

# Overview of Single Phase Induction Type Energy Meter

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Single phase **induction** type energy meter is also popularly known as **watt-hour meter**. This name is given to it. This article is only focused about its constructional features and its working. Induction type energy meter essentially consists of following components:

1. [Driving system](#)
2. [Moving system](#)
3. [Braking system](#) and
4. [Registering system](#)

## Driving system

It consists of two electromagnets, called **“shunt” magnet** and **“series” magnet**, of laminated construction. A coil having large number of turns of fine wire is wound on the middle limb of the shunt magnet.

This coil is known as **“pressure or voltage”** coil and is connected across the supply mains. This voltage coil has many turns and is arranged to be as highly inductive as possible. In other words, the voltage coil produces a high ratio of inductance to resistance.

This causes the current and therefore the flux, to lag the supply voltage by nearly 90 degree.

An adjustable copper shading rings are provided on the central limb of the shunt magnet to make the phase angle displacement between **magnetic field** set up by shunt magnet and supply voltage is approximately 90 degree.

The copper shading bands are also called the power factor compensator or compensating loop. The series electromagnet is energized by a coil, known as **“current” coil** which is connected in series with the load so that it carry the load current. The flux produced by this magnet is proportional to, and in phase with the load current.

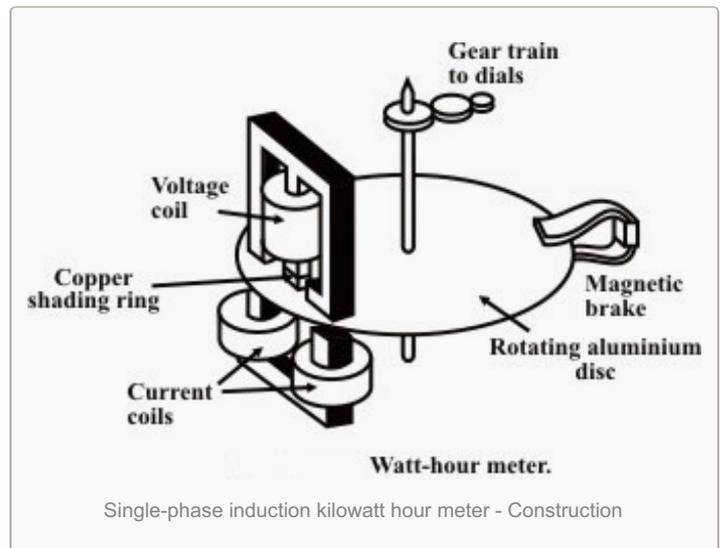
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## Moving system

The moving system essentially consists of a light rotating aluminium disk mounted on a vertical spindle or shaft. The shaft that supports the aluminium disk is connected by a gear arrangement to the clock mechanism on the front of the meter to provide information that consumed energy by the load.



Single-phase induction kilowatt hour meter



Single-phase induction kilowatt hour meter - Construction

The time varying (sinusoidal) fluxes produced by shunt and series magnet induce **eddy currents** in the aluminium disc.

The interaction between these two magnetic fields and eddy currents set up a driving torque in the disc.

The number of rotations of the disc is therefore proportional to the energy consumed by the load in a certain time interval and is commonly measured in **kilowatt-hours (Kwh)**.

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## Braking system

Damping of the disc is provided by a **small permanent magnet**, located diametrically opposite to the a.c magnets. The disc passes between the magnet gaps. The movement of rotating disc through the magnetic field crossing the air gap sets up eddy currents in the disc that reacts with the magnetic field and exerts a braking torque.

By changing the position of the brake magnet or diverting some of the flux there from, the speed of the rotating disc can be controlled.

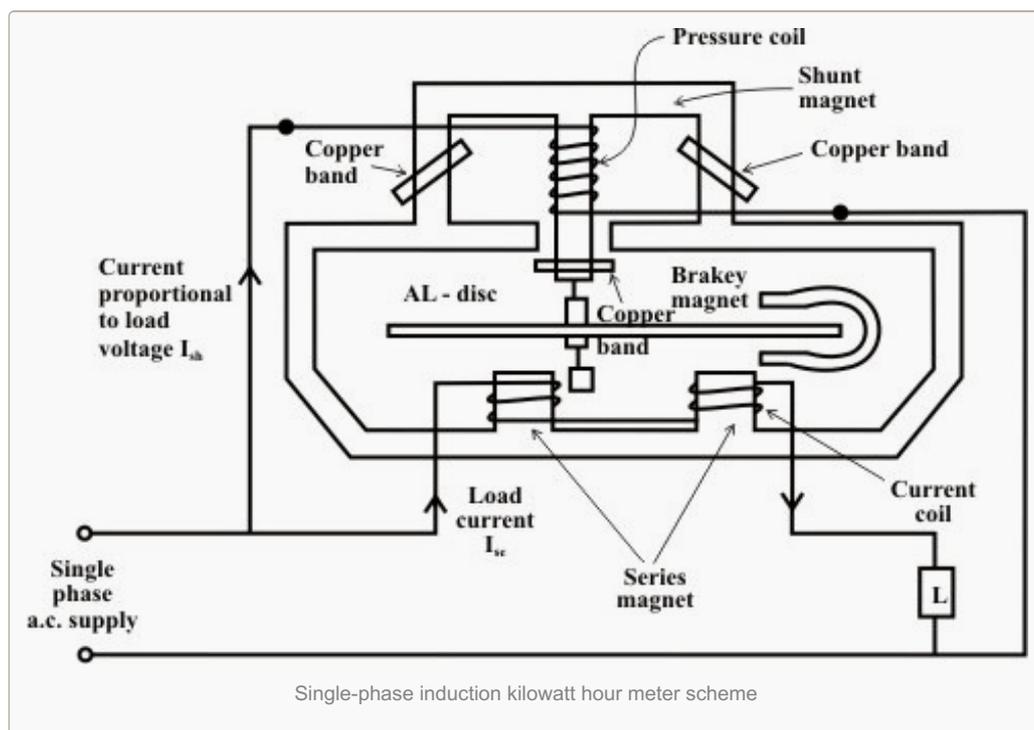
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## Registering or Counting system

The registering or counting system essentially consists of gear train, driven either by worm or pinion gear on the disc shaft, which turns pointers that indicate on dials the number of times the disc has turned.

The energy meter thus determines and adds together or integrates all the **instantaneous power values** so that total energy used over a period is thus known.

Therefore, this type of meter is also called an **“integrating” meter**.



## Working of Single phase induction type Energy Meter

The basic working of Single phase induction type Energy Meter is only focused on two mechanisms:

1. Mechanism of rotation of an aluminum disc which is made to rotate at a speed proportional to the power.

2. Mechanism of counting and displaying the amount of energy transferred.

***Lets have a look over these mechanism in few words:***

### **Mechanism of rotation of an aluminum disc**

*Which is made to rotate at a speed proportional to the power.*

The metallic disc is acted upon by two coils. One coil is connected Or arranged in such a way that it produces a magnetic flux in proportion to the voltage and the other produces a magnetic flux in proportion to the current. The field of the voltage coil is delayed by 90 degrees using a lag coil.

This produces eddy currents in the disc and the effect is such that a force is exerted on the disc in proportion to the product of the instantaneous current and voltage.

A permanent magnet exerts an opposing force proportional to the speed of rotation of the disc – this acts as a brake which causes the disc to stop spinning when power stops being drawn rather than allowing it to spin faster and faster. This causes the disc to rotate at a speed proportional to the power being used.

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### **Mechanism of displaying the amount of energy transferred**

*Based on number of rotation of aluminum disc.*

The aluminum disc is supported by a spindle which has a worm gear which drives the register. The register is a series of dials which record the amount of energy used.

The dials may be of the cyclometer type, an odometer-like display that is easy to read where for each dial a single digit is shown through a window in the face of the meter, or of the pointer type where a pointer indicates each digit

It should be noted that with the dial pointer type, adjacent pointers generally rotate in opposite directions due to the gearing mechanism.

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Source:

<http://electrical-engineering-portal.com/overview-of-single-phase-induction-type-energy-meter>