

Smart Energy and Smart Grids

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References

- [1] Blue Jay company, “Difference of AMR and AMI system”. [Online]. Available at: <http://www.cqbluejay.com/index/Information/105.html>

1 Electromechanical power meters

The classical type of electricity meter is the alternating current (*AC*) electromechanical induction kilowatt-hour meter.

This meter operates through electromagnetic induction by counting the revolutions of a non-magnetic, but electrically conductive metal (usually aluminum) disc.

The disc rotates at a speed proportional to the power passing through the meter. The principle is depicted on Fig. 1. An aluminum disc rotates in the air gap powered by eddy currents. The measured current flows via current coil under the disc on the two-arm core. Thanks to the closed iron core, the pressure coil has a large inductance compared to the current coil therefore there is phase shift almost 90° between the magnetic fluxes of both coils while active load is present. These magnetic fluxes create a rotating magnetic field that rotates disc. The rotating disk drives a mechanical counter via the shaft.

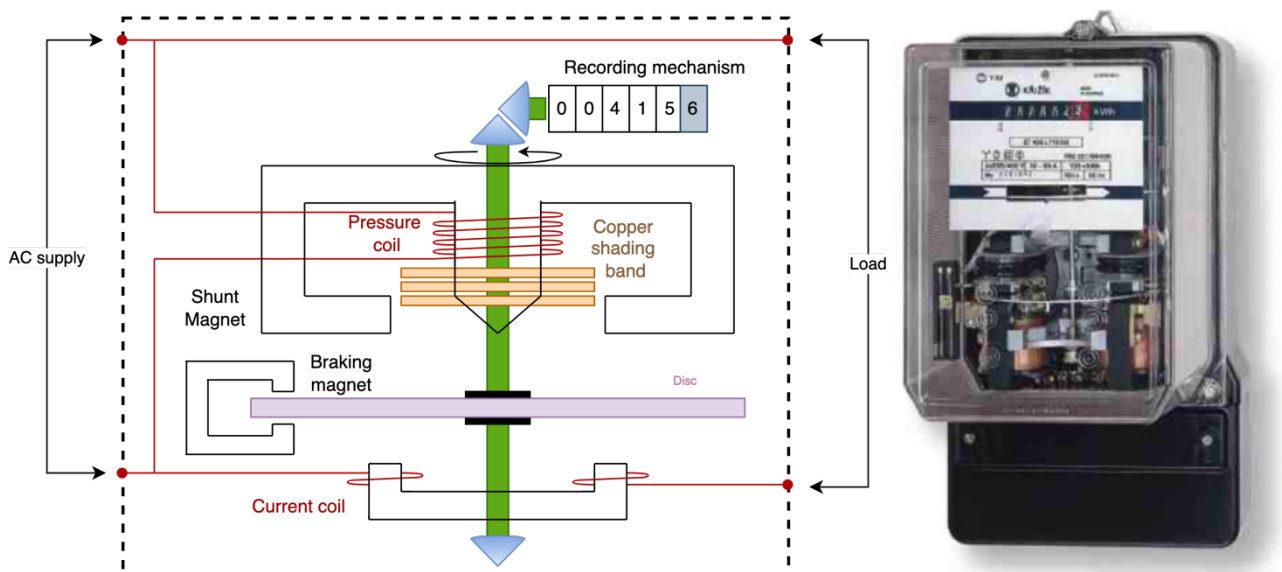


Fig.1 Principle of electromechanical meter (left), example of realization (right)

2 Solid state power meters

More modern approach does not use any moving parts. Such meters are called **solid state electricity meters**.

They also capture the current and voltage but instead of rotating disk, coils, gears they use electronic components and circuits, such as analog to digital conversion circuits (*ADC*), microprocessors, LCD displays, etc. They are capable to measure multiple values such as voltage, active power, reactive power, power factor, etc.

Typical construction is depicted on Fig. 2.

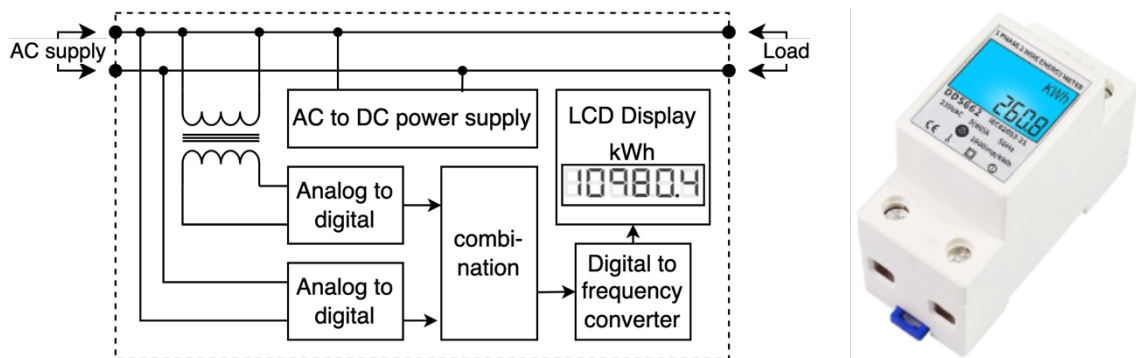


Fig. 2 Principle of a solid state electricity meter (left), example of realization (right)

Naturally, there arises the question how to convey the data from the meter to the information system that process the data. The early architectures such as **automatic meter reading (AMR)** set the goal to automate the process of meter readings.

Before the introduction of AMR, utilities company had to do everything manually by staff directly reading the digits from the devices. Huge amount of time was wasted by this process at service areas.

According to the Demand Response and Advanced Metering Coalition, AMR is defined as a “system where aggregated kWh / water / gas usage, and in some cases demand, is retrieved via an automatic means such as a **drive-by vehicle or walk-by handheld system**.” [1].

The reading process is usually radio-frequency (*RF*) based, where various RF technologies can be used such as ZigBee, Bluetooth, WiFi, etc. The **fixed network** connection can be used as well.

Regardless of how the meter is read, **the communication is one-way**. The meter talks to the meter-reading device, but the device cannot send a command back to the meter. AMR system delivers data to the **company’s databases**. Data in AMR systems are typically gathered only **monthly or, at most, daily**.