Innovative Optimization / Upgrade of SCADA / DCS System

– Investment Saving Technology – Case Story

Water companies worldwide have recently found themselves confronting severe budgetary pressure to renew equipment and improve the performance that is required from existing communication and control systems. This pressure is compounded by the need to technologically update old systems, which must sustain an adequate level of service and maintenance to customers and cope with new constraints, such as communications and data security at high levels, and adding new stations and services to the decentralized system on the ground. Two thirds of SCADA/DCS systems worldwide are currently undergoing or facing an upgrade project. We are not alone.

The waterworks in the Jordan Valley which served the new pioneering settlement in Israel began in 1930 to supply drinking and irrigation water to the residents of the valley, utilizing water from the Jordan River, the lake Kinneret (Sea of Galilee) and the Yarmoukh river.

In 1978, the Water Association of the Jordan Valley (hereafter, the Water Association) was set up by the residents of the valley, in order to produce, treat and distribute drinking and irrigation water, treat effluents, and develop new water sources and technologies. The Water Association is responsible for comprehensive water and sewage services for its clients, who are also its owners, from production to billing.

The Water Association currently operates:

Applications

- A low-pressure system for supplying irrigation water
- A high-pressure system for irrigation
- A sewage collection point for each community
- A real time communication system with full control and HMI in the Control Center

Installations

- 115 pumps in 22 water pumping stations, output 15-1200 HP
- 6 operative reservoirs
- 40 sewage pumping stations
- A central unit for treating drinking water
- A Desalination plant – under construction

The Technological History of communications and control in the SCADA/DCS of the Water Association:

1976	Radio communications Remote I/O	Motorola Intrac
1980	Landline and wireless communication with control center	Motorola Intrac
1985	Landline and wireless communication with control center + HMI	TI (Texas Instruments) Controllers
1995	Real Time radio communication - DCN	TI + Siemens controllers
2000	Realt Time radio communication – DCN	Various controllers
2012	R-Win Real Time cellular/ radio communication	Various controllers

Link ► Photo –Map of stations of the Water Association in the Jordan Valley and around the lake

As the turn of the century approached, the Water Association constructed a process for optimization of the SCADA/DCS system to improve performance while maintaining the value of existing assets and employee competencies with a minimum of investment. The chosen technological solution had to meet an unexpected initial test – a 36 year old station with antiquated equipment, controller and communication, had crashed and stopped working.

Station 1, quick rescue and integration

The station was established in 1976 and transmitted a small amount of data through Motorola's Intrac system. In 1982 additional pumps were installed, as well as a TI controller and landline communications.

In 2012 the landline communication failed, and AGM was called in for rescue operations. Within 4 hours the system returned to full operation with the original 1982 TI controller together with a new IP radio-modem and an AGM R-Win unit.

The station works well with a modern control center; the TI PLC is scheduled for replacement in the next budgetary year, and will be integrated into the existing system in a smooth, quick process.

Food for thought

Aside from the "regular" considerations of budget, smart planning, compatibility with existing system, selecting a reliable integrator, recruiting management and teams for the project, etc., we wish to emphasize the issue of the **solution's life cycle**. The intent is to assess with as accurately as possible the potential benefits and costs associated with the solution throughout its lifecycle, from installation to replacement.

As an example, in station 1 above, the choice of the controller proved exceptionally successful, not only due to its reliable performance over the last 30 years and the 1-2 years still left to go, but also because the controller can integrate with new technology from 2012, interfaces with the solution by AGM that leads to an increased period of yield and performance by the old equipment, while postponing new investments without compromising advanced, current technical and operational capabilities.

Decision makers in the upgrade project of this station now confront a serious challenge in choosing technology and equipment that would meet the needs of the system for the next 30 years, primarily in communications, a more "stormy" field than that of control.

Two points for illustrating the issue:

- The average lifecycle of a SCADA/DCS system is 18 years (based on global statistics), but we aim for 35 years. Who in our vicinity knows how to handle 30 year old equipment in a critical application? (Manufacturers declare their equipment is "open for any future upgrade". They will not be here in 30 years; even Motorola abandoned MOSCAD after 19 years).
- Predicting needs is more important than predicting technologies. For example, the following objectives have dramatically increased in importance during the last decade: 1) utilizing reclaimed water over 80% 2) Securing data and communication to the level of a single datum 3) reducing leaks below 20%. What needs will top the agenda in 15 years?

Station 2, quick rescue, backup and integration

The station was established 60 years ago to pump the Jordan River's waters and distribute them to consumers. More recently it functioned as a backup for a newer station that is 30 years old now. The equipment in it is very similar to station 1, above. It ceased operations two years ago.

To upgrade the "younger sister", a process necessitating shut-down for a number of months, the 60 year old station was reactivated with AGM's winning prescription – an R-Win unit broadcasting through a cellular router the data of the ancient, 36 year old controller, with no changes to the control center. (pictures below)

How does it work?

AGM's field unit that is called **R-Win** (Wireless Internet Networking) is installed between the PLC/RTU data originator and an IP radio-modem or a cellular router in the remote station, broadcasts on a public or private radio network or on a cellular network and allows the end station (pumping, sewage etc.) to communicate with the center and the neighboring stations. One can create a dual configuration- two communications media in parallel, from one station. The system facilitates a secure approach to managing an end station from anywhere via Web HMI.

A few comments about the difficult **work environment** in the Jordan Valley and the resilience capacity required of communications:

- The temperature measured in the control cabinet during the summer reaches 49°C
- The region is saturated with communications "noise" generated by the armies of Israel, Jordan and Syria, rescue services, taxis, logistics systems, various companies, illegal radio stations and civilians active on amateur radio.
- As in many SCADA/DCS systems, many diverse controllers and radio instruments participate in the installations such as Schneider, TI, Koyo, Unitronics, Siemens, AB and others
- The control center is minimalist and is remotely operated with full reliability

Pictures from station 2

Old controller cards from 1976… It works

Yes, this works as well… (picture -Summer 2012)

AGM developed a system for managing real-time communications to the control center and lateral communication between the field stations, that includes software at the center and a compact hardware-software unit in the end stations, known as **R-Win**. One can employ the illustration of installing intelligent and cheap booster unit in an old motor to enhance the vehicle's performance, instead of replacing the entire motor to describe the action of R-Win and its impact.

Applicable benefits received from an SCADA/DCS system in which R-Win units are installed:

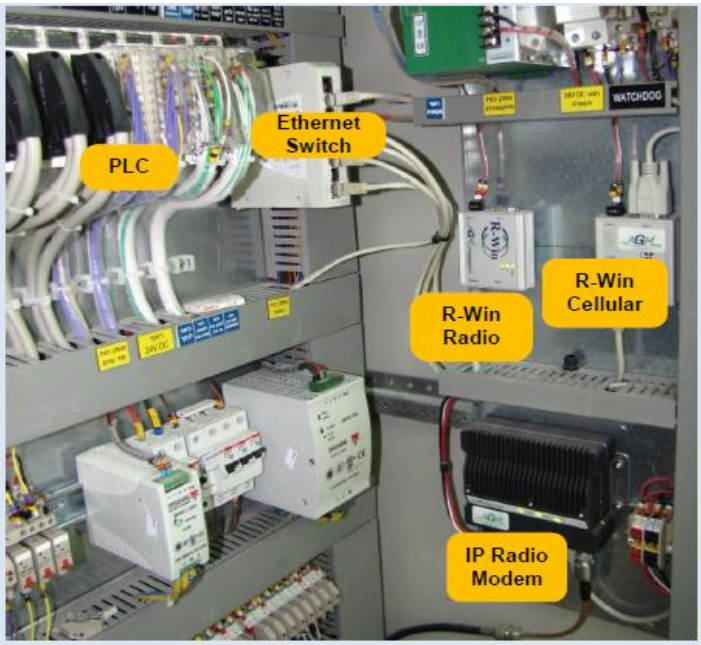
- An improvement in the communication system - each unit is also a Router-Bridge-S&F transmitter with an IP address.
- Communications backup via an alternative communications path to adjacent stations that is operated automatically in case of malfunction of the default route.
- The R-Win unit analyzes the data, time-stamp each one and initiates transmission of changes only according to parameters determined by the customer, broadcasting to an adjacent station and/or to the control center. There is no need for polling by the center, a smart capability that economizes on RF traffic and leaves the radio channel open.
- All the R-Win units can manage local control tasks between themselves without the intervention of the control center.
- An R-Win unit includes a security layer and can be programmed to the higher security level using existing tools. There is an option for secure access to R-Win stations via Web-HMI.
- A low risk easy optimization project that facilitates graduated progress by upgrading each station at a time.

Link ► Diagram – Network Architecture – Wireless Ethernet/MESH Real Time, by AGM

Similar to the PC revolution of the 1980s, AGM has developed technology that adds to the PLC/RTU end units intelligence and communications management, analysis and decision capabilities. This approach facilitates upgrading the performance of a decentralized system while preserving the existing assets value, achieves economies in equipment and employee training without impairing work habits and control center applications.

Installation in an upgraded control cabinet in remote pumping station

- Each component has an IP address.
- In this station, dual- radio and cellular communication is installed in order to secure the system and back up communications.
  This configuration is implemented at all the critical stations in the valley.
- The cellular router does not appear in the photograph



Link ► R-Win technical document

Link ► SCADA/DCS Asset Optimization - Cost comparison

Station 3 after a comprehensive upgrade

AGM Communication & Control Ltd. specializes in unique solutions from planning to installation, embedding and maintenance in projects involving the setup, optimization and upgrading of SCADA/DCS systems that are in used in water, sewage, energy and environmental installations.

AGM based in the Jordan Valley, has been active in Israel since 1996 and recently opened an office in the United States East Coast.