# Monitoring Hydroelectric Dam Alarms

IVC Alarm Server is designed to listen for or recognize a variety of alarm protocols and react to alarms by initiating user-defined responses that may include camera functions.

A three-way consortium comprising ABB Venezuela, ABB Canada and ABB Switzerland was awarded a contract to design, supply and install the unit control, protection and instrumentation systems for the largest dam in South America. The Guri Hydroelectric Plant, Venezuela's largest supplier of hydroelectric power, is located in the Nekuima Canyon, 100km upstream from the confluence of the Caron' and Orinoco rivers. The modernization project will extend the plant's life by 30 years

The construction of the Guri Dam was initiated in 1963. The first powerhouse, containing ten generation units, began commercial operation in 1978, with a total installed capacity of 2,065 MW. In 1985, a second powerhouse was built to house an additional ten generation units, each with a capacity of 730 MW. This brought the plant's total capacity to 10,000 MW, making Guri the second largest hydroelectric plant in the world in terms of power production capability. The plant has three high-voltage switchyards operating at 800kV, 400kV, and 230kV, each arranged in a breaker-and-half configuration. It provides the Venezuelan power market with 12,900 GWh of indispensable firm energy to meet the growing demand of the sector.

In addition to acting as consortium leader and contract manager, ABB Venezuela was responsible for the preparative engineering works required for the installation of the various new systems at the plant and was responsible for their installation and integration at site. Other systems within the remit of ABB Venezuela are:

- The vibration and air gap monitoring systems for the generating units
- A closed circuit television system for process monitoring and security surveillance
- Communication systems: Tele-protection equipment and fiber optic networks

As well as extending the plant's life, the project will improve the plant's availability to levels over 90 percent and should also increase the efficiency of the generating units. The main objective of the modernization project, however, is to maintain the continuous production of clean and reliable electricity.

## Leak Detection System

A key reason ABB chose Industrial Video & Control for the CCTV component was the flexibility of IVC's video management software and its ease of integration with complex control systems. Furthermore, IVC's capability and willingness to customize its software to meet exacting requirements of the project made the IVC system the ideal choice. ABB had a need to integrate a leak detection system with the video monitoring of the dam. The IVC Alarm Server, a module of IVC's View Station Software, is the specific tool used to accomplish this integration. The IVC Alarm Server is designed to listen for or recognize a variety of alarm protocols and react to alarms by initiating user-defined responses that may include camera functions.

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The Guri Dam in Venezuela is the 3rd largest dam in the world.

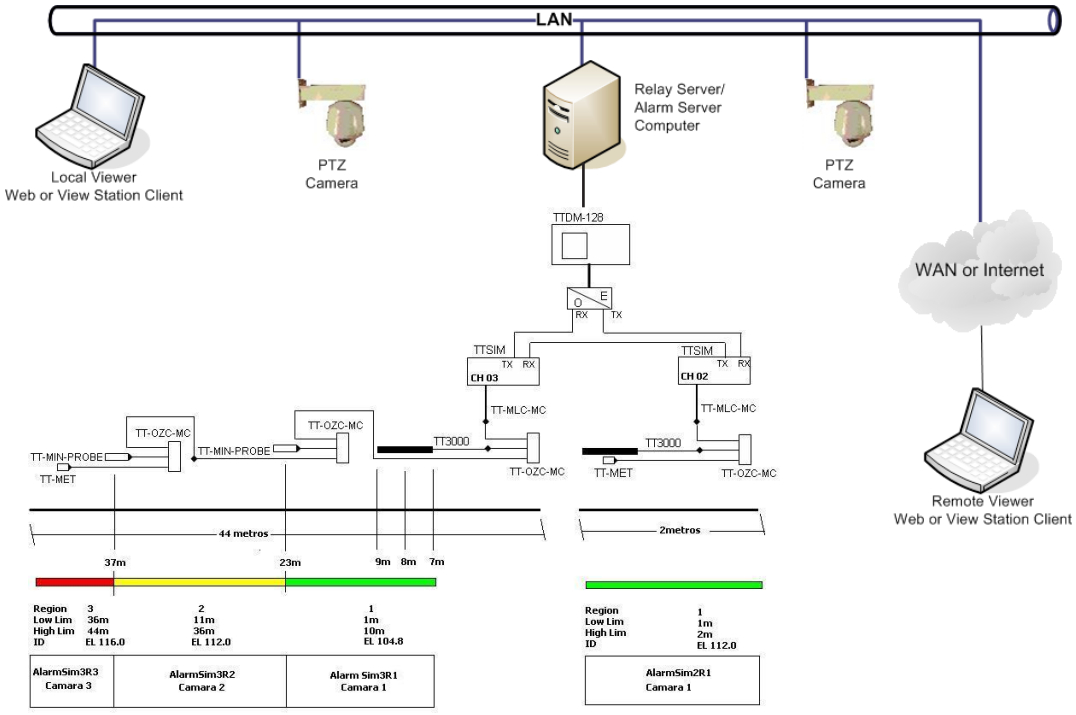


Fig. 1

The Guri Dam leak detection system employed is comprised largely of Tyco Thermal Controls sensor wire and alarm modules. **Figure 1** shows the general application of Tyco TraceTek TTDM-128 master modules and TTSIM slave modules at the dam site. When liquid is detected by the sensor wire, the TTSIM slave modules send MODBUS protocol alarm messages to the TTDM master. The TTDM master maintains a database of these alarms. The TTDM master is connected via a serial cable to a PC running the IVC Relay Server and Alarm Server software. When an alarm occurs, the TTDM writes a value into the PC memory, indicating the source and type of alarm. IVC extended the capability of the Alarm Server to periodically poll this memory location for current alarm information. If a leak or other problem is detected, the Alarm Server will initiate response actions that have been programmed for the specific alarm and location. This includes moving one or more PTZ cameras to preset positions, recording, logging the alarm, and generating visual and audio cues to the operator.

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## Video Surveillance System

Video from Guri's 45 IP cameras is managed by IVC's Relay Server Software. This enterprise-class server software takes in video feeds from the plant's IP cameras and distributes the video to browser-based or View Station clients. As configured at Guri, the Relay Server software runs on two server computers located in the plant's server room. One server manages 22 cameras and the other 23 cameras. In addition to serving live video to clients, the IVC Relay Server provides the following functions:

- Storage of video and snapshots taken as the result of alarm or operator intervention on specified RAID storage array
- Bandwidth management of entire video network
- System security through the assignment of access rights
- Serving and playback of stored video and snapshots

Remote viewers on-site (plant managers, for example) and off-site (government utility or emergency management personnel, for example), given the proper access rights, may access the plant's cameras through the Relay Server's browser interface. Users need only know the IP address of the Relay Server computers. The browser interface provides an intuitive click to point interface that includes a static panoramic image for precise single click camera positioning.

As described above, the primary purpose of the video surveillance system is to monitor the dam and react to alarms created by the leak detection system. The video system currently installed is comprised of 45 cameras, a mix of 18x zoom PTZ cameras and 23x fixed zoom-only cameras. All system cameras are monitored on multiple user-defined operator screens under the control of IVC's View Station Software. In addition to providing unlimited user defined displays, the IVC View Station provides:

- Automated camera scans through available live video windows
- Automated camera and control functions based on user-defined schedules
- Alarm Management
- User defined button panels

A key feature of IVC's IP-based software approach is extensibility. Consequently, it was easy for ABB to extend the camera network into some of the facility's buildings in order to monitor hallways and building lobbies. Future plans include installing additional IP cameras and integrating an existing analog CCTV security system into the IP-video network controlled by IVC camera management software.

The dam runs 45 ip cameras with the feed distributed over 2 computers and managed by IVC Relay Server Software

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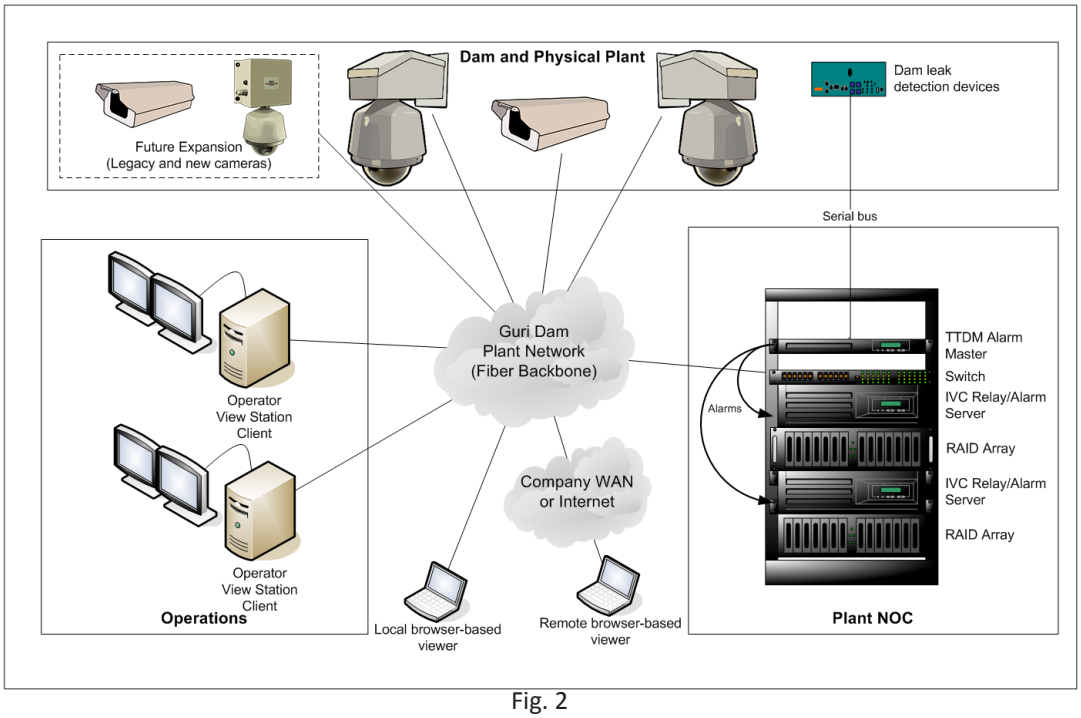


Fig. 2

**Figure 2** illustrates a functional diagram of the video surveillance system we have described in this application note. A key reason IVC was chosen to provide the video system for this major upgrade project by ABB, is that, as a provider of quality industrial-grade video cameras and camera management software, IVC was well-positioned to tailor a solution to exactly meet the needs of ABB and their customer. Our engineering professionals worked closely with ABB's project engineers to determine the most effective way to integrate the Guri Dam's leak detection system and the video monitoring system. Having an integration tool, such as the IVC Alarm Server, facilitated this process and kept the system open for the potential monitoring of other alarm sources in the future.