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Measure - Control - Regulate

Flow measurement for 15,000 liters a second

Project: Spiez hydropower plant, measurement at the Wimmis weir

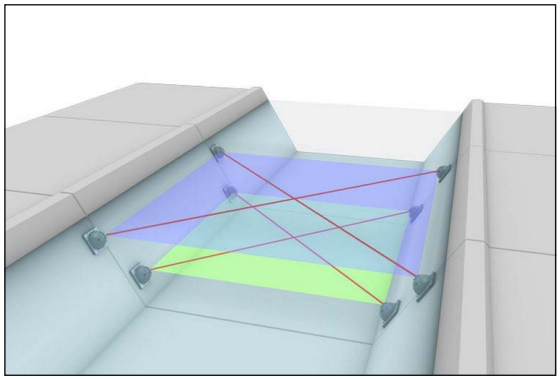
Project description

The BKW power plants of Berne, Switzerland, measure the water flowing to the Spiez hydropower plant at the Wimmis weir. The water flow is measured by an ultrasonic time domain meter from STEBATEC.

Fairly high peak discharge flow rate of up to 15 cubic meters a second as well as the plulsating, turbulent flow conditions are particular challenges to the measuring equipment. The system installed there is designed for such conditions and supplies reliable measuring data.

The challenge is measuring the flow velocity. Velocity sensors which are simple to integrate but fail under the extreme mechanical stress are available in the market. Other measuring systems are designed for laminar flow profiles. Our system is an optimum solution for most demanding requirements such as a rough environment, turbulent flow and high water volumes.

The Wimmis weir



Ultrasonic measuring devices at work

Ultrasonic measuring device

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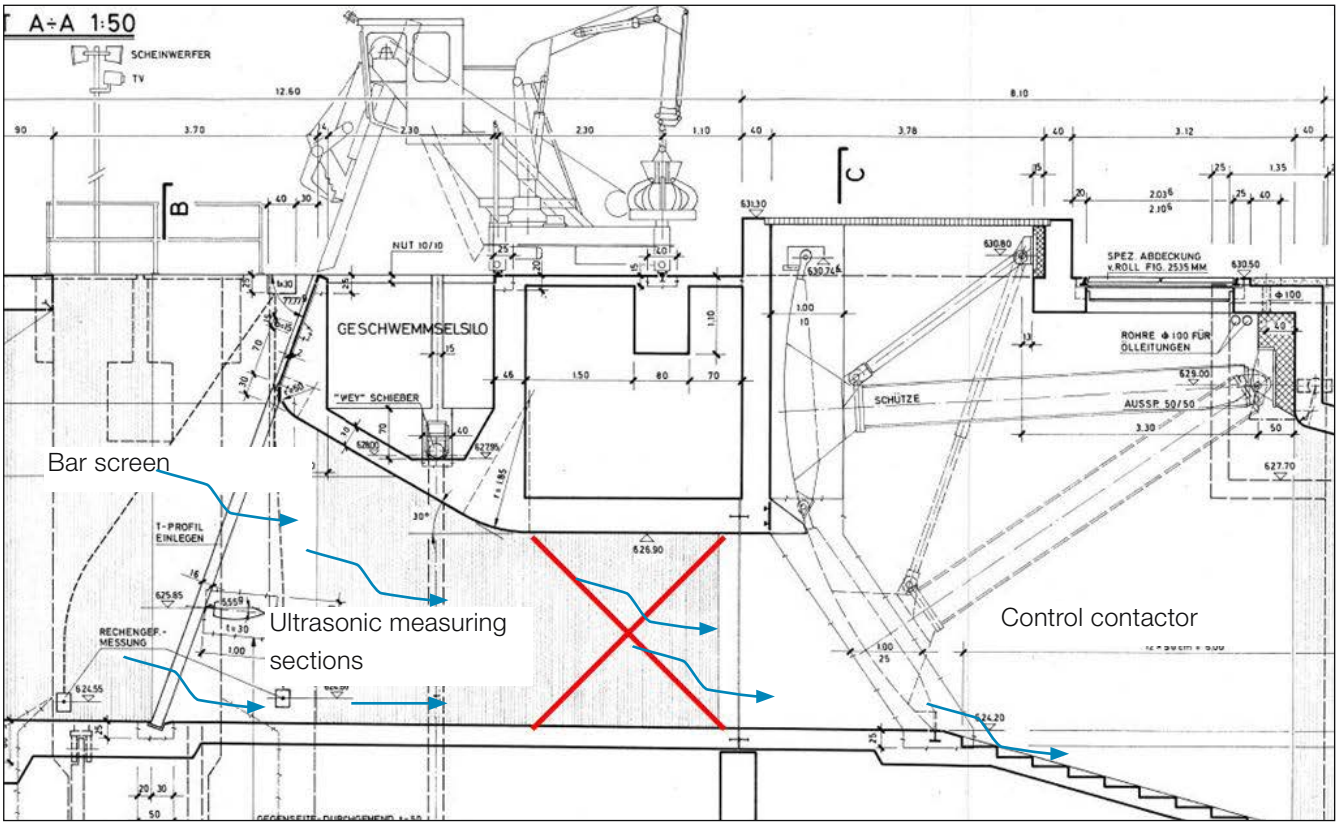
Implementation by ultrasonic time domain method

Explained in simple words, a sensor emits an acoustic signal which is received by a matching sensor on the opposite side of the duct. The time delay between sending and receiving the signal provides the system with information about the hydraulic conditions in the duct, from which the flow rate is calculated. In laminar flow systems, only two (1 pair of) sensors are used. Several measuring levels are applied to detect secondary flows and the different flow layers

Information about the wetted surface is required for calculating the water flow. In part-filled ducts and pipes, the wetted surface is calculated from the water level (with an additional level measurement) and the duct geometry. In the case on hand, no additional level measurement was needed because the pipelines are full constantly.

Measurement



Flow direction

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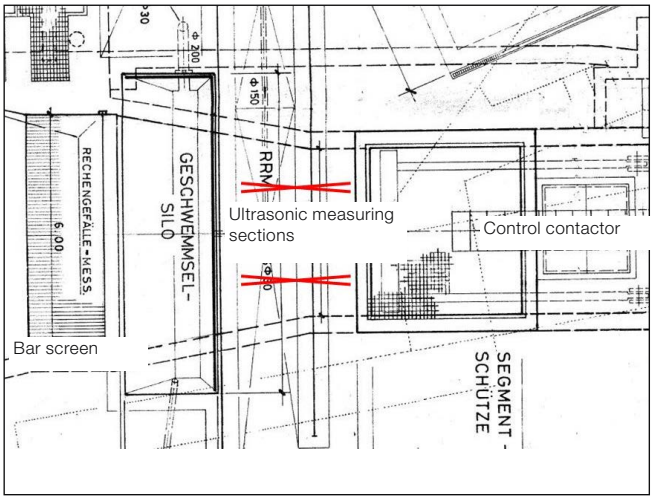
The water passes the bar screen, then the ultrasonic measuring sections and finally below the control contactor and flows towards the Spiez hydroelectric plant.



Hydraulic features and design of the measuring point

The hydraulic conditions are best for measurement there. Because the duct is filled permanently, no additional level measurement is required for evaluating the wetted surface. The effective volume is calculated from the flow rate and the duct geometry.

In the measuring section the flow rate increases towards the opening of the weir. To acquire the data of that dynamic water flow and the “flow threads around the horizontal axis” the flow causes in the spectrum of the whole duct height, the crossing ultrasonic lines are arranged vertically in the duct (see sketch).

In order to include the secondary flows in the measurement, another ultrasonic section each is set up at 90-degree angles to the main measuring sections, which sets secondary flows in relation. The crosswise arrangement of four transducers makes the measurement substantially independent of changes of the flow angles.

Even more differentiated flow measurement information is obtained by arranging several sections crosswise, which includes data from the different flow profiles horizontally side by side.

Reference:
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