

JOB ROLE – Consumer Energy Meter Technician

Sector: Power
(Qualification Pack Code : PSS/Q0107)



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Unit 4: Introduction to Energy meter
Session 1: Energy Meter History

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Session Objectives

1. The student will be able to know basic knowledge of energy meter.
2. explain the use of energy meter.

Introduction

Energy meter is one of the measuring instruments. It is used to measure the electrical energy consumed in premise either it residential or it is industrial. The electrical connection is given to a consumer in a so many ways i.e. single phase connection; three phase connection for residential, commercial (shops, showroom, cinema etc.) and industrial connections. To measure the energy consumed in these organization single phase and three phase energy meters are used, for big show room, cinema and industrial organization LT CT meters are used. There are 11KV, 33KV, 132KV, 220KV energy meters are also available for very high load industrial organization like HEG Mandideep, BHEL Bhopal etc.



Energy Meters

A meter is a device suitable for measuring, indicating and recording consumption of electricity or any other quantity related with electrical system and include, wherever applicable, other instruments such as current transformer (CT), voltage transformer (VT) or capacitor voltage transformer (CVT) necessary for such purpose.

Basic unit of power is watts. One thousand watts is one kilowatt. If we use one kilowatt in one hour, it is considered as one unit of energy consumed. These meters measure the instantaneous voltage and currents, calculate its product and gives instantaneous power. This power is integrated over a period which gives the energy utilized over that time period.

Series magnet carries a coil which is of few turns of thick wire connected in series with line whereas shunt magnet carries coil with many turns of thin wire connected across the supply.

Breaking magnet is a permanent magnet which applies the force opposite to normal disc rotation to move that disc at balanced position and to stop the disc while power is off.

Series magnet produces the flux which is proportional to the current flowing and shunt magnet produces the flux proportional to the voltage. These two fluxes lag by 90 degrees due to inductive nature. The interaction of these two fields produces eddy current in the disk, exerting a force, which is proportional to product of instantaneous voltage, current and phase angle between them.

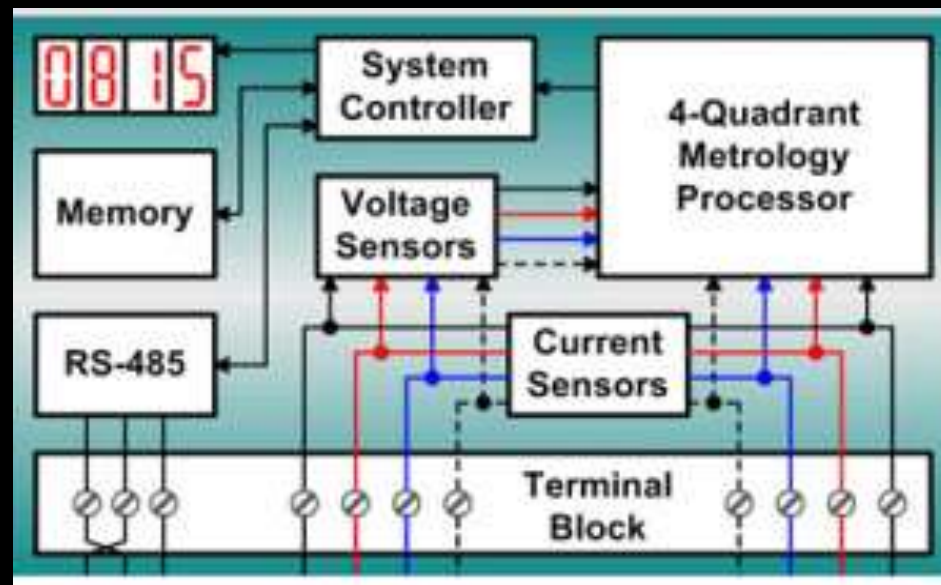
Vertical spindle or shaft of the aluminium disc is connected to gear arrangement which records a number, proportional to the number of revolutions of the disc. This gear arrangement sets the number in a series of dials and indicates energy consumed over a time. This type of meter is simple in construction and accuracy is somewhat less due to creeping and other external fields. A major problem with these types of meters is their easy prone to tampering, leading to a requirement of an electrical energy monitoring system. These are very commonly used in domestic and industrial applications.

Electronic Energy meters

These are of accurate, high precision and reliable types of measuring instruments as compared to conventional mechanical meters. It consumes less power and starts measuring instantaneously when connected to load. These meters might be analog or digital. In analog meters, power is converted to proportional frequency or pulse rate and it is integrated by counters placed inside it. In digital electric meter power is directly measured by high end processor. The power is integrated by logic circuits to get the energy and also for testing and calibration purpose. It is then converted to frequency or pulse rate.

Digital Electronic Energy Meters

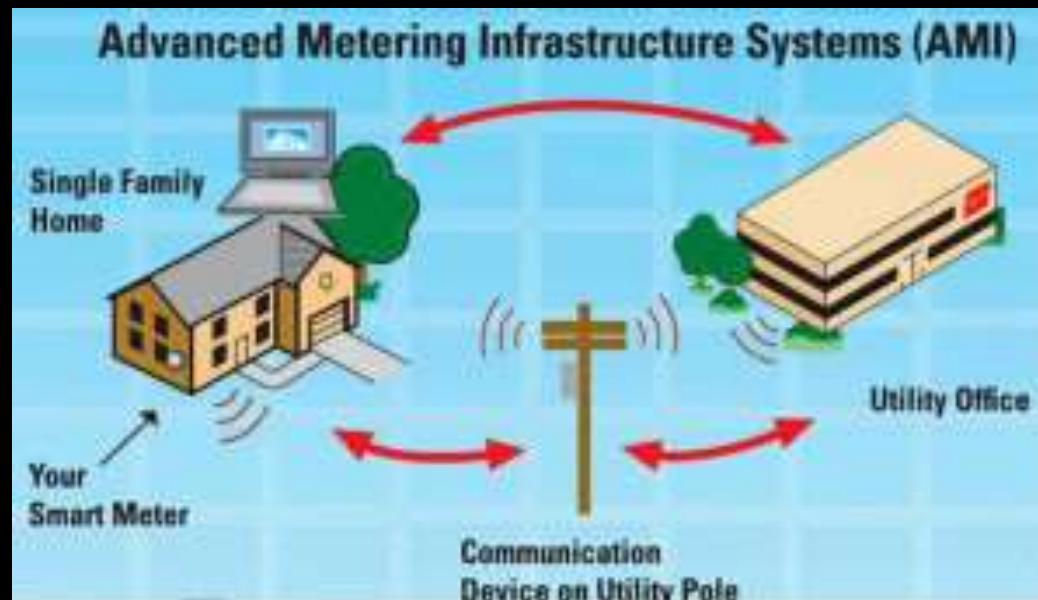
Digital signal processor or high performance microprocessors are used in digital electric meters. Similar to the analog meters, voltage and current transducers are connected to a high resolution ADC. Once it converts analog signals to digital samples, voltage and current samples are multiplied and integrated by digital circuits to measure the energy consumed.



- Microprocessor also calculates phase angle between voltage and current, so that it also measures and indicates reactive power. It is programmed in such a way that it calculates energy according to the tariff and other parameters like power factor, maximum demand, etc and stores all these values in a non volatile memory EEPROM.
- It contains **real time clock (RTC)** for calculating time for power integration, maximum demand calculations and also date and time stamps for particular parameters. Furthermore it interacts with **liquid crystal display (LCD)**, communication devices and other meter outputs. Battery is provided for RTC and other significant peripherals for backup power.
- Now-a-days Analog Electronic meters were replace with Digital Electronic Energy Meters, because there is least chance of energy theft due to digital display unit.

Smart Energy Meters

It is an advanced metering technology involving placing intelligent meters to read, process and feedback the data to customers. It measures energy consumption, remotely switches the supply to customers and remotely controls the maximum electricity consumption. Smart metering system uses the advanced metering infrastructure system technology for better performance.



- These are capable of communicating in both directions. They can transmit the data to the utilities like energy consumption, parameter values, alarms, etc and also can receive information from utilities such as automatic meter reading system, reconnect/disconnect instructions, upgrading of meter software's and other important messages. These meters reduce the need to visit while taking or reading monthly bill. Modems are used in these smart meters to facilitate communication systems such as telephone, wireless, fiber cable, power line communications. Another advantage of smart metering is complete avoidance of tampering of energy meter where there is scope of using power in an illegal way.

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