Advanced Water Metering

Overview

Urban Water Scenario

Over the last few decades, India has witnessed a rapid increase in the urban population. It is estimated that 50% of the population in India will be in urban centres by the year 2050. The growing population invariably exerts tremendous pressure on the existing natural resources. It is estimated that 85 percent of urban population has access to drinking water. However, only a small percentage of the people have access to safe drinking water.

The major issues concerning 'Water Resources' in India can be broadly classified into issues of water quality and quantity (availability), for use in the domestic, industrial and service sectors. While the former issue is been addressed by Various water treatment techniques that has been put in place, the latter which focusses on the Quantity or availability of water has also gained significant importance and is being cataered by metering water consumption.

Water treatment is an expensive affair and that makes the treated water all the more valuable. As an extension to judicious use of the valuable resource , water, metering of water has become increasingly significant especially in urban areas where House service connections are gradually being equipped with Water meters.

Various water utilities of the state have policies and projects in place to convert unmetered water connections converted into metered one in order to stop wastage of potable water.

The Challenge

Though meters have been installed in an attempt to keep a check on water usage by the consumer, however equally important is to ensure that the water meters are metering correctly and are being read accurately for the quantity consumed. In most of the cities in India manual meter reading and hand-written method of meter reading is prevalent in which a meter reader from the Utility physically come to see what reading is been indicated by the meter. Manual meter reading carries with itself many opportunities for human error to cause incorrect reading which can further gives rise to Incorrect billing. Human Error usually encompasses visually misinterpreting the physical meter reading, transposing numbers when entering the meter reading, incorrectly entering the meter reading into the billing system, etc.

The Solution

Automated Meter Reading (AMR), and Advanced Metering Infrastructure (AMI), can address the issue in manual meter reading methods as well as many others like analyzing consumer behavior, network issues, Identifying meter tampering, recording peak flow etc. In the typical life of an AMR or AMI system, the vast majority of all meters are read correctly and accurate billing is done.

Over the last couple of years India has completed a number of small pilots for advanced metering solutions which resulted in enhanced water management, reduced water loss and improved water distribution and continuity. Due to the success of these pilot projects, a number of larger projects for advanced meters and solutions have recently been announced.

Following factors ,must be taken into consideration for a successful operation of Water Metering with the help of AMR system to generate correct bill eventually :

1. Meter Type and right sizing
2. Meter Installation Errors
3. Meter Misreads
4. Checking for Tampering

The purpose of this paper is to :

1) Insights about water metering and Automated Meter Reading

2) Identifying factors affecting meter reading and contribution of AMR system in reducing errors.

How the Meter System Works

First, to understand the factors for this seamless operation of accurate meter reading , it is important to understand how the metering system works.

In a typical meter, the volume or speed of water flow is measured by a mechanical device. The water moving through the meter's measuring chamber causes a magnet to rotate in proportion to the measuring element. A magnetically driven register takes those rotations and calculates volume based on gears which are linked to the rotation speed of the measuring element magnet. These gears turn an odometer wheel which reports the corresponding volume.

Based on the water quality in india, usually a Multijet, Dry Dial, magnetically coupled meter is installed. The operating principles are based on the tangential incidence of a multiple water jets over a radial impeller (turbine) placed inside the measuring chamber of the meter.The rotation velocity of the impeller is proportional to the impact velocity of the water, or in other words, to the circulation of flow rate.

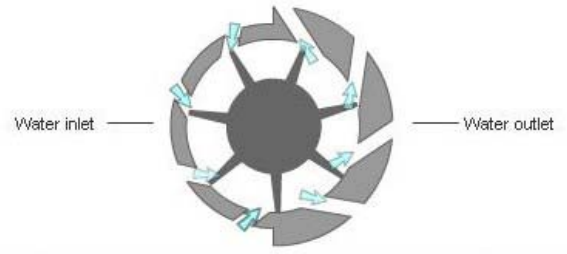
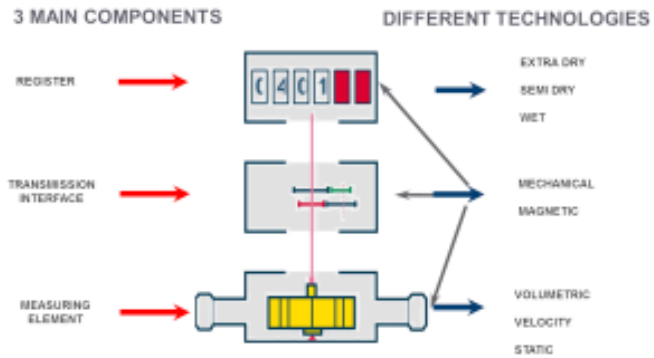
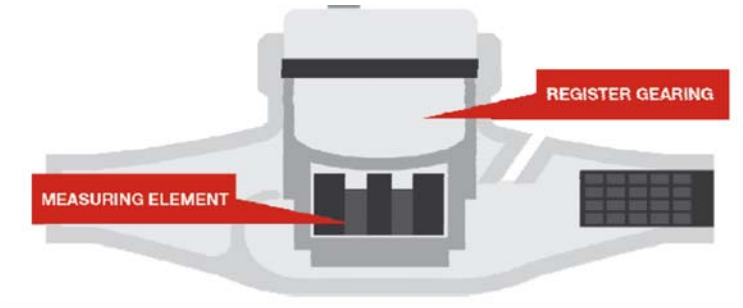


Image below shows the three major components of a typical meter.



Cross Section of a basic water meter



Automated Meter Reading or AMR technology

Automatic Meter Reading is automatically collecting consumption, diagnostic, and status data from water meter devices and transferring that data to a central database for billing, troubleshooting, and analyzing.

AMR technologies include

1. **Touch base**
2. **Radio frequency (RF) having Walk by, Drive by and fixed network system.**
3. **GSM & GPRS.**

- **Touch based AMR** :- Meter reader carries a data collection device with a wand or probe. The device automatically collects the readings from a meter by touching or placing the read probe in close proximity to a reading coil enclosed in the touchpad.
- **Radio Frequency (RF) based AMR** :- The common technologies are ones using either handheld, mobile or a fixed network. The RF systems and equipments in use are two-way and one-way. RF based meter reading usually eliminates the need for the meter reader to enter the property or home, or to locate and open an underground meter pit
    - **Walk By** :- In Walk By AMR, a meter reader carries a handheld computer with a built-in or attached receiver/transceiver (radio frequency) to collect meter readings from an AMR meter. This is referred to as “walk-by” meter reading.
    - **Mobile or “Drive-By”** :- In Drive By, a reading device is installed in a vehicle. The meter reader drives the vehicle, while the reading device automatically collects the meter readings. Walk By or Drive By solution is best suitable for residential areas.
    - **Fixed Network AMR :-** This is a method where a network is permanently installed to capture meter readings. This method can consist of a series of antennas, towers, collectors, repeaters, or other permanently installed infrastructure to collect transmissions of meter readings from AMR meters and get the data to a central computer without a person in the field to collect it.

Mobile meter data collection systems has been widely adopted by utilities and service companies all around the globe and it’s increasingly being accepted in various parts in India too. This mature technology significantly accelerates meter reading speed and avoids risk of visual reading mistakes.

- **GSM/GPRS based AMR**: - In this technology Data Loggers are used with GSM/ GPRS to transmit the readings to a mobile or a central unit, by sending SMS/Data, which ensures recording of Accurate meter reading and no estimates. This technology is usually adopted from Bulk water meters, where consumption is high and also these consumers are the main contributors of utilities revenue.

AMR meters records consumption and alarms/tamper information and communicate the data to data collection systems including Handheld device, Mobile AMR systems and Fixed Network AMI systems.

Factors for Accurate Reading

A variety of factors can affect water meter reading accuracy.

Meter Type and Rightsizing

If a meter is not optimized for a particular application, it will not measure consumption accurately, resulting in revenue losses, or, in some cases, over-registration. Therefore, it is important to determine the ideal meter size and type, compound, turbine etc.. When installing a water meter, or when auditing an existing meter setting, one should refer to the appropriate meter manufacturer's installation recommendations to ensure a long, accurate meter life.

AMR meters with advanced functionality can help utilities determine if their meters are right-sized for a particular application and record water consumption patterns which are analyzed to help determine water meter replacements. Also,it help utilities identify underperforming water meters that may need to be replaced. It can be used at any time without having to physically access the meter to add any equipment.

Meter Installation Errors

Proper installation of the meter is important for assuring billing accuracy. There are many things that can occur during installation that could potentially cause an inaccurate meter read that is greater or less than the actual consumption amount.

Below are a few recommendations for correct meter installation for accurate reading, If any of the following conditions are not followed , it could result in incorrect reads:

- Meter must be installed in either horizontal or vertical position as per its specifications.
- The arrow of flow on meter body must coincide with direction of flow in the pipeline.
- The pipework must have previously been flushed out via a dummy length of pipe fitted where the meter is to be installed (if necessary for several days)
- When putting the pipework into service, the upstream stopcock must be opened very slowly until the air has been totally evacuated.
- The meter must always be installed at the low point of the pipework.
- After installing the meter, charge the line into service by opening the stopcock very slowly until the air has been totally evacuated.
- To allow draining the pipework and exchanging the meter, it is advised to connect valve both upstream and downstream of the meter.

Meter Misreads

Many factors can contribute to the misreading of a meter. In a direct-read situation, it is possible that a meter reader could misread the register number and write down a number higher or lower than the actual consumption amount – simple human error. If a meter is installed indoors, the might not be able to accessible requiring an estimated or "curb" read.

AMR/AMI generally eliminates these potential misreads.

Incorrect data elements in a utility's Customer Information System (CIS) can lead to collected readings being formatted incorrectly. Multiplier and truncation values need to be set properly based on the register/meter sizes and number of dials.

Checking for Tampering

Meter tampering is a situation where a meter has been illegally altered. Common examples are meter bypassing, use of magnets to slow the meter recording, and broken meter seals. With the increased use of AMR/AMI technology, gathering tamper information has become increasingly important.

Fortunately, AMR Water meters come equipped with tamper indicators to help utilities identify if someone has tampered with a meter (possibly in attempt to steal water) or to identify if there is a problem with the meter. Monitoring for a change in a tamper value can help alert utilities to a problem with a meter or meter tampering.

If a tamper is indicated, this information is collected and displayed with the meter usage data via walk-by and drive-by reading systems. If the customer is on-site the meter reader may choose to deal with the problem immediately. Alternatively, with AMR systems, the utility can generate a report in the office from the collected data to provide field service personnel information and take appropriate action as per the utility's policy.

Additionally, the interval data (hourly/Daily/Weekly/Monthly) gathered by AMR meters allows utilities to monitor for unusual water usage activity which could indicate a leak.

Using Software Applications to Detect Inaccurate Usage

There are several methods for identifying and detecting inaccurate usage. Audits can be used to help identify many of the above examples by monitoring month to month usage and calculating estimated ranges for the current month. Tampers can be monitored to detect potential tampering as well as other events.

Conclusion

- AMR/AMI technologies are often implemented to fix errors caused by aging infrastructure or human error.
- With the proper information and tools, utilities can quickly fix and avoid billing errors, resulting in fewer lost revenues and more satisfied customers.
- Accurate, reliable and electronic data transfer from the meter register to the billing system expeditiously leading to customer satisfaction.
- Solution to improve meter reading efficiency and eliminate billing data manipulation without having to intrude into the consumer premises.

- Improve morale of the workforce in being able to use advanced, efficient and easy-to-use meter reading system.
- Reduce operating costs, read to bill times, bill disputes, non-revenue water
- Improve billing accuracy and Improve customer satisfaction.

For more information about Itron products and solutions for the water utility industry including billing accuracy or access to other White Papers, start here: www.itron.com.

Authors:

Kalpana Bhaskar
Astt. Product Manager

Ajit Magar
Technical Consultant

Itron India Pvt. Ltd.
