AIA AUTOMATION INDUSTRY ASSOCIATION

Automation India

Enabling Global Competitiveness

Issue 13 – October 2008 A newsletter of the Automation Industry Association of India

President's Message

Dear Friends,

After the success of PharmaTech 2008 earlier this year, we decided to extend our focus to another extremely important segment, where public and private sector partnership is of paramount importance — Water & Waste-Water Industry. The Water & Waste-Water Industry affects our lives — now & in the somewhat uncertain future! Water Security for the nation is the 'mantra' of our Government. Some say, if there is a third world-war it would be on ownership of diminishing Water Resources!

AIA has once again planned a well-rounded choice of topics and speakers & we hope for maximum participation from all the industry stakeholders particularly, the End User segment from the Corporations & Municipalities, as well as CETPs. This issue, coinciding with WaterTech 2008, has ***Mr R Vanamali as our Guest Editor****. Mr Vanamali, Director, Director-Strategic Business Development, Endress+Hauser (India) Pvt. Ltd. Mr Vanamali, has been active in several initiatives promoting tangible benefits of new standards and technology.*

The newsletter showcases learnings from India and abroad. Presented in a vendor-neutral manner, you will find many interesting technical & application insights, which I'm sure will help users and integrators innovate and implement more effective automation strategies in the future projects. AIA would be happy to play the role of a knowledge partner and facilitate the Government's mission of 'Sustained Water Security for the Nation'.

Automation needs to be an integral part of engineering education. AIA recognizes the stiff challenge we face in delivering hi-end technology education across the country. The preceding quarter of 2008 witnessed the launch of AIA's Campus Connect Initiative. A high quality Industry-Academia workshop at AKG College of Engineering, Ghaziabad brought together eminent Policy Influencers, Users, Automation Industry Leaders, Academia and HR managers to debate various models of collaboration. Building further, we have constituted multi-vendor training teams, and the first such team is partnering IIT Madras to conduct an Automation & Robotics training programme for engineers from Automotive Industry. We welcome all sectors of Industry to try this partnership model for their training needs, and we assure them that will get quality upfront.

Meanwhile, the preparations for our first International Exhibition and Conference are underway. All our readers will be duly informed of the highlights through emailers. I trust you will find your share of interest.

With best wishes,

SUNIL KHANNA
Hon. President, AIA

Automation Strategies to Improve Water Supply and Water Quality

17th October 2008
Chennai

Welcome address
SUNIL KHANNA

Inaugural address
AK MEHTA

Keynote address
Enhancing Urban Water Systems: Emerging Opportunities for New Technologies
Prof. SRINIVAS CHARY VEDALA

Curtain raiser
R VANAMALI

Challenges in Modernisation of Existing Systems
ANAND WACHASUNDER

On-line Analysis and Control
JOHN RODRIGUES

Ground Water Monitoring and Standards
S SEKAR

Cleaning and Re-use of Waste Water
D MADHAVAMOORTHY

Total Analytical Solutions
AJIT JOSHI

Intangibles in Re-use of Waste Water
Dr S SUNDARAMOORTHY

Micro Sewage Treatment for Rural Areas
Dr ANAL CHAVAN

Water Audit and Leakage Management
PRANOY SINHA

Enabling 24x7 Supply
Dr SV DAHASAHASRA

Revenue Maximisation
DEVARAJAN ANAND KUMAR

From the Guest Editor

Dear Readers,

In managing the integrated cycle of water supply, new standards of efficiency, quality and profitability have emerged in other countries and we have some really good projects shaping up in our own country. In particular, the focus on how process and asset related data is measured, acquired, diagnosed and presented, has been remarkable and widespread. With the technological evolution of instruments, the wide availability of field buses and communication techniques based on established protocols, we are able to make these new functionalities possible. Most other industrial segments have derived considerable advantages integrating automation strategies with their operational goals; we are now seeing the awareness spread in the Water & Waster-Water Industry.

The purpose of this newsletter is to present a uniformed choice of technical options using proven automation technology and architecture, starting from the measuring instruments, going through the digital communication aspects, energy and cost savings, reliability and other asset management functionalities. Contributions have come from many companies who have shared their experiential learning. We are thankful to all the authors.

The newsletter is being released at WaterTech 2008, Chennai. This symposium will address 3 vital areas that automation technology can surely impact : Potable Water Quality, Waste-Water Treatment & Recycling, and Water Conservation. While speakers from Government & Academia will share with us the macro-aspects of Water & Waste-Water Management; there will a good dose of technology and operational sharing in all the 3 technical sessions. All speakers & technical presenters are renowned & acknowledged professionals in their fields. We expect delegates from various Water Boards, Municipalities, OEMs, Consultants and Automation professionals to participate enthusiastically & benefit from this knowledge-sharing event & return with more value-added ideas for their own projects. We are grateful to IWWA for encouraging and supporting this initiative.

R VANAMALI
Member, Executive Council, AIA

For more information on WaterTech 2008, visit www.aia-india.org

From measurement, control to asset management: pathway for the water industry

The water treatment plant in Dego, Savona, Italy is part of the CIRA consortium which operates within the consortium member municipalities of Cairo Montenotte, Carcare, Dego, Altare and the municipalities of Cosseria, Plodio, Bormida, Mallare and Pallare, spread over 200 sq.km. The plant caters for a total of about 50,000 equivalent residents, also treating wastewater coming from industrial sites, with an annual output of more than three million cubic meters of treated wastewater and a production of 1,400 tons of sludge obtained from the anaerobic digestion process.

Overview of the Water Treatment Plant in Dego, Savona, Italy

Operation of the city and industrial sewage treatment plant is based on the activated sludge biological process, which is broken down into two distinct lines: one for sewage treatment, the other for sludge treatment.

All process compartments of the water treatment plant are currently operating, The water treatment plant is entirely equipped with intelligent devices with Profibus technology, which include in-line analysis measurements, ultrasound and magnetic flow rate measurements, ultrasound and water head level measurements, temperature measurements, automatic samplers, etc.

The main functions of the system are connected to the control of the intake works lifting system, to the control of motor-operated by-pass management valves, to local station management, to blower regulation via inverter and to the control and management of instruments and motors by acquiring the measured values, diagnostic parameters and configurations.

A supervising and asset management system has been developed on the basis of this architecture, which can be used both at the water treatment plant and from remote stations through web access.

ASSET MANAGEMENT SYSTEM

In addition to the automation and supervising system the water treatment plant has also been equipped with an asset management system. The installed system is based on the FDT/DTM software technology which constitutes a multi-vendor standard and ensures openness and performance with the following provisions:

- Sensor setup and configuration saving
- Download of source configuration if the device is replaced
- Technical documentation and maintenance management
- On-line diagnostic activity execution
- Download via web of the instrument production certificates so as to directly find spare parts, any substitutes of obsolete instruments, certificates and technical documentation in general
- Autonomous management of engineering and purchase via e-shop.

BASIC REQUIREMENTS

The circulation of information is the key to everything. The actual challenge is to create open and high-performance architectures. An architecture declared open is actually multi-vendor at all levels and that the customers can actually select the most important information to manage their process efficiently.

The ability to select the data that actually contributes to giving added value to management among a large quantity of data available is all important. We ask ourselves three simple questions:

1. Do we know exactly which assets of our plant are critical and how to maintain them efficiently?
2. Are we sure that the current operational maintenance choices minimize the risk of unscheduled downtime?
3. Are we sure that the current preventive maintenance activities are the most effective in relation to their cost?

DIGITAL PROTOCOLS

The advent of digital protocols in process signal transmission has revolutionized information processing modalities for plant management and automation. First of all, consider the improvement in terms of accuracy of the processed signal: a traditional 4.20 mA signal requires multiple analog/digital conversions that deteriorate the signal; a native digital signal is processed and transmitted as it is, maintaining high quality resolution characteristics.

Furthermore, a 4..20 mA signal brings one single piece

of information connected to the trend of the physical value that represents it in a directly proportional way; instead, a digital signal can bring multiple pieces of information depending on the coding that defines the used protocol; for example, not only does the main measured value transit on the backbone, but so does other process information as well as the diagnostic status of the device that makes the measurement. The huge increase in efficiency due to this macroscopic difference is already apparent.

Another revolution deriving from the nature of digital communication is signal Bi-directionality: the same backbone allows data not only to be acquired but also to be sent, thus allowing the desired control actions to be performed directly and effectively.

From the installation viewpoint digital innovation has allowed cabling structures to be simplified and electrical and instrumental boards to be considerably reduced, thus resulting in an overall saving of approximately 15%.

INFORMATION FOR BETTER MANAGEMENT

In a system like the one analyzed the information content is vast and making all the information available does not automatically mean optimum management.

Only an exhaustive study of the plant allows us to fully understand which instruments, and consequently which information among that available, can effectively contribute to optimum management.

In fact, optimizing management costs does not have one single solution since there are many variables at stake, such as plant layout, the type of sensors and actuators installed and the management logics. Below is an example of a study carried out for the water treatment plant in Dego, which points out that only a part of all the devices to be managed is actually at high risk, and only half of them needs specific maintenance.

Process Risk	Instrumentation Risk			Total TAG	Summary	
	A	B	C			
	High	Med	Low			
1 - High	3	3	1	7	35	Process loops
2 - Med	12	59	33	104	11	Measuring principles
3 - Low	16	26	16	58	11	Process zones
Total TAG	31	88	50	169	29	Vendor equipments

Asset Risk Analysis — Example

Cost optimization can therefore be achieved by controlling the critical "areas", which makes a direct impact on maintenance budget control, spare part warehouse control, decreasing plant downtime risks, technological adjustment of the plants, plant standardization and maintenance activity planning.

CONCLUSION

According to studies, a Plant Asset Management system can decrease the costs associated with maintenance procedures by 30%, that is to say increase the efficiency of the resources available; besides the macroscopic reductions in plant downtime costs, which arise due to insufficient or improperly targeted maintenance activity.

Among all the installed components, the field components were the most critical ones from a maintenance point of view, since there were higher percentages of sensors, remote I/O, positioners and actuators, which were also broken up and scattered over a wide area; such devices are typically subject to greater wear and require periodic maintenance since they are associated with plant safety.

What has been implemented is actually a system that we call "Life Cycle Management", whose purpose is to enable the user in managing the entire life cycle of the plant. Now that the first year of management has passed, the user can start reaching conclusions and make the first assessments.

We have seen how much information can come from the field thanks to modern technologies and "real" system openness. Wastewater industry can migrate from cost saving during installation and startup to cost saving during operation with improved functionalities.

A. Casiraghi, Shrikant Kulkarni,
A. Provesi, A. Icardi

LUMINESCENCE TECHNOLOGY FOR ON-LINE DISSOLVED OXYGEN (DO) MEASUREMENT

Current available technology to measure Dissolved Oxygen in Aeration basin is based on amperometric measuring principle. It requires regular maintenance in terms of replacement of membranes and electrolyte. Also the DO measurement is dependent on the flow rate of sample.

New unique design of DO sensors is based on luminescence technology. This technology does not need any membrane or electrolyte which makes it almost maintenance free. Also the response time is much quick which makes it ideal for control applications in waste water plant.

For the measurement of oxygen concentration, the optical phase shift between blue and red light pulses is measured with high precision. The entire measurement, calculation and output of the measured value occur inside the sensor. This sensor measures the partial pressure of oxygen pO2 just as classical sensors do; This can be processed for display as % air saturation, concentration in mg/l, ppm or even as ppb.

The sensor works by monitoring the status of a blue LED with one of the photodiodes. Another photodiode with the red filter measures the oxygen dependent red light. The red light is generated on the luminophore through luminescence (fluorescence) after stimulation by the blue light. Electrons are excited to a higher energy level, and return to their original level after emission of red light. When the luminophore comes into contact with elemental oxygen, the oxygen molecules absorb energy, resulting in reduced intensity of red light emission. This difference in intensity is analyzed within the instrument's self-monitoring system.

AJIT JOSHI

Automation overview for successful water management

"WATER" is the first Principle of all things. All things come from WATER, and all things return to WATER.

Water is one of our most important natural resources. We drink it, use it for cooking and cleaning, and depend on it in many aspects of our lives. As such, it shouldn't be surprising that water abundance is becoming a national priority. Assured treated water supplies and environmentally acceptable waste water treatment is the current focus for the water industry in India. Various multilateral financing agencies (such as ADB, World Bank, JBIC & US Aid) and Government of India, through the JNNURM programme have huge allocations lined up for Drinking Water & Sanitation projects.

All new Drinking Water projects in India are focusing on

- 24 *x* 7 Supply
- Complete Automation of the water supply scheme.
- Water Metering in the distribution network to know unaccounted flow of water (UFW).

Though Instrumentation & Automation accounts for between 3 -5% of a complete project cost, it impacts the final result most crucially. In this article we shall focus on the importance of instrument selection. Further articles shall deal with SCADA and teleprocessing technologies.

METERING & WATER QUALITY ANALYSIS

Whether it's measuring household or office building water consumption, measuring water in open channels coming from natural reservoirs, or measuring water used inside chemical or power plants, water flow measurement is often a necessity.

To understand and know the supply - demand behavior and the plant efficiency it is very important to measure the quantity of water at various stages in any water supply scheme such as at Raw Water Intake, WTP inlet, WTP Outlet. For measuring the treatment losses flowmeters will be required to be installed at inlet to backwash tank, outlet to backwash tank & de-sludging line.

SHIFT FROM MECHANICAL METERS TO ELECTROMAGNETIC FLOWMETERS

In this industry, turbine and positive displacement flowmeters were the predominant technology options. However, with the emergence of full-bore, in-line electromagnetic flowmeters the shift is beginning to make economic sense both on account of reliability and accuracy.

Mechanical meters have a moving part which obstructs flow and creates a pressure drop. Magnetic flowmeters do not have any moving part, do not restrict the flow and hence there is negligible pressure drop and no wear and tear which lowers maintenance and downtime. Electromagnetic flowmeters can be used for slurry application having high solid contents.

ECONOMIC COMPARISON — MAGNETIC VS MECHANICAL

Case study 1: Impact on Billing

Consider a Flow rate of 2,000M3/hr, and water revenue of Rs.9 /M3

500mm Magnetic flowmeter	**500mm Mechanical Meter**
Accuracy: ± 0.5%	Accuracy: ± 1% (best estimate under site conditions)
Possible error: 10 M3/hr	Possible error: 20 M3/hr

Improvement in measurement and billing, by using inline calibrated magnetic flowmeter is upto 10 M3/hr. (20-10)

Average billing inaccuracy per day = 10x24x9/2 =Rs. 1,080/-

Annualised impact : Rs 3.9 lacs

Case study 2: Impact on Energy Consumption

The pressure loss of a single mechanical bulk meter and strainer will be approximately 0.5 bar on a 600mm line.

The energy (pumping) costs per year as a result of this pressure loss can be calculated by using the simple formula

Energy (pumping) cost = (W/1000) (Operating hours per year) (Rs./kW.hr)

where W = $\triangle$P (kPa) x Q (LPM)/60η ($\triangle$P is pressure drop across metering skid in kPa, Q is flow rate in LPM, η is pump efficiency)

Assuming that the $\triangle$P is 0.5 Bar (50 kPa), flow Q is 2000 m3/hr (33,000 LPM), pump efficiency is 80%, the pipeline is in operation throughout the year (8,760 hrs) & energy cost is Rs. 4.5 /kW.hr

Hourly energy wasted per hour: 50 x 33,000/(60 x 0.8)/ 1,000 = 34.375 kW

Annual Energy wasted = Rs (34.375 x 8,760 x 4.5) = Rs 13.5 lacs

WATER QUALITY ANALYSERS

pH

Water quality depends on the source of it. Extreme conditions of Hard or Soft nature of water are harmful. pH is the is an important parameter to indicate purity of water. Continuous monitoring of pH helps in keeping close track of changes of pH in sample water and also it helps to take a control action to keep pH within required band. The most important part of any pH system is pH electrode. Proper Selection of suitable pH electrode for given application is important to get accurate results. This also helps in keeping pH system on line all the time and requires less maintenance. pH electrode measuring glass should withstand chemicals since treatment of water involve use of different chemicals.

TURBIDITY

Turbidity is another important parameter to indicate good quality of drinking water. Turbidity is measured with light scattering principle. Even though the water is free from suspended solids, there is good chance of having high turbidity which carries lot of microorganisms harmful for human beings. As per international standards turbidity of drinking water has to be of less than 5 NTU. Some stringent quality standards calls for turbidity of less than 1 NTU.

Such low value, accurate measurement is possible with good quality of turbidity sensor. Such sensors are immune to false signals like reflections from walls of mounting chambers or reflections because of natural light sources. They are free from interferences caused by air bubbles present in water. Self cleaning facility like Wiper cleaning or ultrasonic cleaning are features to look for in good quality turbidity sensors.

RESIDUAL CHLORINE

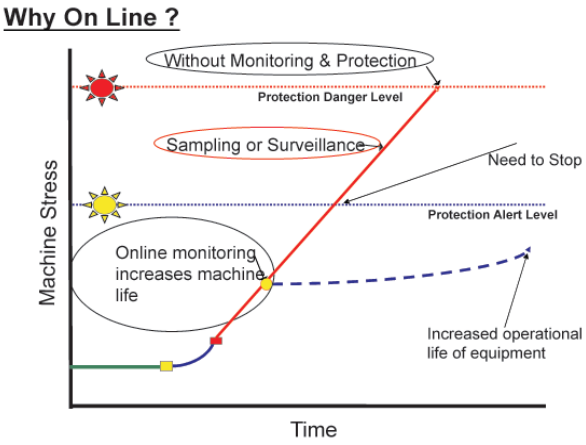
Chlorine is used to disinfect water from all bacteria. One should have optimum level of Chlorine in drinking water. Excess Chlorine is harmful to human body and less chlorine won't keep water safe for long time. Hence one always keep some excess chlorine in water apart from level which takes part in treatment of water. This is called as free chlorine or residual chlorine.

Most of the Chlorine sensor measures Hypochlorous acid. To calculate Residual Chlorine from HOCL, pH compensation is required. Also Residual Chlorine measurement requires sample temperature compensation.

PREVENTIVE MAINTENANCE

Progressive Water Boards in India are implementing on-line vibration monitoring system for all critical rotary equipments as a part of preventive maintenance.

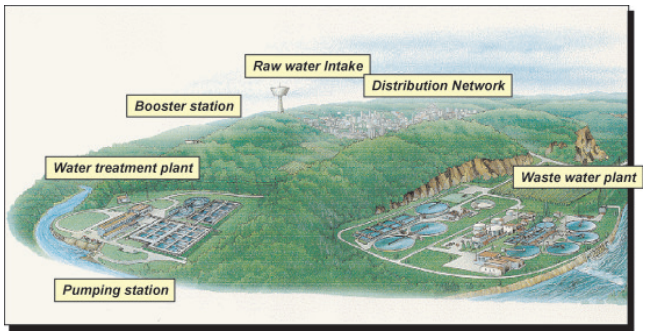
Any pump vibration monitoring system would primarily measure relative shaft vibration and absolute bearing vibration. A relative shaft vibration is the vibration (usually in microns) which is mainly measured for journal bearing type large Pumps/Motors. It is measured by mounting



Non Contact Type Eddy current sensors on the shaft. Absolute bearing vibration is the vibration (usually in mm/sec) which is mainly measured for Antifriction / Roller / Ball bearing type Pumps/Motors. It is measured by mounting Contact Type Accelerometer or velocity sensors on the bearing housing.

COMPLETE AUTOMATION

Any water supply scheme would comprise of Raw Water Pumping Station, Water Treatment Plant & Clear Water Pumping station.



The scope of a complete automation system would cover engineering, installation, diagnostic tools, data communication and reporting of

- Mechanical Equipment — Raw water, dewatering and backwash Pumps, Butterfly, motorized, bleeding and feeder Valves, Thrust bearings
- Electrical Systems — Power Supply, LT and auxiliary Motors, Circuit Breakers
- Instrumentation — Flow meters, Level sensors, Pressure transmitters, Turbidity sensors, pH sensors, bearing temperature sensors. Network & Data interface Equipment — RTUs, Modems, Telemetry Receivers, Gateways

While Sensing is key to a strong foundation for an Automation project, the SCADA software ties up the entire mass of data and constitutes the visible face of a Water Management System. A complete automation system will help in improving the efficiency of the water supply equipment and the overall water treatment and distribution systems, paving the way for predictive maintenance, asset optimization and accurate billing.

Rakesh Mishra

Managing Utility Assets with the Power of your Data

Companies in water/wastewater treatment, distribution and collection want to more effectively integrate and analyze real-time and historical data with existing systems, automation and controls for more sustainable, profitable operations.

Utilities invest considerable sums of money in their water and wastewater networks — so it is probably worth spending a little more to ensure they operate efficiently. As the vital importance of water conservation grows ever more apparent, large amounts (of water and money) can be saved simply through rapid detection of leaks and other untoward events on a water network's pipelines. The water industry has been slow to take advantage of information technology, but it is catching up quickly. In many parts of the world, water managers now depend entirely on real-time data to manage their water supply and wastewater services. Automation has become a core enabler of the operations.

Water loss due to leakages is a bigger problem than people may think. With regard to water leakage in India, this is of major concern and of significant importance to those companies involved in the transportation of water any leakage can have significant financial consequences.

In India there is great opportunity and benefit to manage leakage considering the scarcity and cost of drinking water in the region coupled with unreliable weather prediction and truant monsoons. It is gradually being accepted that Water networks need to be managed and maintained around the clock and, as a result, the concept of infrastructure asset management,

Conventional methods of leak detection rely mainly on the expertise of operators to identify leaks within the system based on pressure losses at various locations. Pressure management and DMAs (district metered areas) are used to prevent leaks and detection is typically done by using acoustic listening devices, leak noise correlators and tethered hydrophone systems

Although this method works in the case of large leaks in which there is a considerable loss of pressure in the pipeline, it is more difficult to identify smaller leaks which, over time, cause a majority of the total water lost. Leaks that are not visible in the water distribution system can go undetected for months and even years. Typically water leaks don't happen quickly — they appear over a period of time.

The challenge is not only to detect, but even avoid a water leak in the first place. Data acquisition software allows a utility to collect data from all control systems and instrumentation, which is the key to water leakage prevention and detection. Without the data, a utility can only guess at the amount of leakage and would not be able to detect long run leaks that are not visible.

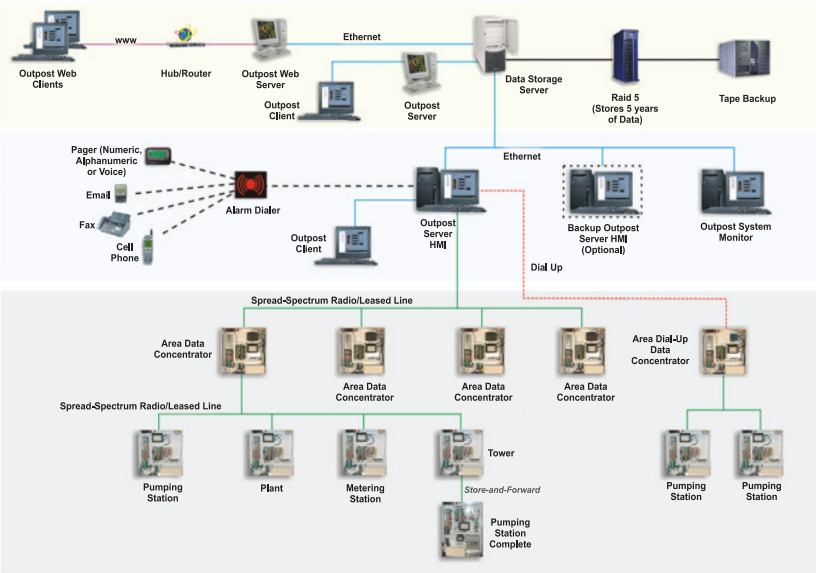
Utilities need to be able to collect and analyse data before any optimisation or leakage reduction can be accomplished and measured. Based on the constant stream of data collected from water meters, the system can conduct real-time water balances to alert operators of possible leaks or anomalies in the entire water distribution network. It can reconcile the entire water distribution system in real-time.

A software-based leak detection system will assist the operators of the pipeline to quickly and accurately identify potential and actual leaks and put into place measures to reduce the losses.

In an attempt to overcome some of the telemetry issues which generally face these systems, solutions have been developed which can provide leak detection analysis based on data received on an hourly basis, performing analysis runs of the hourly data within minutes to determine the status of the pipeline.

Real-time data describing various pumping scenarios is brought into the system and analyzed via performance equations to give required summary information (e.g., daily totals, averages). The system is configured to perform a range of analyses automatically with real-time and historical data, such as: comparisons conducted between seasonal periods; and overlaying

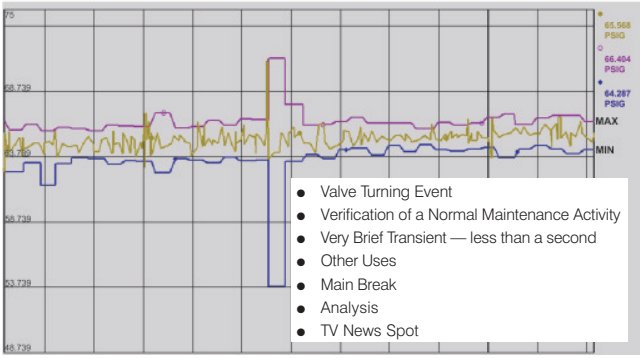
TYPICAL NETWORK ARCHITECTURE



similar months from a number of different years and contrasting aggregates over two- to five-year periods.

Modern analytic tools provide the ability to embed analysis and models automatically, as opposed to manually combing data from disparate systems, resulting in predictive information that gives insight into the capability of the infrastructure to meet operational demands.

In the future, users can plan to take this a step further, to add system capabilities that proactively notify users — a big step, which will eliminate the requirement for constant monitoring.



Pressure Monitoring of the Water Distribution System allows for: leak detection, water hammer source identification, and logging valve turning events.

DEMYSTIFYING THE ENTERPRISE DATA HISTORIAN

An enterprise data historian is a central data repository for all process control information in your enterprise, encompassing all real-time and historical information (time series) collected from automation and control systems. A valuable tool for utilities, data historians turn raw process control data into actionable, consistent information, leading to improved decision making and efficient operations.

Control and automation systems can generate volumes of data — from sub-second to only on an exception-basis — but companies don't know how much data is going to be generated (e.g.. number of values and changes in values); therefore, they cannot effectively collect all the information in relational databases.

The data historian, based on a time-series database (non-relational), allows users to collect all the relevant information they need and analyze it based on raw and aggregated values. Time-series process control data can then be leveraged with other existing enterprise or business systems, such as: ERP, CMMS, GIS mapping, LIMS or asset management.

Abraham Samson

Sound advice

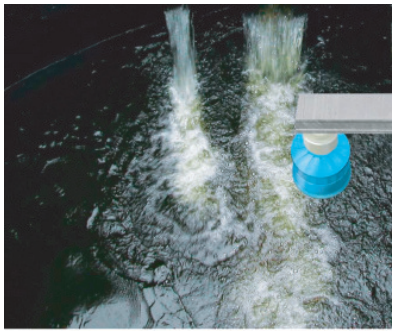
The measurement of level and flow is crucial to effective and efficient waste water treatment. Ultrasonic technology promises that and some more.

When it comes to flow and level measurement in waste water treatment, ultrasonic is the way to go. The single phrase that sums up the benefits of ultrasonic is non-contact. You have a choice in measuring sewage level, by being in contact with it or not being in contact.

Level devices can be continuous like ultrasonic and radar or point-level like floats and hydrostatic. Contact measurement devices like floats, bubbler and hydrostatic systems are vulnerable to clogging and other problems caused by suspended solids, harsh corrosives, grease and silt in the effluent, and need to be cleaned and replaced often. The higher maintenance costs and repairs associated with contacting devices can exceed any initial savings. Moreover, there is also a high element of risk to personnel going down into wet wells for maintenance of contact equipment.

Ultrasonic meters are amenable to quicker installation and configuration. They can also configured on site. The unit acts as an ultrasonic tape measure. Once the empty distance is programmed in, the unit will base all its calculation from this reference. The empty distance could be from the transducer face to the bottom of the well or wherever you want the end point to be. The unit can be commissioned, whether the well has sewage in or not. Hydrostatic devices have to be calibrated in the factory. So if you order them wrong, you are stuck.

As the core purpose of level measurement is one of efficiently controlling a process using pumps and valves, ultrasonic level meters are a smart choice because they can provide the information you need to monitor and control pumps effectively. Most ultrasonic meters come equipped with relays for simple pump control that facilitate, for instance, economy pumping by scheduling

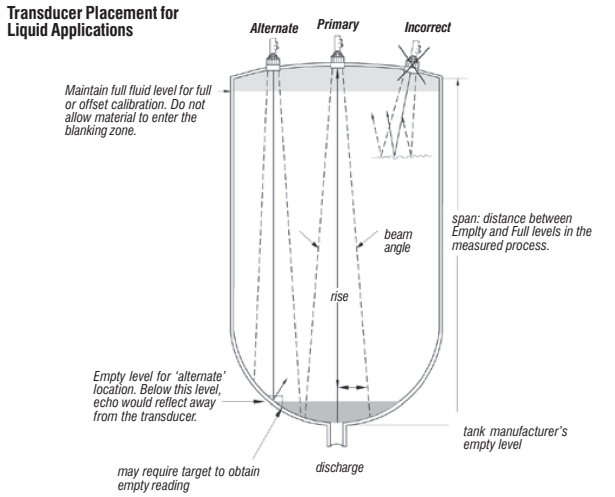



pumping for off peak periods to save on energy costs; monitor pump performance including pump status, efficiency and total pumped volume so that failing or under-performing pumps can be repaired, replaced or used less. Where a plant has pumps of varying capacities, one can program the controller to turn the pumps on and off depending on flow. Utilities want to engage the high capacity, high energy-consuming pumps only when needed. Advanced controllers offer a variety of pump control routines and subroutines such as fixed duty assist and fixed duty backup; alternate duty assist and alternate duty backup; service ratio duty assist and service ratio duty backup. These routines manage pumps efficiently to save energy. This information enables plants to optimise operations with pump control by level rate of change, service ratios to balance pump run times, pump start delays to reduce power surges, pump run-on or valve flushing to clear sediments. The end result is a reduction in scum line build-up and more effective routine maintenance. The range of control options is extensive with relays and current outputs as standard, but digital communications is becoming also more common. Advanced systems also enable monitoring of flow trends. By doing that across the entire network, plants can identify and address current and future problems. For example, one of the big challenges over time is that of specifications to meet future population demand. It is common for pumps to be under or over-specified. Trend flow monitoring identifies increases in demand for future planning and engineering.

So how should one go about selecting ultrasonic level measurement systems? Usually, customers are concerned mainly about accuracy and reliability. Measurement devices today are more or less meeting the user expectations on accuracy and reliability fronts. They are expected to work first time out of the box and still be working a year later in the field. The twist in the tale is their perceived measurement reliability over time.

MEASUREMENT RELIABILITY

The fact of the matter is that the world inside a wet well is anything but ideal with various influences that affect the return signal. There are internal structures such as pump cases, benching, guide rails, ladders, braces and struts. The process will have filling and emptying flows that obstruct parts of the well and cause turbulence or foam on the water surface. Ambient noise can be a negating influence and so can temperature. The challenge is to ensure reliable and accurate level measurement under such real life conditions.



Primary Location: *The primary location is the preferred location and should be used whenever possible. The centre of the tank generally gives the most reliable readings because there are fewer obstructions to provide false echos.*
Alternate Location: *This location is used if the centre of the tank is already in use or if the tank roof is too weak to hold the transducer safely.*
Incorrect Location*: This is a poor installation location. The echos are shown reflecting away from the transducer face.*

An ideal situation would be one where the level measuring product can be mounted clear of all obstructions. However, this is often not possible, and even otherwise, the ideal state could be disturbed once the filling and agitation begins.

An alternative system with built in signal-processing software, will not only automatically learn an installation but continue to adapt its internal map as things change. The intelligence is derived from a set of algorithms that analyses echo profiles (a digital picture of the reflected echo) and learns to ignore obstructions and false echoes.

In sump applications where submersion shield is a standard protection for the sensor face, one can look at the signature of the echo from the air within the shield. This information can be used to turn on additional high-high level alarms.

Turbulence or foam on the water surface can result in echoes being directed everywhere except back to the receiver. In such a situation, many level measuring products quickly revert to "lost echo mode" and fall back to various modes of 'hold last' reading or simple error output. Sonic intelligence can determine if the surface is agitated or covered in foam by analysing the statistics of the fluctuating signals which manage to return. With the knowledge of how the level was moving before and also which pumps or valves are open, it can continue to track the level even with intermittent measurements.

David A Hewitt, TM Nagarajan

Energy Management for Water Supply Industry

Energy conservation is the element of utmost attention for every industry, looking into increasing energy demand and limited resources of fuel. While meeting the objective of making water available on 24 X 7 basis to growing consumers, it is also crucial to address the need of energy conservation.

Water distribution system of any township covers mainly Lifting stations, pumping stations, WTP, MBRs ESRs, GSRs, Main & trunk pipelines, ETP & STPs. Various process involve pumps driven mainly by motors, which consumes more than 80% of energy supply available for water distribution of any municipal authority. Power management system proves as solution to address the need of energy conservation. It can be implemented through various schemes as mentioned below.

(i) **Power Monitoring**

- Monitoring & recording electrical parameters like Voltage, Current, frequency, KWh, KVArh & KVA through special panel meters.
- Recording the status of electrical control element like contactors, breakers, relays controlling Motors, transformers, load buses, substations equipment.
- Interfacing the panel meters & relays to automation system so as to measure and record energy usage to allocate energy cost process area wise.
- Record Maximum demand so as to control consumption of energy and avoid additional charge by electricity board for irregular power consumption and reduce the operational cost.
- Recording the health parameter like of winding temp, Oil level , Vibration level of motors & transformers for better maintenance and reduce downtime.

(ii) **Reactive Power Control**

- Active & Reactive power are part of any electrical network. The active power is used by load and meet its output requirement. However reactive power is used to meet the magnetic field requirement. Majority of load of electrical network are inductive in nature like motors, transformers. Electrical network for water distribution is always under varying load condition so as to meet the varying water demand.
- Reactive power lags behind active power. It is therefore necessary to control & manage the flow of reactive power to achieve higher efficiency of electrical system and reduction in cost of electricity consumed.
- Effective method of reducing and managing reactive power is by power factor improvement through power capacitors. This can be achieved through Fixed compensation or Variable compensation depending on type of load. Automatic power factor correction systems helps in achieving consistent higher power factor through out varying load condition.
- Power factor management reduces losses of transformers, switchgears and cables; avoid over sizing, electricity cost due to levy of penalties/ loss of incentives.

(iii) **Variable frequency Drives**

- As mentioned above pumps consume most of the energy supply for water distribution and transmission.
- Normally it is observed that irrespective of load demand, motors driving pumps during operation in water distribution & transmission run at full speed utilizing 100% power when they are connected to direct on line.
- Power consumption is product of head and flow. So reducing the flow during low demand period can help in achieving power saving considerably. Reducing the speed of the motor can reduce flow of the pump. Variable Frequency drive (VFD) which work on 3 Phase , 415 V supply is able to deliver the variable Voltage and Frequency output. VFD drives motor at reduced speed and varies the flow output of pump as per demand. This helps in achieving saving in energy.
- Apart from energy saving, VFDs protect motors from high starting in rush current (600%) reducing it to (150%). This increases the life and ultimately efficiency of motor for longer period.

CASE STUDY

Motor Rating = 360 KW, Application = Pump

Rated Parameters:

Rated flow: 231 M3/HR, Discharge Pressure: 37.27kg/cm2, Suction Pressure: 2.87 kg/cm2, Differential Pressure: 34.4 kg/cm2, Pump efficiency: 72%

Present Running Parameters: (As measured)

Flow: 280 MT/HR (Specific Gravity: 1.37) i.e. 204 M3/HR, Suction Pressure: 2.4 kg/cm2, Discharge Pressure: 42.5kg/cm2, Differential Pressure: 40.1kg/cm2, Valve Opening: 24.1%, Pump efficiency at 204 M3/HR: 68%, Motor efficiency (assumed): 90%

Input Power to the Motor P= (40.1*9.81*10)*(204/3600)/(0.68*0.90)= 364kW

(The effect of static head is not considered, as it will be same for the next case with variable speed drive)

Ratio (Actual Flow / Rated Flow) = 204/231= 0.8847

If the pump speed is reduced by the same proportion, using variable speed AC Drive, the differential pressure will reduce by square of the same ratio. Hence, new differential pressure will be =34.4* (204/231) 2 = 26.92 kg/cm2

Revised Input Power to the Motor P' = 26.92*9.81*10)*(204/3600)/(0.68*0.90)= 244 kW

Net Savings = 364-244= 120 kW

If VSD losses are = 10 kW (96% efficiency),

Net Power saved is 110 kW

With Unit Power rate of Rs 4.00, Total savings per year will be 110*8760*4.0 = Rs 38.5 L

Note: It is assumed that the monitoring points of suction & discharge pressures are such that the difference in these two pressures eliminates the effect of static pressure. However, if actual static head is given, the calculations can be refined further. Similarly, resistive drop in the piping is neglected.

(iv) **Soft Starters**

Looking at power scarcity in some areas, especially in urban & rural, where water lifting stations & pumping stations for water transmission are located, it has become imperative to implement alternate source of energy like diesel generator set. However to protect such high cost capital equipment, it is advised to use a means of reducing starting current of large AC induction motors. There are many types of methods like Wye-delta Starters, auto-transfomer & solid-state starters.

Out of above methods, Solid-state starters, or Soft Starters gives an edge over other in terms of ease of operation and maintainability.

- Soft Starters control the voltage applied to motor by use of solid state AC switches (SCRs) in series with supply to the motors.
- Being electronic controller, Soft Starters deliver much more advantages, like Soft stopping, its compact modular design occupying less space, a low voltage test mode that aids commissioning, a real time clock for event monitoring & logging of electrical parameters, simulation, storage of multiple motor characteristics pattern.

Anand K Nigam

Portable on-site checkmetering

When a flowmeter in operation has to be verified it usually has to be uninstalled from its location and transported to a facility where the necessary verification or checkmetering can take place. However, with an on-site verification device this task is made much faster, easier and at a fraction of the cost. When using the right meter, the result can even be as accurate as any off-site verification.

OFF-SITE VS. ON-SITE VERIFICATION

In order for these plants to operate efficiently, the plant manager needs to be certain that each flowmeter is operating 100% correct. Upon delivery, meters are usually calibrated and therefore, the operator can be sure that they measure correctly. However, if the flowmeter operates under very harsh conditions, if it has been running for hours on end or if the plant operator simply questions a meter's performance, it can be necessary to check that the meter is still running exactly the way it is supposed to.

Doing this can be very time consuming and difficult because it often means that the equipment has to be removed from its location and sent to a factory for testing. Such an operation requires that the plant needs to be shut down in order to uninstall the device, which means lost production time, hours of hard work and ultimately, loss of money.

In a situation where it is expensive and takes a lot of time to uninstall a meter, it can therefore be very beneficial to perform an on-site verification of the flowmeter instead. When performing such a task, a portable measurement device is used to verify the performance and accuracy of the flowmeter. This allows for the verification to take place

while the meter is in operation, which is clearly a benefit for the plant operator because a temporary shut-down becomes unnecessary.

However, if such a verification process has to prove itself useful to the customer it has to offer the same benefits as an offsite verification. This means that it has to be just as accurate and reliable.

RELIABLE VERIFICATION

Among the various options typically used for verification today, one product is of particular relevance to the water and wastewater industry: the clamp-on checkmetering kit. Since the meter is based on the ultrasonic flow measurement principle, it comes with functionalities that other flow technologies have difficulties with. First of all, it can be used to measure practically all conductive or nonconductive clean or moderately aerated liquids or liquids with suspended solids. This basic feature makes it possible to verify or check the performance of existing meters located at any given water and wastewater plant measuring for instance raw sewage, effluent or fresh water. Other application areas include temporary leak detection in large intake or distribution pipes in the irrigation industry.

Accuracy is typically around 0.5-1% and the repeatability on the better side of 0.015% making it deal for verifying high precision measurement tasks such as the addition of chlorine to drinking water.

DUAL MODE OF OPERATION

One of the most significant advantages, however, is that the meter has two modes of operation: transit time and Doppler.

- Transit time operation is the preferred mode for relatively homogeneous liquids because the ultrasonic transit time pulses require a trouble-free passage of the pipe in order to deliver a signal that can be processed. Homogeneous liquids are found in primary sludge, mixed liquor or drinking water applications.
- Doppler operation, on the other hand, relies on solids or debris in the liquid to offer a precise signal and hence, is the preferred measurement method for liquids with extensive suspended solids or aeration. Such conditions are typically relevant for measuring thickened and digested sludge.

The system can be set up to automatically switch from one mode of operation to the other as conditions change eliminating the need to alternate between meters. As the above examples illustrates, the dual mode capability enables an operator to use the checkmeter on almost any application at a water and wastewater plant because its operation can be adjusted and optimized to the specific measurement tasks regardless of aeration and solid percentages. In enables verification of any brand or type of flowmeter based on the traditional flow measurement principles including electromagnetic, ultrasonic, orifice or rotary piston technologies.

PORTABILITY ENSURES VERSATILITY

The last factor adding to the versatility of this particular checkmeter is its portability. The kit is battery-powered and comes with a selection of transducers that fit the most common pipe sizes and types within the industry. Since the kit is of the clamp-on meter type, it utilizes external transducers that can quickly and easily be installed on the outside of the pipe. This allows the meter to be transported from one installation to another facilitating the performance of surveys and monitoring of temporary or permanent flowmeter installations.

ON-SITE VERIFICATION A POWERFUL TOOL

So using an on-site clamp-on ultrasonic checkmeter to verify the performance of existing meters, has several benefits for plant operators and managers in the water and wastewater industry. The most persuasive one being, however, that it offers an inexpensive and easy way of verification without having to perform a costly and time-consuming off-site verification.

Brian Roughan

WATER LEAKAGE PLUGGED

Automation helps to integrate, monitor and optimize Water Utilities for better distribution management and leakage reduction. Utilities want to accurately estimate the amount of non-revenue water in a distribution system, in terms of background leakage, burst leakage and other loss components based on the field data. Non-revenue water is the amount of water that is unaccounted or lost in the distribution against the system input volume. By continuous online monitoring, analyzing various leakage components and key performance indicators, utilities can obtain real-time information and implement leakage reduction measures through Pressure Management and timely Leak Repairs. Plant personnel get to see real-time opportunities to improve the efficiency, reduce expenditure on operation and maintenance, improve customer service and enhance the Utilities profitability.

Bangkok's Metropolitan Water Authority (MWA), supplies more than 1,600 cubic metres of potable water, across more than 24,000km of pipelines to about 11 million people. According to MWA, the amount of water losses in their distribution network was more than 40 percent. By continuous online monitoring across 1,000 measuring points, calculation of leakage components, and the assessment of water losses using various Key Performance Indicators, MWA is set to achieve its goal of serving its shareholders, customers and the environment.

Devarajan Anand Kumar

GSM and Broad Band

A future of teleprocessing enablers for water industry

CHALLENGES PLACED BY WATER DISTRIBUTION SYSTEMS

- A typical water distribution system is spread over large geographical area and requires teleprocessing of data from remote area.
- Accurate and reliable data acquisition over telemetry needs reliable and affordable carrier (media) for data like flow , level , pressure , pump status etc. Media for teleprocessing should be easily available and simple in maintenance.
- Communication should be understood by semi- skilled staff who operate at remote places without supervision.

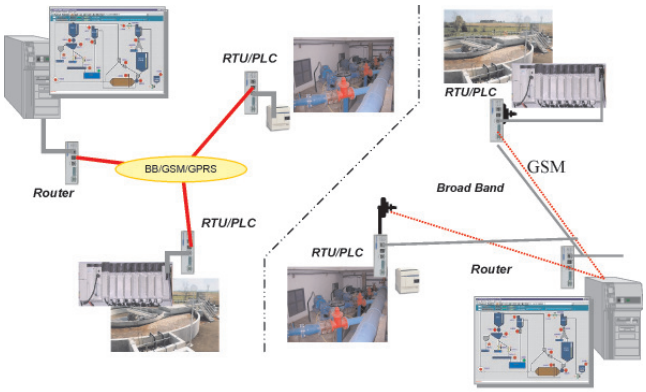
While facing above challenges a favorable factor is that data dynamics is relatively slow in process of water industries. Flow, pressure etc. does not vary fast, except in case of sudden leaks and bursts.

Teleprocessing of data in early 90's was achieved often thru license band radio or via satellite. With the continuous development of automation hardware and software, by early 00's Europe and American water industries started using RTU's based on GPRS/GSM/Broad Band teleprocessing with small application logic built in.

The technology now available for the Indian market in year 2008 is even more advanced, reliable, relevant and optimized. A typical RTU or PLC based system would have:

- Communication should be understood by semi-skilled staff who operate at remote places without supervision.
- Local data storage capacity with time stamping capability
- Battery back up in event of power failure
- In built GSM modem or facility to hook up external GSM modem
- Web based navigation for programming and monitoring
- Ethernet Port for Broad band connectivity with relevant features like SNMP, DHCP and Port configuration
- Serial port for fetching data from slave PLC

SYSTEM ARCHITECTURE



- HMI software with schedule dial up OPC server in case of GSM based system
- HMI software with routing and firewall for Broad band based system
- HMI software with remote connectivity for MIS system

As the bulk of data logging occurs at remote places, this data is transferred using GSM channels to centralized control room through periodic data polling or data file transfer over data call generated by pre defined schedule. GSM based systems also have an advantage of sending SMS periodically to various nos. which can be logged. Data sent by this method are time stamped. This fulfills data acquisition needs of the system with accuracy and at low cost. In event of alarm conditions, it is sent out of turn with report of exception. Provision of sending SMS to mobile helps executives to stay in touch directly with system parameters.

In metro or urban areas, where broad band is easily available, broad band and internet based data acquisition make every thing online and real-time based. This is the best form of data acquisition combining accuracy and high speed. When implemented with Google- earth features, geographic positions of pumping station or distribution station can also be embedded for easy viewing of operators. HTML based configuration and programming making it programmable from any where without any geographical limitations. Each RTU becomes a WEB server on its own, emailing reports directly to whosoever needs to read them.

Niraj Desai

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