





What if the pipe runs dry?

A redundant remote control and automation solution makes the water supply of the city of Luxembourg more reliable

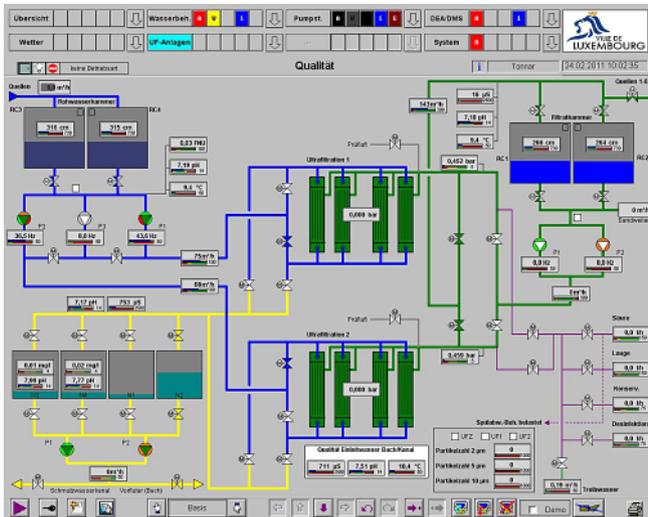
The city of Luxembourg waterworks were looking for an automation system that would ensure a high quality and reliable water supply – and they found it. The solution: A redundant, dedicated-line system in combination with a continuous remote-control system that transfers data along two different paths.

Many cities have to pump their drinking water over distances of hundreds of kilometers. This is not the case for the city of Luxembourg. Here ultra pure spring water bubbles from the Luxembourg sandstone at numerous locations. The 72 springs can supply the city with as much as 60 percent of its water requirement. The waterworks buy the remaining 40 percent from a reservoir that belongs to the Sebes syndicate. There is one more special feature: The service of the Eaux de la Ville de Luxembourg and its staff of 66 supply drinking water to not only the 92,000 inhabitants but, during the week, also to around 140,000 daily commuters from France, Belgium and Germany. Six pump stations, twelve elevated tanks and two water towers are used to maintain adequate line pressure along the 400 kilometers of pipe line from the former fortress town and across great differences in elevation that prevail along stretches of this pipe line.



Siemens' comprehensive automation and remote-control solution allows the monitoring and control of the entire water supply from the control station and from each substation.

siemens.com/telecontrol

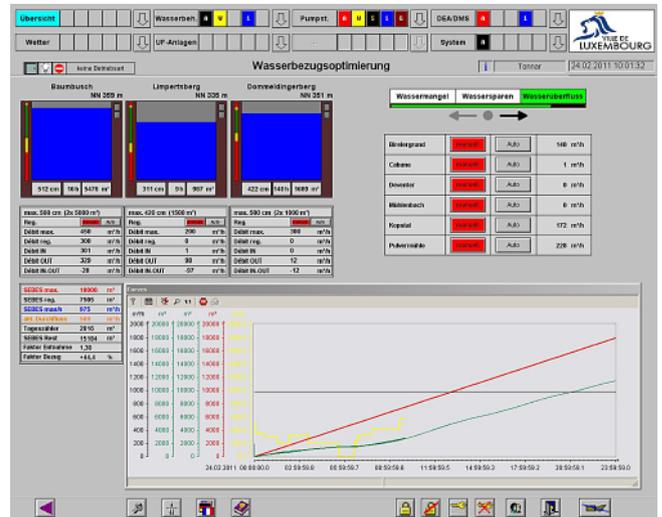


Clear quality measurement display panels in the visualization program (limit ranges using traffic light color principle) allow the operator to see at a glance whether the measured values are in the „green zone“.

Because they know what they are doing

In 2009, the city of Luxembourg waterworks decided to bring their entire water supply system up to state-of-the-art standard. A new automation and remote-control system was to be implemented to ensure an efficient and reliable control and monitoring of the entire water supply, including all remote terminals. The most important requirement for the new system: Reliability. “The main reason for the modernization was that redundancy was required”, explains Nico Pundel, director of the waterworks. “In the old system it would have been very expensive to implement redundancy and we would still have been left with outdated technology.”

Redundancy is of crucial importance to the waterworks, not least for reasons of economic efficiency, especially as there is a limit to the amount of water that can be drawn from Sebes. If the city requires more, it has to pay a contract penalty to the municipal authority. Consequently, the city of Luxembourg uses a special higher-level program that intervenes in the control system and regulates the various pump stations, tanks and water towers accordingly. “If the program fails, especially during the hot summer months, things can get really expensive for us very fast,” explains Yves Tonnar, the engineer in charge of technology at the waterworks.



A complex calculation program which ensures that the water limit from the Sebes river dam is not exceeded – otherwise it will become expensive.

Various solutions were proposed and their advantages and drawbacks were discussed in detail. There was one thing, however, that everyone could agree on: The higher level automation system would have to be flexible, open-ended and an industrial standard. Siemens was able to meet these requirements. “Everyone in the Siemens world is familiar with Step 7. However, there were only two external experts who could program Step 7 in the old system. We didn’t want to find ourselves this dependent again”, explains Tonnar.

Standard and nevertheless completely unique

A standard automation system based on the SIMATIC WinCC process visualization system was selected. The SCADA system (Supervisory Control and Data Acquisition) is technology and industry neutral in design, modular in structure, extendable, completely scalable, and is also suited for distributed systems. Although WinCC is essentially an “off the peg” system, the city of Luxembourg has customized the process visualization system to its own special needs. The competence team from Siemens Mannheim supported the city in this. Again and again Tonnar tested the wide-ranging skills of the competence team’s programmers with ideas for sophisticated calculation programs or also with straightforward graphic representations, which however required a great deal of complicated programming: “The programmers were extremely motivated and performed great work.”

One special feature of the system, for example, is a simple and consistent color designation in the visualization system, which is also reflected in the local stations and tanks or the clear representation of measured values for determining the water quality. Color coded limit ranges show at a glance whether a measured value is “in the green range” or requires re-adjustment in the process. Measured values can also be simulated; in other words, fed directly in the control system using I&C. This type of simulation is useful if a measured value fails and no measured value is then signaled to the system. For the system, a missing measured value is a faulty measured value. For safety reasons, the drinking water is then “destroyed”. Measured values can be simulated, for example, to ensure that high quality water is not directed back into the stream as wastewater.

In addition, a higher level designation system (HID code) is implemented, i.e. a cross-industry coding of plants, plant segments and equipment for uniform and system coding. Encoded in this system, for instance, is the exact topographical location of a gate valve or other device in the entire system. The code can be switched on or off in order not to overload the visualization screen.

“The technology we have implemented is well above the current standard. There are probably very few cities that have a waterworks that is operated at such a high technological level and with this degree of reliability”, according to the director of the waterworks. Each pump station was previously manned around the clock in three shifts to control measured values continuously and adjust the process if necessary. “Modernization will allow us to eliminate many of these shifts. Today we can deploy our staff much more effectively for skilled tasks”, says Pundel.



A special water usage optimization program ensures that the giant water tower in the Kaltreis district is filled to under the edge on the hottest days of the year.

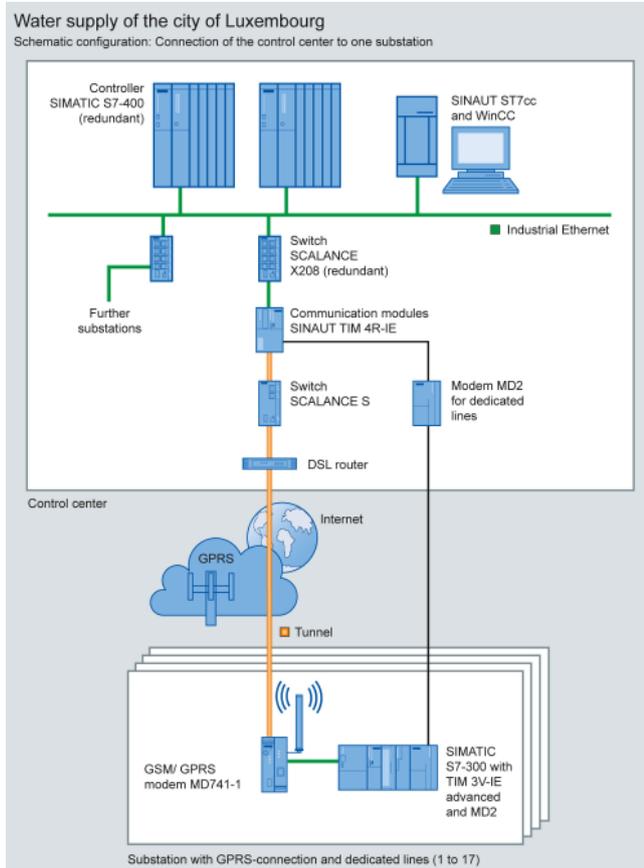


All threads of the redundant high-end automation solution come together in the control cabinet of the waterworks. The Siemens remote-control components are also installed here.

Just in case...

SINAUT ST7, which belongs to the TeleControl Professional range of products, will be used as the preferred remote-control system. The system, which is based on SIMATIC S7, monitors and controls remote process stations fully automatically.

The highest level of reliability was required here too. “Previously, we had only one server and would have had a real problem if this had failed. Added to this was the fact that we had only one wire connection. If an excavator had hit this, the whole system would have been incapacitated”, the engineer explains. Today, the city of Luxembourg waterworks has two servers, which are situated at different locations – and thus also two remote-control stations. One of the control stations hereby manages the process. All the functions are also active in the second control station, but no control commands or setpoint values are transferred to the substations. If one control station fails the other one is activated without any interruption.



System configuration of the control station and one of 17 remote terminals – Kopstal pump station.

Each control station is equipped with two SIMATIC S7-400 controllers; the remote terminals each operate with one SIMATIC S7-300 controller. The data connections between control station and remote terminals are also redundant in design – first via GPRS (General Packet Radio Service) and second via a dedicated line. Each of 17 substations allows a continuous process data communication with the two central control stations, as well as a cross-communication with each other. “The stations are operated fully automatically and the entire system can be operated from all substations and, of course, also by laptop”, explains Pundel. Other advantages:

- **Event-controlled communication:**
If necessary, the operating personnel can be quickly notified and intervene without delay in the process.
- **Event-driven data transfer:**
Only data whose state has changed is transferred. This allows a best possible transmission rate to be achieved.

- **Emergency program:**

If the entire network were to fail for any reason, the SIMATIC S7-300 controllers and the corresponding SINAUT TIM 3V-IE Advanced Communication Modules in the individual stations will continue to operate autonomously using a type of emergency program. Each transmission module has its own large buffer for several thousand data messages. This allows downtimes in the transmission section to be bridged.

- **Correct archiving of process data:**

All data messages in the control system are timestamped at the place of origin – including summer/winter change-over.

- **Comprehensive project planning from the control station to the remote terminals.**

- **Securely protected against unauthorized access:**

Outside access to the network is protected using a SCALANCE S612 security module. Secure remote access via the Internet is thus possible at all times.

(See box for product details)

1001 possibilities of remote control technology

WinCC system’s Web Navigator in conjunction with the TeleControl Professional remote control system allow systems to be controlled and monitored via the Internet from any location. “Theoretically, you can do everything from at home”, says Tonnar. “In actual practice, of course, there are various users with various authorizations.” The system offers other benefits as well: The engineer can even control the entire system using his smartphone. The consistent remote control system allows not only a comfortable monitoring and control of the entire water supply, but also saves substantial travel times and numerous local deployments. Tonnar confirms this as well: “Before, I was to spend up to half of my working hours in the car and at the pump stations. The furthest station is around 20 kilometers away. Today, I don’t spend more than 5 to 10 percent of my time there. We have never calculated what the precise savings are, but the new solution saves a lot of time and therefore a lot of money.” The city’s citizens have already noticed the benefits in their wallets. The new system allows the waterworks to offer their customers the valuable water at an extremely moderate price. “The key factor is that the redundancy provides a double safeguard and a high level of reliability for our water supply,” the director emphasizes.

Fit for the Future

Thanks to modern communication technologies, fault messages are also sent automatically today. If a fault occurs at the weekend, for example, the Siemens Alarm Control Center automatically sends an SMS which has to be acknowledged within a specified period. True to the motto "Two are better than one", the waterworks does not want to rely on a single system here either. The already installed communication modules, whose functions also include an SMS alarm signaling, offer an elegant and cost-effective solution to the problem. "We are planning to implement this additional safeguard in the near future. The SMS messages will then be sent twice, once at the top level from the control system and once at the bottom level from the substation. If we then also use two different providers, we are certain to be on the safe side", according to Tonnar.

Pundel has the following to add: "When this solution is in place we can eliminate almost all the weekend shifts". Staff that is on duty at the weekend in particular can simply dial in from their laptops at home and check at regular intervals whether everything is OK. Ideas for additional program modules are already starting to take shape in the minds of the Luxembourg waterworks specialists. Planned, for example, is a maintenance program for the pumps, whereby maintenance and repair of equipment such as pumps and motors can be planned and carried out in advance. This is expected to prevent uncontrolled machine downtimes in future.

Another idea is to make the water hardness measurement data available online to provide citizens with even more information about the service and further increase their confidence in the quality of Luxembourg's drinking water.

The Remote-Control Technology in Detail

Systems for the substations

- SIMATIC S7-300 controller
- SIMATIC MP 377 Touch Multipanel
- SINAUT TIM 3V-IE Advanced communication modules
- SINAUT MD741 GPRS modem
- SINAUT MD2 dedicated-line modem

Systems for the control station

- SIMATIC WinCC
- SINAUT ST7cc control station software for the connection to WinCC
- SIMATIC S7-400 controller
- SINAUT TIM 4R-IE master communication module
- SINAUT MD2 dedicated-line modem
- SCALANCE X204-2
- SCALANCE S612

Siemens AG
Process Industries and Drives
Process Automation
Postfach 4848
90026 NÜRNBERG
GERMANY

Subject to change without prior notice
PDF
Reference FAV-413-2011 En
DR.PN.PA15.XXXX.95.11
Produced in Germany
© Siemens AG 2015

The information provided in this brochure contains merely general descriptions or characteristics of performance which in case of actual use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

All product designations may be trademarks or product names of Siemens AG or supplier companies whose use by third parties for their own purposes could violate the rights of the owners.