AVK SMART WATER DIGITAL MONITORING ON WATER NETWORKS

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Expect...

CONTENT:

WHY DO WE NEED DIGITISED WATER DISTRIBUTION?

Digital solutions can help fight some of the environmental and urbanising challenges that water utilities face daily. Technological development has made it economically feasible to digitise large parts of society and new technology such as Internet of Things (IoT) provides the water sector with new opportunities.

Challenges within water supply management
Every day, water companies face challenges related to water supply management. The potential impact of water scarcity; increased water consumption, high energy costs, urbanisation and Non-Revenue Water (NRW) are just a few of the challenges forcing water companies to think of innovative solutions.

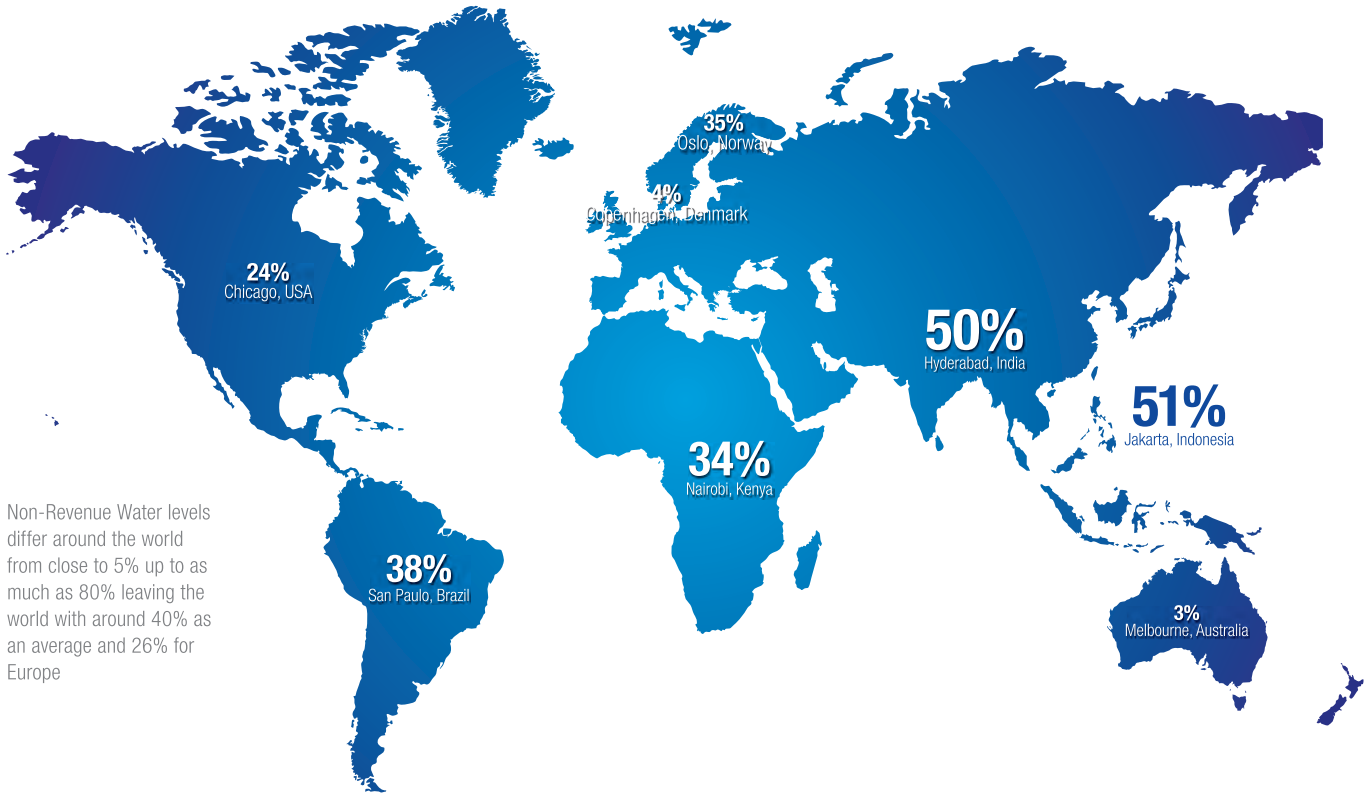
Non-Revenue Water is basically produced and cleaned water lost somewhere in the water distribution system, never reaching the consumer. This means water not used or paid for affects local economies as well as local resources. The problem is universal, ranging from NRW levels of about 5% to as much as 80% in certain areas. Clearly, there is a need for a more sustainable way of delivering water.

The challenge is to streamline the operation, maintenance, and increase safety of the supply network and water quality, and at the same time protect environment and water resources. An important part of the solution is to be able to monitor pressure, valve open/close position, and pollution in the distribution network.

Overview of the entire water network at a glance
With thousands of valves, fittings and hydrants installed across the distribution network, valuable information about its condition is right at hand. What if some of your most critical valves sent messages to you every time they are operated?

Not just your valves, but also fire hydrants and from section inlets. Based on data directly from critical points in your distribution network, you can make fact-based decisions that will help you manage your water distribution in a more sustainable and efficient way.

Advantages for local utilities and for the environment
Digitalisation and transparency contribute to better structured and automatic operations. Digital solutions actively contribute to reducing water loss, energy consumption and operational costs as well as ensuring the water quality. It leads to huge advantages locally, and it contributes to overcoming global, environmental challenges. Furthermore, optimising the system to only distribute the needed amount of water will allow for energy savings.



Non-Revenue Water levels differ around the world from close to 5% up to as much as 80% leaving the world with around 40% as an average and 26% for Europe

INTERNATIONAL REQUIREMENTS
UN GOALS AND EU DIRECTIVE

As a water utility, you have the responsibility to ensure safe water distribution for your consumers. However, it is a global challenge to take care of our water resources and ensure clean drinking water for all. Therefore, sustainable water supply is high on the international political agenda.

EU Drinking Water Directive requirements

Digitalisation of the distribution network not only provides the transparency needed to support making the right decisions. It may also prove necessary to meet the efficiency requirements in international legislation.

The purpose of the EU Drinking Water Directive is to ensure safe and clean drinking water. It concerns materials in contact with the drinking water and limit values to be accepted in water distribution, and it focuses on risk management and lowering water loss.

With leakages and pipe bursts, there is a risk that contamination enters the pipe system. Therefore, each member state must evaluate and set targets to reduce water loss. New technology can efficiently support utilities in meeting these new targets by improving the way pressure can be managed, leakage can be monitored, and theft can be detected and avoided.

Member states must ensure that the complete distribution network is subject to a risk-based approach. A correct risk assessment includes considerations as to how all access points to water are managed and protected. Any risk assessment should also consider the risk posed by inappropriate pressures in the distribution network. Too low pressure entails risk on intrusion of contamination while too high pressure means higher leakage levels and increased risk of bursts. Pressure and temperature sensors in the network, and remote monitoring of hydrants and gate valves will ensure management of these risks in the best possible way.

UN goals for sustainable development

The 17 UN Sustainable Development Goals (SDGs) are designed to lead the world in a more sustainable direction. A digitised distribution network allows the water utilities to increase efficiency and reduce water loss – and thereby ensure protection of our resources. This way, it contributes significantly to the UN SDGs 6 and 11 to ensure clean water, sanitation, safe, resilient, and sustainable cities.

TRUST YOUR NETWORK THROUGH **DIGITAL MONITORING**

In many countries, utilities responsible for delivering clean water to consumers use data to control and monitor their distribution network. They have smart meters installed in most households, so they can bill consumers based on actual consumption.

Between the water works and the consumers, there are so few sensors installed that this area is sometimes considered the black box. Within this area it is next to impossible for utilities to know exactly what is going on because the area is huge, and most assets are installed in the ground. This leaves utilities with uncertainty about the position of their valves, difficulties in locating leaks, and challenges with acquiring data of sufficient quality.

However, within the network, there are thousands of valves, fittings, combi-crosses, and hydrants installed, and each of these assets are ideal points to collect data from. AVK Smart Water makes it possible to collect this data by providing intelligent sensors that can be installed in the distribution network. This means that the water utility can acquire data from their assets and turn the black box into a more transparent water network.

With a transparent water network, you can localise leaks faster, extend the lifetime of assets, save resources by minimising truck rolls, and save energy by only pumping the needed capacity. These are just a few of the advantages you will receive by introducing the AVK Smart Water solution into your water network.

VIDI CLOUD

A multi-device, cloud-based software platform created to receive and collate data captured by AVK Smart Water products.

VIDI FLOW

Measuring flow volume and dynamic rates for monitoring and leak detection.

SMART WATER AIR VALVE

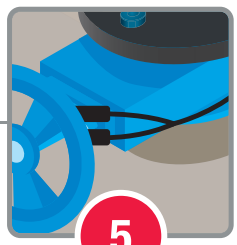
Provides 'remote' visibility across your air valves, reducing operational costs and leaks that can lead to fines.

VIDI LEVEL

Remotely monitors and provides non-contact rising level measurements across a broad range of applications.

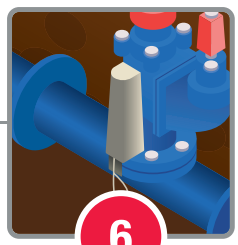
VIDI OPEN/CLOSE

Can be retro-fitted to most valve and hydrants with handwheels, swing check valves with levers, or other types.



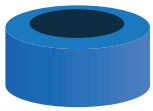
VIDI TEMPERATURE

Tracks the temperature of drinking water across the distribution network from water company to customer.



VIDI POSITIONER

Transforms a standard valve or hydrant into a smart, intelligence gathering tool, providing insights for network improvements.



CONTROL VALVE(S)

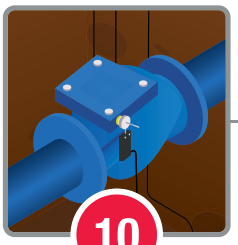
AVK offer many types of smart control valves, with variations of 879-diaphragm and 872-needle control valves.

VIDI PRESSURE

Remote sensors frequently monitor water pressures delivering insights that optimise network performance in line with demand.

SMART CHECK VALVES

AVK check or non-return valves are mainly used to prevent the backflow of water to protect a system and its assets and to reduce the risk of water hammer.



AVK ASSIST

A comprehensive mobile-first, paperless solution for tracking all your assets across your distribution network.

VIDI PRV DASHBOARD

Offering diagnostics on valve failure, advice on spare parts needed as well as identifying DMA valve operation which can lead to false alarms with network issues.

AVK SMART WATER SOLUTIONS FOR WIRELESS DIGITAL MONITORING

AVK Smart Water is a new concept consisting of battery-operated wireless sensors which are data-collection ready, and a software platform for visualising the complex data, turning it into valuable insights.

The sensors are developed for AVK core products such as gate valves, fittings, and hydrants. When installed, the sensors will provide data directly from applications in the water distribution network and send the data to the dedicated software platform. This digital monitoring solution makes it possible to optimise the operation of a water network by saving resources, reducing water loss, and optimising the general planning and operation activities within the network.

Monitoring with state-of-the-art technology
By installing AVK Smart Water sensors in the distribution network, utilities can achieve a transparent network that makes it possible to remotely monitor and diagnose problems, prioritise, and manage maintenance issues, and optimise the entire network's efficiency.

AVK Smart Water sensors include:
- VIDI Positioner for valves and hydrants
- VIDI Open/Close
- VIDI Flow, VIDI Pressure and VIDI Temperature
- VIDI Level

The sensors send data to VIDI Cloud, a software platform developed and provided by AVK Smart Water. Through an API (Application Programming Interface), the sensors can also send data into your preferred IT system. This makes it easier to compare data and compile a complete overview of the distribution network.

Through digital monitoring, AVK Smart Water paves the way for reduced water loss from leaks, increased workflow efficiency, and a clearer overview of network conditions.

Effectively lower water loss
One of the most efficient methods to reduce background leakage and bursts is better pressure management. VIDI Pressure sensors provide the data needed to efficiently manage pressure, which will help utilities minimise leaks throughout the distribution network.

In addition, with the leak detection feature in VIDI Cloud, advanced algorithms use data from VIDI Flow sensors to monitor leakage levels. This will enable utilities to prioritise resources and reduce leak run-time.

With VIDI Positioners on valves, utilities will receive an alarm when assets are operated. That way, utilities can limit the water loss due to tampering and theft from hydrants and public accessible gate valves.

Increase workflow efficiency
Intelligent pressure sensors from AVK Smart Water will provide utilities with the data needed to manage pressure throughout the distribution network. This will result in less network on-site visits as there will be fewer bursts to repair and lower energy consumption for pumps as the set point can be reduced, and generally it will extend the lifetime of your assets.

VIDI Pressure and VIDI Temperature provide the transparency needed to efficiently support customers' calls as all relevant network information is ready at hand, thus enabling utilities to further improve customer service whilst spending less time on support.

VIDI Positioners and VIDI Caps eliminate time wasted on investigating the status of valves and hydrants while streamlining maintenance work. The solutions automatically keep track of the latest use and increase efficiency throughout the distribution management.

Better overview of network conditions
There are many risks related to water distribution. Low pressure entails a risk of intrusion of polluted water and poses a serious health risk for consumers. With VIDI Pressure sensors, utilities will be warned if pressure falls below a certain set point.

Hydrants and publicly accessible gate valves are potential entrances for pollutants either by mistake or intentionally. VIDI Caps for hydrants and VIDI Positioners for gate valves help manage this risk by alerting utilities if hydrants or valves are opened.

The overall solution from AVK Smart Water keeps track of the current state of the water network. VIDI sensors register changes in the hydraulic setup e.g., when a valve is opened or closed or when the pressure, temperature, or flow are abnormal in the network. With such misconfigurations, utilities risk loss in hydraulic performance and pressure, which can result in increased energy costs.

Due to the wireless nature of IoT, the pressure sensors can be installed at any critical point in the distribution network.

A VIDI Positioner installed in-situ underground.

Hydrant with VIDI Temperature installed. VIDI Temperature is typically installed in combination with a gate valve, hydrant or similar. After installation, the device transmits information about the temperature in the network to the VIDI Cloud platform that stores the data.

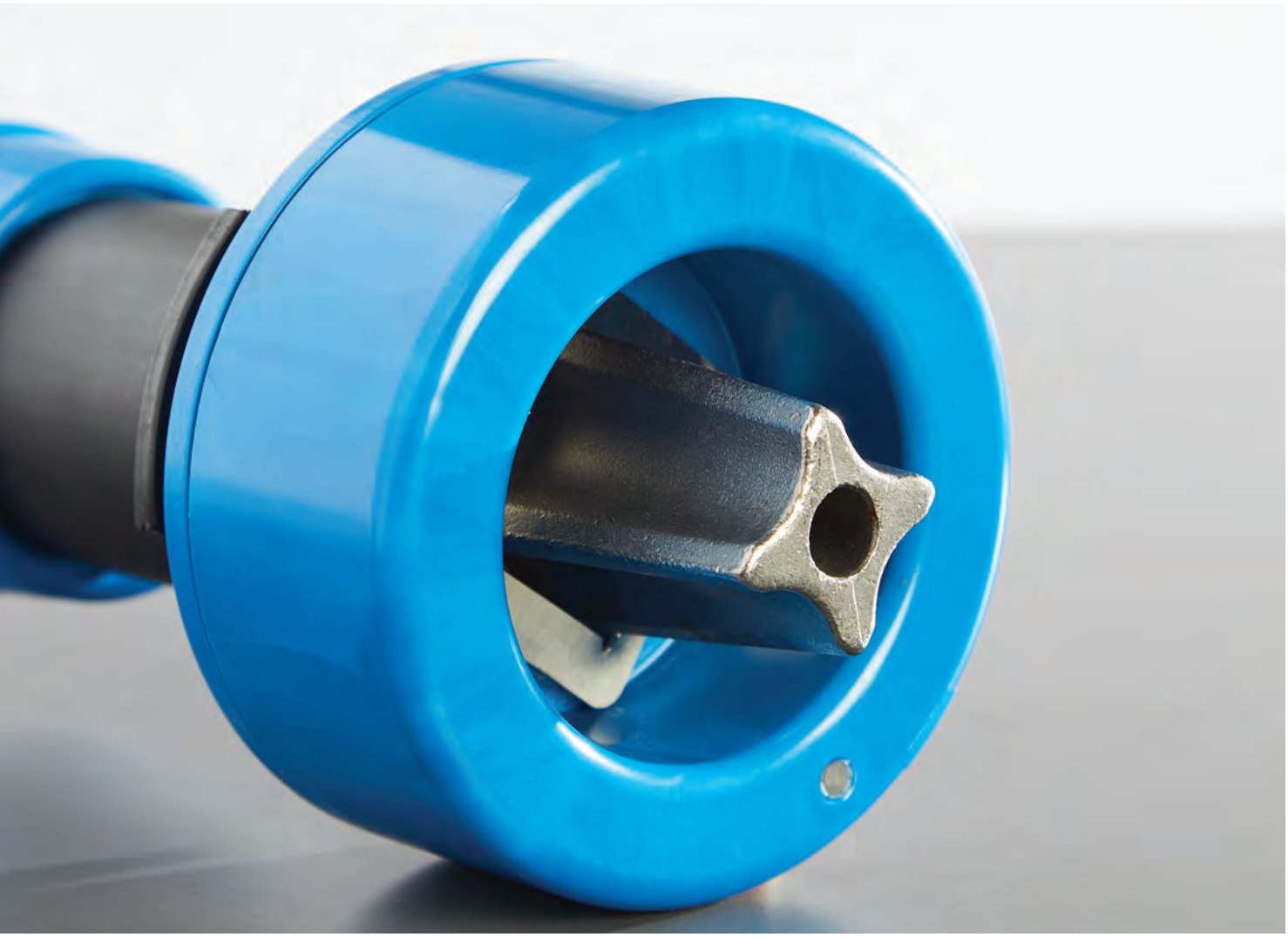
INCREASE THE QUALITY OF DATA WITH **VIDI POSITIONER**

Valves are a very important part of the water distribution network, and utilities have thousands of them installed. Here, they all serve a variety of crucial functions such as dividing and isolating subsections and controlling pressure and water flow.

Most valves are buried in the ground, which makes it difficult to know exactly where they are, if they are opened or closed, and whether they are damaged or not. Worst case scenario, a wrongfully opened or closed valve can influence other measurements such as flow or pressure, and thereby give incorrect information about the distribution network's real condition. This can affect the utility's ability to ensure a fully functional water network and the best service for consumers.

Optimise operation by checking the quality of measurements
VIDI Positioner will provide utilities with valuable insights by digitally monitoring the position of valves. With its open/close feature, VIDI Positioner can detect whether the valve is opened, closed, or any percentage in between.

With VIDI Positioner installed, water utilities will receive data from critical points in the water network and give them the opportunity to check the quality of other measurements such as pressure and flow. Based on the data, water utilities can optimise the operation of the water distribution network, extend the lifetime of assets, and perform efficient NRW reduction.



INCREASE WATER SUPPLY EFFICIENCY WITH VIDI PRESSURE

Water utilities all supply water under different conditions and in different terrains. Large differences in the terrain make it difficult to avoid high pressure in some parts of the network. High pressure is known to increase the leakage level.

However, it is not always due to high pressure that pipes burst. It can also be due to fluctuations that force the pipes to continually expand and contract. That is why pressure monitoring is an important tool in the efforts to lower water loss.

Fight water loss with pressure management
To prevent pressure fluctuation, utilities must have intelligent pressure sensors installed at important points in the distribution network.
Installing these sensors, ensures detailed knowledge is collected about the pressure, enabling the utility to optimise and stabilise their daily operations.

With the information from VIDI Pressure sensors utilities will know when to regulate pressure, and thereby:

- Reduce stress on infrastructure
- Extend assets' lifetime
- Minimise maintenance costs
- Reduce water loss
- Minimise risk of water contamination
- Reduce energy consumption

REACH FULL NETWORK POTENTIAL WITH IoT SENSORS

Monitor your valve positions with VIDI Open/Close. There are many valves installed in the water distribution network e.g., swing check valves, penstock valves, and butterfly valves to name a few. They all serve a variety of crucial functions such as controlling the pressure and flow in the network as well as boundary valves at each section in the distribution network.

Information about these key assets is often based on assumptions, as they are typically buried in the ground. Not knowing the open/close position of them can affect the level of water loss and change the overall operation of the water distribution network.

Optimise the network and prolong asset lifetime

VIDI Open/Close can be used with several valve types e.g., on a regular gate valve with a handwheel or on a swing check valve with a lever. The most beneficial place to install an open/close sensor is on critical valves that needs monitoring 24/7. With the VIDI Open/Close sensor installed on these key assets, utilities will receive regular and reliable information about the open/close position of these assets.

Whether it is installed on a gate valve, a swing check valve, or a penstock valve, VIDI Open/Close provides the necessary data to monitor key assets continuously. With this reliable information water utilities can optimise their general operation of the network and extend asset lifetime.

Track water conditions with VIDI Temperature. Supplying consumers with clean and safe drinking water is the main goal for water utilities. Therefore, they are met with high expectations and demands to ensure that the drinking water for consumers is of the highest quality.

A huge part of ensuring clean drinking water depends on a controlled temperature all the way from the suppliers to consumers. Water temperature is known for influencing the network both when the temperature is too high (risk of bacteria) or too low (risk of bursts of blocked pipes).

Reduce risks of bacterial growth or pipe bursts

If the temperature increases, the risk of bacterial growth increases as well. VIDI Temperature will give a clear indication of the temperature in the network, and if it increases utilities can make informed decisions based on data directly from the water pipes. That way, water utilities can ensure that the water is safe to drink for consumers.

At the same time, if the water temperature drops, the VIDI Temperature sensor provides the utilities with the exact temperature enabling them to decide when action needs to be taken. So, if the water temperature drops below freezing temperature, utilities know that they must be aware of pipes bursting or clogging.

REACH FULL NETWORK POTENTIAL WITH IoT SENSORS

Lower water loss in the network with VIDI Flow. Every day, millions of cubic meters of water flows through the water distribution network, with the sole purpose to be delivered to consumers. However, it is no longer enough to produce water to meet the general demand. It is also important to control the effectiveness of the water supply, and minimise the water lost during production and transportation to the consumers.

By continuously monitoring how much water flows through the distribution network, water utilities will be able to detect anomalies, and they can decide what measures need to be taken.

Detect anomalies to discover leakages faster
VIDI Flow provides regular data sets detailing how much water is flowing in or out, depending on where it is installed. By using VIDI Flow to measure the water flow, utilities can detect anomalies earlier and improve the resilience of the distribution network.

When anomalies are discovered faster, utilities can also minimise water losses, decrease costs related to leaks, and increase consumer satisfaction.

For water utilities to detect leakages and bursts, it is important to measure water flow at strategic points in the distribution network on an ongoing basis. By installing VIDI Flow at section/DMA inlets, it is easier for utilities to detect smaller leaks as well as narrow down the search area.

PRESSURE | FLOW | TEMPERATURE | LEVEL | OPEN/CLOSE

Improve level measurements with VIDI Level. There are often certain risks related to drainage pipes, as they can be subject to sludge or clogging. Sand traps are supposed to protect against this from happening. Over time sand traps are slowly being filled with sand; thus, it is important to empty the traps continuously to avoid flooding.

Reduce the risk of intrusion and deterioration from flooding
Level sensors are needed in sand traps, where the medium rises over time. In relation to large water flows, full sand traps can lead to floods and cause damages to properties or pollution of the environment.

VIDI Level makes it possible to remotely monitor sand traps. Thus, utilities can avoid unnecessary inspections of sand traps, as it will provide a clear view of the sand level. A level sensor can be used in different applications such as:

- Level of sand in sand traps
- Level of water or wastewater in buffer tanks or basins
- Level of water in pits, wells, and chambers
- Level of water in lakes and streams

USE LEADING TECHNOLOGY FOR SUPERIOR COVERAGE

AVK Smart Water uses the wireless IoT technology NB-IoT (Narrowband Internet of Things) for all sensors to ensure great radio performance, long battery life, and high data security. NB-IoT makes the sensors simple to install and easy to operate. Once sensors are installed, the only expense for utilities is a small subscription fee, and data is delivered as a service.

To make digital monitoring of assets more convenient for utilities, all AVK Smart Water sensors use API (Application Programming Interface) to easily integrate data directly into any preferred IT system.

Utilities have different requirements in relation to reading and using data. AVK Smart Water ensures that utilities do not have to worry about changes in protocols or security systems. With API, the complexity of IoT and smart products is removed from utilities and handled for them. That way, utilities can focus their efforts on more important tasks.

WHAT IS NB-IoT?

NB-IoT or Narrowband IoT is a wireless communication standard for Internet of Things (IoT) using the existing telecommunication infrastructure.

Due to its wide coverage, improved indoor coverage, and its energy efficiency, NB-IoT is suitable for wireless devices installed in areas with poor coverage and that demands maximum battery lifetime.

TAKE CONTROL OF YOUR ASSETS WITH AVK ASSIST

Many utilities highlight asset mapping and network management as an ongoing issue in their daily operations. AVK Assist is an intelligent app developed to aid and improve asset and network management.

AVK Assist enhances traceability of products by using digitally recorded quality and test data from the point of production.

Each installed valve has a unique GPS pin location and, when combined with a photo of the installation, provides a complete, secure, accurate and auditable record of every valve you install.

Installation data is confidential to the customer and can be exported in formats that allow integration with existing mapping systems.

With AVK Assist, you can:

- Register VIDI assets
- Activate/devices VIDI devices
- Calibrate VIDI devices
- Check status
- Send data to VIDI API/VIDI Cloud

AVK Assist is an application made up of four key elements:

- AVK Insight
- AVK AR (augmented reality)
- AVK Toolbox
- AVK Info

CONVERT DATA INTO VALUABLE INSIGHTS

AVK Smart Water offers software solutions that include a dedicated web platform for data visualisation and software packages with different features to cover customers' needs.

AVK Smart Water offers solutions that include a dedicated web platform for data visualisation and different feature packages to cover the utilities' needs.

There are three feature packages:
- VIDI Basic
- VIDI Advanced
- VIDI Premium

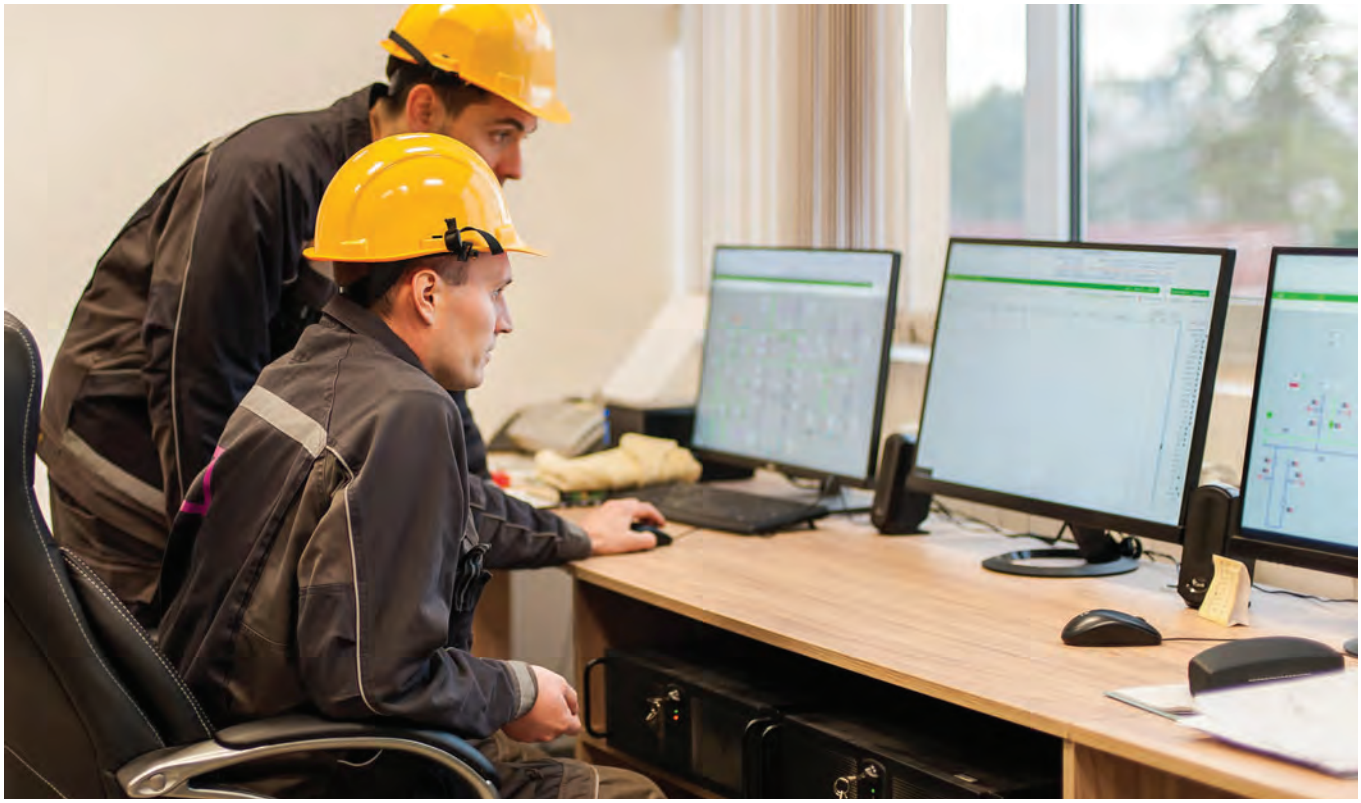
Simple and user-friendly
VIDI Basic is the simple and basic tool for visualising and monitoring assets in the network. It provides utilities with a map-based overview of the data from the AVK Smart Water IoT sensors. It is intuitive as it provides a quick overview of the most important information for daily operation such as abnormal conditions.

More functions more possibilities
VIDI Advanced offers the same features as VIDI Basic. But in addition, it provides alarm dispatching, which gives the utility the opportunity to react instantly, minimise water loss, and optimise the general maintenance of the distribution network.

Through the alarm dispatching feature, users can set up multiple notification messages in case of specific events. Notifications can be dispatched by both e-mail, text message and/or automated Telegram bot to a specific crew member. The given crew member can then interact with the alarm by either acknowledging or ignoring it. If the alarm is not responded to, it will reappear within a time frame predefined by the utility.

The complete package
In addition to the features of VIDI Basic and VIDI Advanced, VIDI Premium offers a complete package with monitoring, visualisation, and assets management on one platform. VIDI Premium provides the leakage detection module with individual DMA thresholds and District Metered Area (DMA) reports.

The leakage detection module analyses the water balance in each DMA. By visualising the trends in consumption, utilities will have an instant indication of potential leaks and bursts. In addition, the module considers the water consumption related to seasonal changes and public holidays.



CASE STUDY: HOW VIDI PRESSURE SENSORS ARE HELPING TO DETECT ISSUES BEFORE THEY OCCOUR

AVK UK has been trialling two of its VIDI Pressure sensors on the Hafren Dyfrdwy water distribution network. Here, in a two-part case study, David Hurley, Director - AVK UK Smart Water, explains the background and how the trials have already revealed some fascinating data.

Case Study - Part One

Rob Edwards
Smart Water Specialist

Since November 2020, AVK UK has been trialling two of its VIDI Pressure sensors on the Hafren Dyfrdwy water distribution network. These have been installed on a pressure reduction valve (PRV) in Pandy and a hydrant at Glyn Ceiriog, the largest village in the valley, located some sixteen miles southwest of Wrexham.

Many of the communities served by Hafren Dyfrdwy are located in remote and rural areas where GSM (mobile phone) connectivity is poor and often non-existent. This is particularly true of the Ceiriog Valley. This absence of connectivity has meant Hafren Dyfrdwy has been, until recently, unable to undertake remote monitoring of its distribution network in the area.

In the case of the VIDI Pressure sensors, communications have been established using LoRa (Long Range) radio technology. The key advantage of LoRa is that it facilitates long-range data transmission at low levels of power consumption. LoRa enables Hafren Dyfrdwy to receive regular data from the pressure sensors without having to worry about the impact on battery life.

Rob Edwards - AVK UK Smart Water Specialist: “This trial has effectively acted as a proof of concept for Hafren Dyrdwy. LoRa has shown that you can install VIDI Pressure, Flow and Temperature sensors along the Ceiriog Valley and receive uninterrupted, low cost data feedback. Remote, rural areas are resource intensive from a traditional network management perspective. VIDI sensors combined with LoRa communications technology is set to change that.”

Footnote: In 2017, Severn Trent purchased Dee Valley Water. From June 2018, all of the water and wasterwater activities of the two companies have operated under the name of Hafren Dyfrdwy. Hafren Dyfrdwy translates from the Welsh as ‘Severn Dee’.

- **Turn to pages 18-19 for the second part of this case study.**

Contact Rob directly, for more information about Smart Water, products, trials or your own project. We’d love to hear from you.
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CASE STUDY: AVK UK SMART WATER SENSOR TRIAL DATA SHINES A LIGHT ON NETWORK BEHAVIOUR

In this second installment of a case study conducted just outside of Wrexham, Rob Edwards, AVK UK Smart Water Specialist talks about how the trials have developed and how previously hidden areas of a network have now been revealed, while also providing reliable data useful for making operational decisions into the future.

CASE STUDY

Case Study - Part Two

The role of Rob Edwards, AVK UK Smart Water Specialist, is to work with water companies, their consultants and contractors, and other manufacturers to create smart water networks. Here he talks about his second visit to Wrexham, where he is working closely with Hafren Dyfrdwy on a trial of AVK's VIDI smart water sensors.

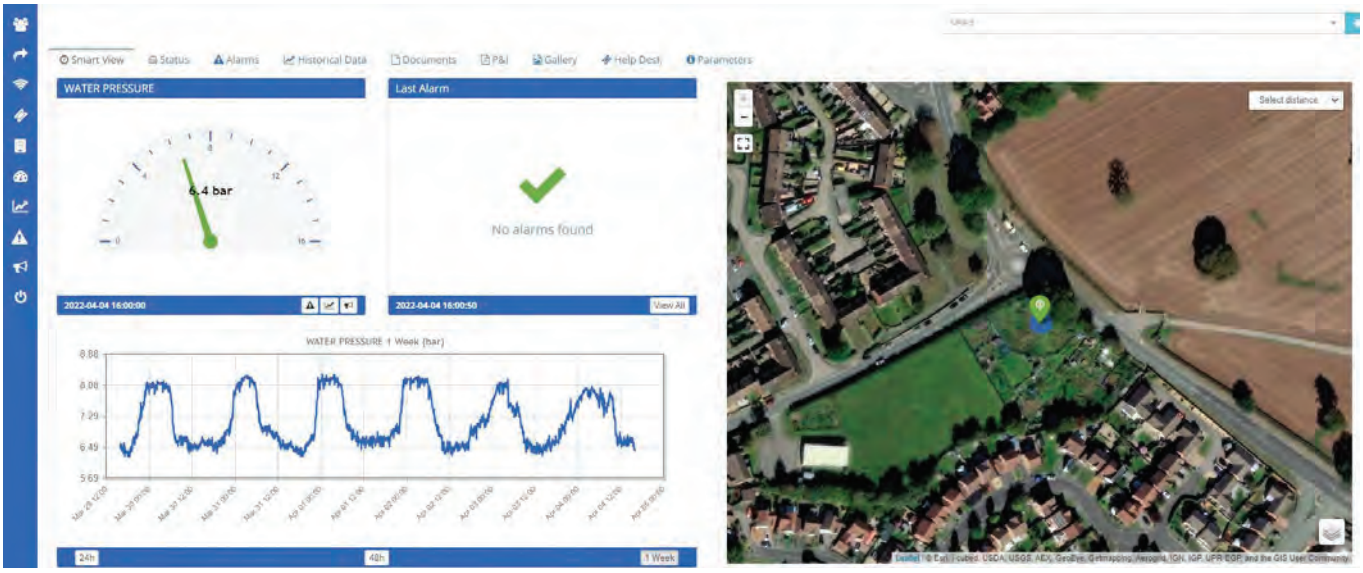
The water network in Wrexham includes a ring main that runs around the town and the purpose of the trial is to increase the operational visibility of that ring main and monitor and improve its performance.

In Phase One of the trial, Rob worked with Hafren Dyfrdwy engineers to install VIDI Pressure, Flow and Temperature sensors on eight hydrants and two kiosk tapping nodes. The connectivity of the LoRaWAN network, being used to transmit data from the sensors to VIDI Cloud via the internet for analysis by Hafren Dyfrdwy's engineers, was also checked.

Rob said: "In Phase Two we have installed a further 17 pressure, flow and temperature sensors to increase coverage across the ring main. We have also installed the first VIDI Level sensors in valve chambers. The level sensors detect the level of water present in the valve chamber. This

data is important for many reasons. A submerged air valve could easily suck contamination into the water supply leading to a major disruption in customer service performance.

"With the technology proven, in July we implemented 'alarm' alerts based on the data transmitted from the temperature, pressure and flow sensors. When an agreed threshold is breached, engineers receive a message via their mobile phone to alert them to the breach. The engineers can then determine what action to take well before the situation becomes critical. "During Phase One, there were two bursts on the network. Referring to temperature data collected by the VIDI sensors, Hafren Dyfrdwy engineers



have noticed a strong relationship between higher ground temperatures and leakage. This is certainly worthy of further research as the dataset grows.

"In Autumn, an AVK UK smart water Pressure Management Device (PMD) is being commissioned at one of Hafren Dyfrdwy's pumping stations. The PMD is fitted to the pumping station's resilience valve and will be transmitting data directly to the Hafren Dyfrdwy control room.

"Feedback from Hafren Dyfrdwy has been very positive. As the trial develops their engineers are recognising that the data received from the sensors is robust and can be relied upon when making operational decisions. The data relating to cold and warm temperatures and associated leakage is particularly interesting and may be revealing an aspect of network behaviour that was previously hidden.

CONTACT

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