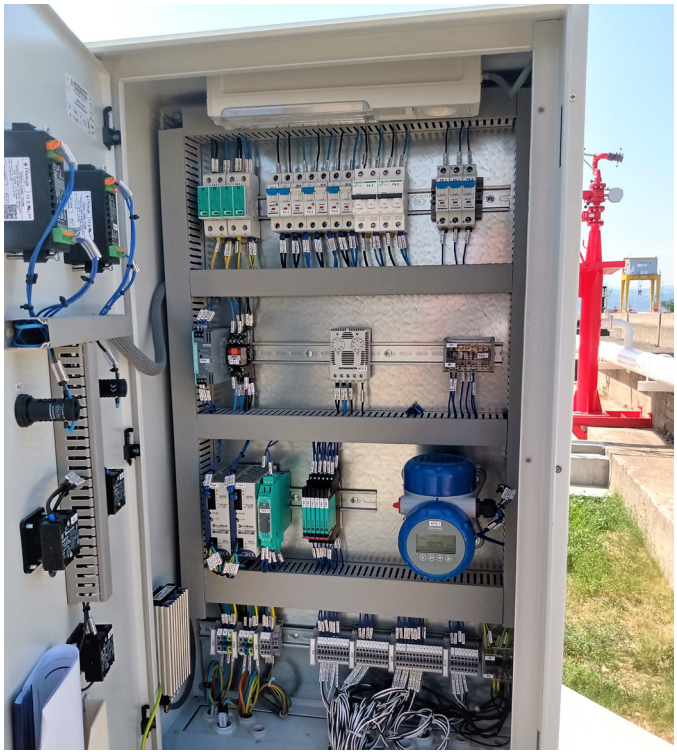


APPLICATION REPORT

Power Generation

Level measurement for ship locks of a hydroelectric dam

- Reducing vessel waiting times by nearly half an hour
- Guided radar level measurement to balance level differences between lock chambers
- Without mechanical parts or air supply for bubbling or maintenance
- Reliable and accurate control variables for efficient lock control and ship transit

ЕЛЕКТРОПРИВРЕДА СРБИЈЕ

1. Background

Djerdap 1, located in the Iron Gate gorge on the Serbian side of the Danube River, is one of the largest hydropower plants (HPP) in Europe with a capacity of 1,058 MW. State-owned utility company Elektroprivreda Srbije (EPS), who runs the industrial complex, is not only responsible for electricity generation but also for operation and maintenance of the ship lock used to transit vessels through the Djerdap 1 dam. The dam has a navigation lock with three rectangular chambers to bypass it. The lock length is 620 m / 2034 ft.

2. Measurement requirements

To increase navigation lock efficiency, minimise long closures and vessel waiting times as well as strengthen the overall reliability and competitiveness of the waterway, the utility company started an overhaul of the lock. The whole project, co-financed by the European Union (EU), was contracted to an EPC. One part of this complex project involved modernising the instrumentation for water level control.

Efficient and safe lock control requires the water levels upstream and downstream of the lock as well as in the lock chambers to be measured. The shock pressure of water on the gates can be prevented if the lock gates are moved only when water levels on both sides of the gates are roughly balanced, with a defined tolerance of 30 mm / 1.18 inch. Reliable level measurement is key to enabling automation of the process. The lock chamber water levels serve as control variables for smooth lock control and ship transit. The water level in the lock chambers can vary from 7...21 m / 23...68.9 ft.
Next to a submersible level probe, the operator decided to also install an alternative level technology in each chamber. The gates of the chambers only open when the different level measurements in the chambers are within a tolerable deviation of 30 mm / 1.18 inch.

KROHNE

3. KROHNE solution

KROHNE's OPTIFLEX 2200 (F) level transmitter was selected for level measurement in the various lock chambers. The cost-efficient, yet reliable and long term stable 2-wire TDR guided radar level transmitter was installed above manholes using a metal bracket. Due to the required measuring range, a single cable probe was selected. It is designed for continuous measurement of liquids up to 40 m / 131 ft and perfectly meets the accuracy requirements in this application. The OPTIFLEX 2200 works without moving parts and does neither require any regular maintenance nor air supply.

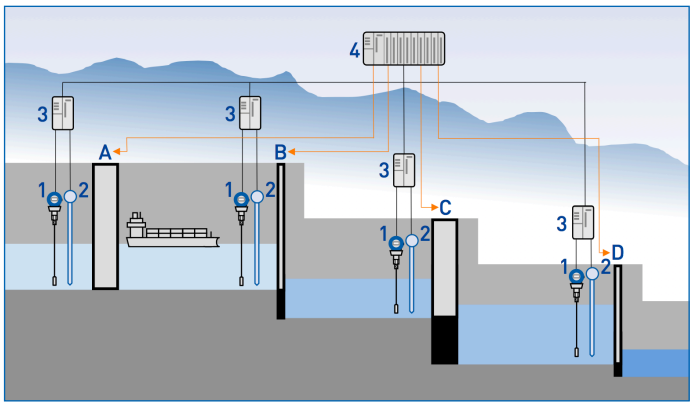
As with all KROHNE guided radar level transmitters, the OPTIFLEX 2200 came calibrated for this application. The remote version (F) of the level transmitter allowed the signal converter to be installed up to 100 m / 328 ft from the TDR radar level probe. WIG D.O.O., KROHNE's authorized channel partner in Serbia, integrated each level transmitter into the control system of the operator. Signals from the level transmitters and probes are connected to the corresponding redundant PLCs, i.e. to the redundant distributed I/O units of the electro-hydraulic drives at the upper, middle and lower head.

Measurement of water level in a lock chamber

Lock control: simplified process scheme

1 OPTIFLEX 2200
2 Hydrostatic pressure sensor
3 Distributed I/O unit
4 Lock gate control

A 1st lock gate
B 2nd lock gate
C 3rd lock gate
D 4th lock gate



The difference between TDR and hydrostatic level measurements must be <30 mm / 1.18"; Deviations between water levels of lock chambers must not exceed a threshold of 30 mm / 1.18"

Remote converter of an OPTIFLEX 2200 level transmitter installed in a distributed I/O unit

4. Customer benefits

The TDR guided radar level transmitter helped the operator improve lock efficiency significantly, reducing ship transit time by almost half an hour. This in turn increased the overall competitiveness of the waterway. Long closures due to inadequate control variables and lack of automation are a thing of the past.

Working jointly with KROHNE's channel partner WIG also paid off for the contractor and the operator. WIG covered the complete scope of supply – from technical advice to delivery and integration into the customer's PLC environment to flowmeter commissioning and after sales service. With its global network of regional offices and sales representatives, KROHNE is able to support customer applications and EPC projects worldwide.

5. Product used

OPTIFLEX 2200 F

- Guided radar (TDR) level transmitter for storage and process applications
- Continuous measurement of level, distance, volume, mass or dielectric constant

Contact

Would you like further information about these or other applications?
Do you require technical advice for your application?
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Please visit our website for a current list of all KROHNE contacts and addresses.

www.krohne.com