

# Remote automation and analytics for a smart water grid

Expressing a sentiment that could apply equally to any country, OFWAT, the Water Services Regulation Authority responsible for economic regulation of the privatised water and sewerage industry in England and Wales, considers that resilient, reliable and sustainable water and wastewater services are essential for people, for the economy and for the environment.

By Philip Hall



Figure 1. Rotork IQ3 actuators were chosen to provide reliable operation of radial gates that play a vital river management role on the River Thames. Reliability problems with previously installed actuators mostly resulted from inadequate environmental sealing. It was therefore decided that replacing them with double-sealed Rotork IQ3 watertight actuators would be the best solution.

Rotork's responsibilities encompassed all aspects of the task in an extended scope contract, including removal of the existing actuators, fitting Rotork IQ3 actuators and MTW gearboxes, cabling, commissioning and project management. The upgrade has delivered peace of mind that the weir can be operated with confidence, without the worry that was previously experienced.

Objectives identified by OFWAT include the improvement of day-to-day resilience through the reduction of the number of supply interruptions, sewer flooding and pollution incidents, the reduction of water leakage and introduction of performance commitments specifically on improving resilience to drought and flooding. Recommendations include the assessment of a wide range of options including investment in new infrastructure, water transfers and measures to significantly improve water efficiency and reduce consumption, and the adoption of system wide approaches to understanding,

planning and managing risks to the delivery of wastewater services.

As a provider of flow control solutions, Rotork represents much more than simply a manufacturer of valve actuators. Whilst core activities involve isolating and regulating duty valve actuation and automation, complementary technologies and solutions include network control systems, wireless communications, predictive diagnostics, intelligent asset management and local process control.

## Some of the issues

If a leak is detected in a remote location in a water network, this often requires a person to



Figure 2. Rotork IQ intelligent valve actuators provide full automation of a flood alleviation scheme protecting the historic town of Cardigan in West Wales. Rotork's responsibilities included an initial survey, removal of old actuators and replacement with new, installation of a PLC control cabinet with HMI for local control and indication, interfacing with the level sensor and telemetry system and commissioning of the completed installation. Operation of the site is now fully automated and remotely monitored.

travel out to a site, turn off at least one valve and open several others. This operation can take time, particularly when the appropriate valve is not immediately identifiable. Valve automation with remote indication often solves this problem, enabling appropriate action to be performed by staff in a centralised control room without necessarily leaving the building. Similarly, peak pressures and pressure variations can fatigue pipes in isolation joints, leading to leaks and bursts. Pressure spikes are often the result of manned operation performed locally. Automation with intelligent actuators can minimise the network pressure fluctuation and reduce the overall leak rate by controlled closing of critical valves. In addition to maximum reliability, the modern intelligent actuator is designed for enhanced functionality, particularly in those areas associated with predictive maintenance and asset management.

### Technologies for a smart grid

Rotork IQ intelligent actuator technology is capable of providing a proliferation of data, recording all the activity with an immense amount of detail, including the number of valve operations, alarms, failure to respond events, valve torque profiles, unauthorised operation attempts and many other events. The ability to objectively analyse this information and identify the key areas that are important for each site's specific requirements is an essential requirement for effective asset management. For example, there are many different styles of valve and they each have their own unique torque demand curve. Capturing the torque demand curve from a newly installed and calibrated valve actuator in a datalogger file provides a reference point against which future curves can be measured. As the valve ages it may become more difficult to open and close because of internal and external factors. Identifying

issues such as these can be used to plan inspection and schedule maintenance without interrupting operations and improve overall asset management.

### Diagnostic capabilities

Rotork datalogger files can be downloaded and transported from site to office for storage and analysis on a PC running Rotork IQ-Insight 2 software. Effective asset management programmes can then be planned and implemented, maximising plant utilisation and minimising the risk of unexpected interruptions. Alternatively, this data can be collected by the control centre over the digital monitoring control network. This is particularly beneficial if the actuators are situated in remote, harsh or potentially dangerous environments. With Rotork this is possible using the Profibus open system and Rotork's own Pakscan system, both of which are used by the water and wastewater industries.

The Rotork IQ Profibus DP interface card provides comprehensive control and feedback data about the valve and actuator using DP-V0 cyclic communication. Extensive actuator diagnostics and configuration information can be provided using the DP-V1 acyclic data supported by the card, enabling valve profiling and diagnostic data collected by the IQ actuator to be incorporated into asset management systems. The Rotork Device Type Manager (DTM), provides enhanced commissioning and asset management benefits for Profibus-enabled Rotork valve actuators. Benefits of the DTM include the elimination of field visits to review, record or change actuator configuration information. The same applies to the collection of datalogger information that can be used to diagnose problems.

### Built-in redundancy

Pakscan is a digital control system designed specifically for valve actuators and has actuator focused features that are unavailable from other designs. For example, each Pakscan master station has the capacity to monitor and control up to 240 actuators on a single fault tolerant field network, up to twenty kilometres long without repeaters. This is an important reliability and economic consideration as repeaters require separate power supplies, can





Figure 3. The valve upgrade with IQ3 actuators at a water treatment plant in Olathe, Kansas, USA, included filter plant butterfly valves in an area beneath a walkway which made it difficult to access and operate the actuators. With the Rotork actuators, the installation of Remote Hand Stations (RHS) eliminated this problem.

The RHSs are mounted on the walkway to enable the user to conveniently and safely operate, interrogate and configure the actuators below. Unlike alternative options offering only basic operation and indication, the RHS retains all of the actuator's functionality, providing an exact duplicate of the actuator switches, display window and control interface.

slow the data transmission speed and introduce a single point of failure. The failure of a repeater will result in loss of communication with all downstream field units. Pakscan connection to other devices such as pumps and flowmeters is also possible, using the Rotork General Purpose Field Control Unit (GPFCU).

Pakscan provides dual host communication paths as standard and has the ability to isolate any field based fault without interrupting communication with other units on the loop. In fact Pakscan's configuration provides built-in redundancy in every area - from the valve to the control room - ensuring that vital information for the host controller on valve position, status and condition is as secure as possible.

### Self-healing network

The modular nature of the Pakscan master station also enables the choice

of a wired or wireless network. The Pakscan wireless network provides access to all the standard positional and status data available from the wired Pakscan system, together with the diagnostic and asset management information stored by Rotork IQ actuator dataloggers and configuration files. Pakscan wireless provides a simple access route to this asset management information.

To provide robust on-site communications, the wireless option operates a meshing system which will ensure that all field units have the facility of at least two routes back to the master station. If the normal traffic route is blocked, the network will find another way to route the messages. This self-healing network complements the fault tolerant capabilities of the Pakscan two-wire loop. Along with the existing in-built security features of the Pakscan system, the security of data over the

air is ensured by using encryption facilities.

Overall, the utilisation of these technologies contributes to improved operational stability, delivering increased reliability, increased availability, targeted servicing and fewer unplanned shutdowns, meeting many of the recommendations put forward by OFWAT.



Figure 4. The Viseu Sul WWTW in Portugal is the first in the country to adopt advanced membrane filtration (MBR) wastewater treatment technology. MBR treatment plants work without the addition of chemicals and with relatively low energy consumption. Centralised process control and automation is facilitated using Profibus DP enabled Rotork IQ3 actuators to operate penstocks and butterfly valves for flow control throughout the wastewater treatment process. Extensive actuator diagnostics and configuration information is included in the data supported by the Profibus card, enabling valve profiling and diagnostic data collected by the IQ actuators to support asset management at Portugal's environmental benchmark for wastewater treatment.

### About the author

Philip Hall is the Frameworks Manager for Rotork, managing the current and prospective Framework accounts. Philip originally joined Rotork as a Service Engineer. In 2009 he was promoted to Service Manager and relocated to the Middle East. In 2014 he returned to the UK and embarked on his current position. As Frameworks Manager, Philip plays a key role in promoting Rotork's product and service development within the water & waste treatment industry.  
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