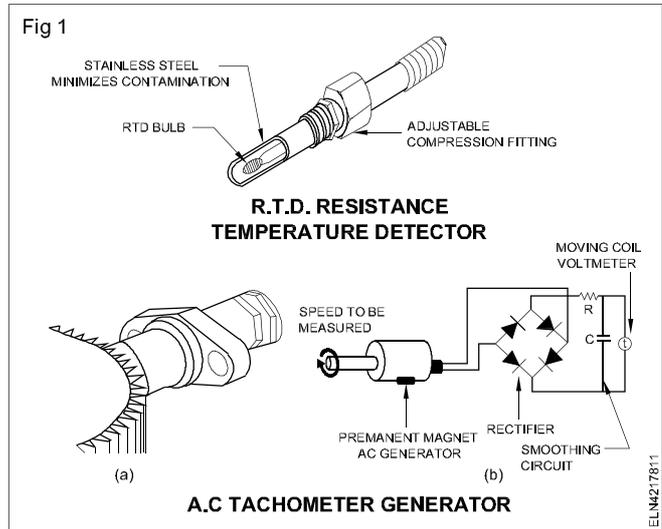
Sensor assembly and measurements

Temperature measurement using resistance temperature detector (RTD) and $\sqrt{1}$ assembly with position adjustment, tachometer sensor assembly and a AC tachometer generator is in Fig 1. The AC is rectified by a bridge circuit. The amplitude and frequency of the induced emf are equivalent to the speed of the shaft. Thus either amplitude or frequency is used for measuring the angular velocity.

Performance testing of panel board

It is important to see that the panel board is to install carefully as it carries a number of connection and controls. Any loose connection or wrong connection to any device will affect the performance and it may cost more.

While testing the performance make sure that all connections and wiring are correct and as per IE rules. Wrong connection and substandard materials will cause heavy damage to the panel board. The continuity of cable, earth resistance values are to be kept in the safe level as per IE rule normal.



The panel board should be earthed properly and all metal parts have to be connected to earth. If the current in the panel board is heavy; a separate earthing has to be provided and maintained within the standard.

Connection to machine from panel board has to be made on short as possible. If the machine draws less current, line drop will be minimum and resultant power is low hence in cable is also low and even negligible. If the connecting cable length is much more than line loss will be too high and it will turn shorten the life of machine and cables connected. Running of cable can be made as per the situation and facilities. Keep away from direct sun light wet condition, and near fire or any other polluted areas.

A simple model panel board to the load power is given for your guidance in Fig 2.

