Embedded PC is the key that opens the "Waterdoor"

Magical water feature enabled by PC-based control

The "Waterdoor", created by engineering firm as-systems, highlights the World of Water exhibit in the Swiss town of Flims. Visitors watch, amazed at the dense curtain of water drops that magically opens when they approach. The one question on everyone's mind: Will the waterfall really stop when you walk through it? A Beckhoff CX8090 Embedded PC with integrated EtherCAT Terminals and TwinSAFE safety technology ensure that it does and that no one gets wet.

© Photo by Matthias Nutt

The "World of Water" in Flims, which was renamed "Sinfonia d'aua" when it opened in September 2013, demonstrates how natural resources can be used in an efficient, environmentally-responsible manner. Triggered by the accidental tapping of an underground lake during tunnel construction, the project took shape over quite a few years to remedy the situation. The complete water supply was restructured in an environmentally-minded manner, facilitating use for drinking water, power generation, and to cover the ski slopes with artificial snow. In the Punt Gronda station, interested visitors can learn about the complex ecological relationships between the water sources in the mountainous Flims region and the technical implementation of the project. "The Sinfonia d'aua presents the broad subject of water from various perspectives. We believe that nature is the most valuable asset in our tourism-oriented region. We don't just want to explain how our valuable natural resources should be treated, we want to demonstrate it using examples," says Martin Maron, director of Flims Electric, the company that was instrumental in bringing the project to life. To develop a unique water attraction that utilizes natural surroundings, as-systems was hired to install a curtain of water, which ultimately materialized as the Waterdoor.

Notably active in international light, sound, and stage projects for over 20 years, as-systems has a long history of designing amazing water features and displays. From complete landscapes with waterfalls, cascades, and fountains, to water screens showing projected images combined with complex lighting designs, the projects inspire the kind of awe and wonder that visitors experience when encountering water indoors.

### Working technological wonders with a CX8090 Embedded PC

What looks at first glance like a miracle is enabled by advanced automation technology. The interactive water exhibit consists of a rail containing hundreds of jets mounted over a door lintel. A compact CX8090 Embedded PC and EL2798 EtherCAT relay terminals provide control for the jet assembly. Each of the digital terminals has eight switches that function like relay contacts for AC/DC voltages. The electronic switch connects with powerful MOSFET transistors, offering low start-up resistance to prevent high voltage peaks and electromagnetic interference. In addition, the CX8090 controls a total of 144 data points.

When the door radar detects a visitor, the water curtain opens from the center outward – similar to a curtain in a theater – and closes again after the visitor has walked through. A DMX terminal controls an LED bar in the door lintel, signaling green for "Go" and red for "Stop". Another function of the LED rail is to illuminate the water drops, which refract the light and thus become much more clearly visible to the visitors.

The Embedded PC regulates water levels and flow speeds, as well as valve settings. The water for the door is initially routed from a reservoir into a 1000-liter holding tank via a magnetically-controlled valve. The system monitors this valve,


Surprised faces: triggered by motion sensors, the Waterdoor opens to let visitors pass through without getting wet.

© Photo by Matthias Nutt
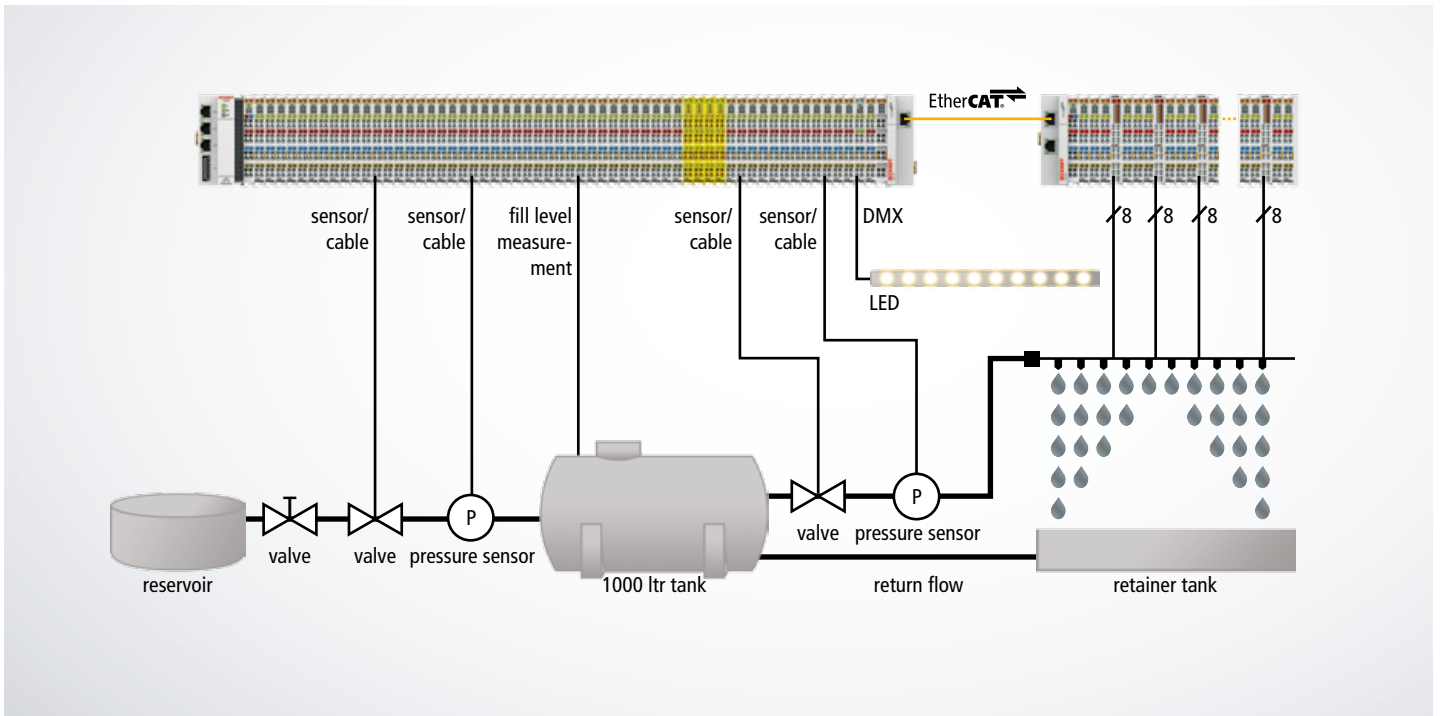
as well as a manual valve, to completely isolate the system and prevent any backflow. The fill level and the refill logic are also monitored, i.e. the refill flow is limited and controlled to prevent any water from being refilled, in case of a leak. After performing all these checks, the system pumps the water to the door lintel. The system monitors the water's flow speed and pressure, as well as internal sensors, to detect any cable breaks. Since the pump turns itself off when the curtain has been open for a certain period of time, it also has special algorithms to prevent misinterpretations. Water tank safety is controlled using Beckhoff TwinSAFE Terminals that differentiate between rising water levels caused by the curtain being open for a long time or drainage problems. The system also uses a KNX interface to report events, such as a critical fill level, via SMS.

"The PC-based controller is ideal for our applications, not only because of its small size, its modularity, and ability to handle many types of signals. It also can be integrated into our remote control network to ensure trouble-free operation at all times," says Andreas Staphan, Managing Director of as-systems. "We also use the high-precision EtherCAT controller for our 'magical waterfalls', where individual valves are opened and closed to create pictures and messages in the form of falling water. In addition, we have decided to equip our future special exhibits with Beckhoff components. This allows us to standardize modules, taking advantage of the worldwide support and distribution network provided by Beckhoff to service our worldwide exhibits."
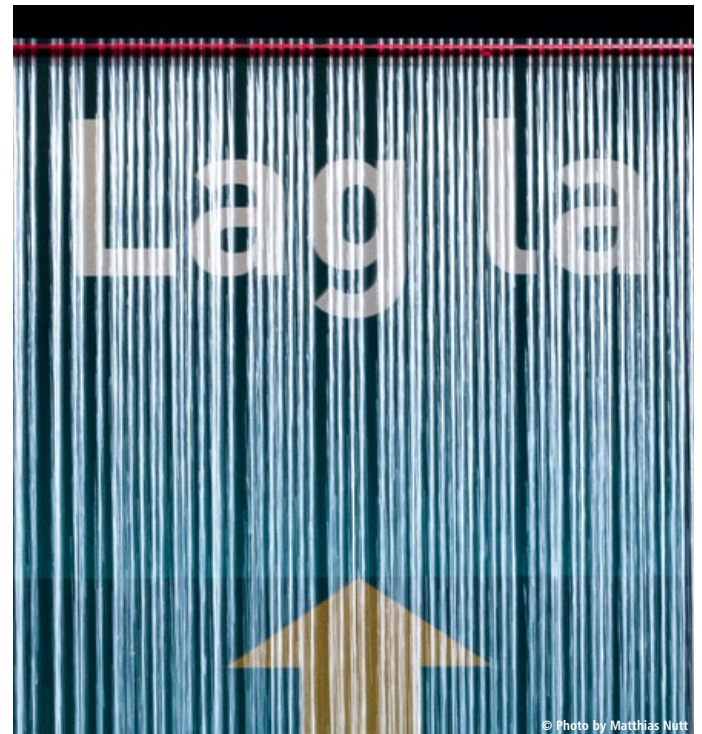
A DMX terminal controls the LEDs above the opening. Red indicates "Stop", while Green means "Go".

Further information:
www.as-systems.com
www.flimselectric.ch