Farm Data Systems and Azcal Management Reduce Pump Management Time by up to 90%

Cost-effective automation and internet of things technologies save time and yield better control

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THE CUSTOMER

Azcal Management farms 8,700 acres in Kings County, California, in the heart of the San Joaquin Valley. They farm a diverse range of crops including pistachios, wine grapes, alfalfa, and row crops like onions, garlic, and tomatoes. Pioneers in precision agriculture technology, Azcal focuses on increasing production, on efficiency, and on improving crop quality.

In drought-prone California, farmers walk a fine line on water use. Water costs, government regulations, and concern for future water availability all mean they must start focusing much more on providing just enough water for crops, not too much or too little.

One of the Azcal ranches has 12 deep-well pumps, all with VFDs (variable frequency drives), feeding a single mainline serving a 4,000 acre ranch just south of Lemoore, California.

Monitoring and controlling these pumps used to be a full-time job for farm managers Jake Sheely and Marty Rhoads. It took six to seven hours throughout each day to drive around the ranch and make the needed micro adjustments to pumping and irrigation systems.

Their monitoring was vital, ensuring that system pressures and flows were within range and that pumps were operating efficiently. With four or five well pumps running at the same time, Jake and Marty had to be extremely diligent to avoid both low and high pressure events and often had to switch wells based on farming needs.

The wells must be kept in operation but not overdrawn. A drop in the flow rate would mean the well was overdrawn, and if air was sucked into the pump, the well could require thousands of dollars to repair.

All Azcal wells and irrigation filter stations are equipped with VFDs and flow meters.

In addition, like many growers, they also suffered from power failures and incoming voltage spikes. It could be several hours before they realized a pump was no longer running or had burned up.

The time involved in manual monitoring and control was just too much. Azcal looked for a simple way to automate their water management and track pumping events for monthly water accounting.

Azcal interviewed several Ag Tech providers about their need for remote pump monitoring and control. They tried proprietary tools designed for pump control, but although these tools worked for one pump and 40 acres, none of them could integrate everything at scale. And there was limited support for remote control or sophisticated PID loop control.

Discouraged, Azcal was dubious when Farm Data Systems (FDS) in Madera, California, approached them with some new technology. However, FDS owner and president John Williamson had worked on projects for them with a previous company, so they were willing to listen.

"No one has been able to deliver what we needed," said Jake.

THE SYSTEM INTEGRATOR

"Not that many system integrators serve the Ag market," explains John. "They are focused on post-harvest—pack houses—not really in the field."

Azcal well pumps all feed the same mainline pipe, leading to complex pressure management requirements.

As John notes, agricultural customers are trying to solve fairly simple problems, but there are so many difficulties that it becomes complex. Assets are spread out over wide distances. You can't run Ethernet wiring; the system has to be wireless. And cost is a huge factor, as farms don't usually have big budgets.

But the engineers at FDS have spent the last 20 years figuring out how to make technology in the field both relevant and cost-effective to growers. In the early years they used their own technology for monitoring, but customers began asking for more and more features. So FDS standardized on Opto 22 hardware and Ignition software from Inductive Automation®, bringing agriculture into the internet of things.

"Five years from now I don't know how anyone will be able to farm efficiently without this IoT technology," says John.

Using the Opto 22 hardware and Ignition software, FDS has developed an end-to-end field monitoring and automation solution for crop irrigation management.

Opto 22 *groov* EPIC controllers and *groov* RIO modules connect to sensors and equipment in the field to gather data and automate control.

"There are 60,000 irrigation pumps in California, and 60-70% have only got four to six I/Os. It doesn't make sense to put a full controller in there."

- John Williamson, Farm Data Systems

FDS' Water Informatics platform, an Ignition project hosted on FDS' private cloud, provides the control and data that farmers need in a way that they understand and can easily use. Each customer has a private view based on their login that shows just the assets and information for their ranch.

By avoiding expensive custom hardware that can be time consuming to build and maintain, FDS can keep prices affordable while also limiting downtime if something needs to be replaced or upgraded. With off-the-shelf controllers, sensors already widely used in many other industries, and their own easy-to-use software, FDS' systems are very affordable for farmers.

Not only has the company significantly improved irrigation management at over 500 farms covering more than 50 crops, they also farm their own 200-acre technology lab to test system improvements.

Azcal filter stations typically serve multiple crops in fields of various sizes.

THE SOLUTION

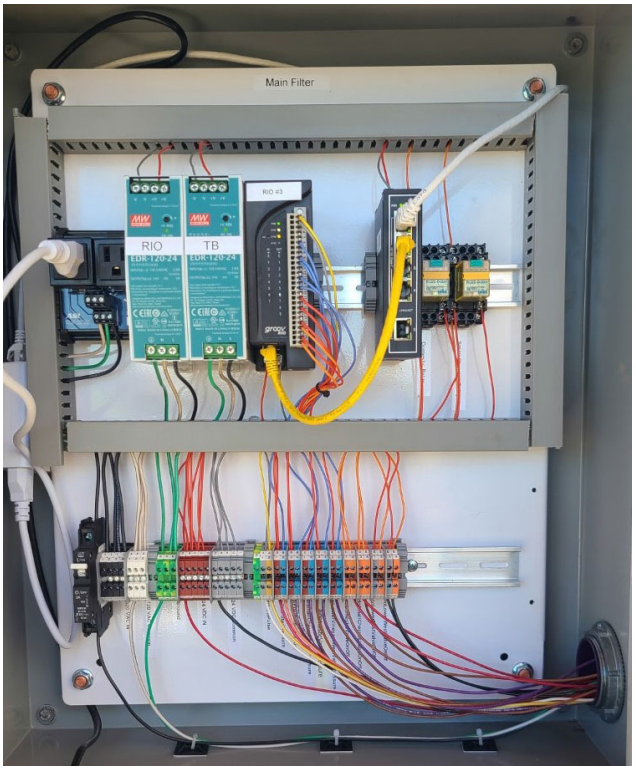
What Azcal needed was a controller at each well pump, fully integrated with their existing VFDs, that would allow them to remotely start and stop pumps as well as make micro-adjustments to either the speed or the pressure setpoints. They also needed reliable monitoring of flow meters and incoming voltage.

FDS met Azcal's needs with an integrated, modular architecture that can be easily adapted to meet the unique requirements of each customer.

THE HARDWARE

Farm Data Systems began using Opto 22 controllers and I/O several years ago. They had used Allen-Bradley® products for pump control, but the systems were too expensive for most farms.

When they discovered that new IoT products from Opto 22 could do the same things more efficiently, John says, "Opto opened the door into Ag for us."



The *groov* RIO with 10 universal I/O channels is well suited to Ag pumps.

Initially they chose the Ethernet-based, rack-mounted SNAP PAC R-series controllers and I/O for field installations. When Opto 22 released *groov* EPIC and *groov* RIO, however, they saw an opportunity to reduce costs further.

"There are 60,000 irrigation pumps in California, and 60-70% have only got four to six I/Os," says John. "It doesn't make sense to put a full controller in there." Instead, FDS uses a *groov* RIO universal I/O module, a small unit that offers a broad range of software-configurable signal types, plus built-in security and IoT communications.

For system control, FDS uses the sturdy *groov* EPIC edge programmable industrial controller. Designed for industrial automation and the internet of things, the EPIC offers security features including a configurable device firewall, user accounts and authentication, data encryption, security certificate management, VPN client, and dual independent Ethernet ports. With control programming options and the ability to run Ignition software, EPIC is a step ahead of other industrial controllers on the market.

Both *groov* EPIC and *groov* RIO include Node-RED and MQTT communications, which FDS is increasingly using to streamline data capture. A *groov* RIO at a remote location, for example, can send data via MQTT directly to an MQTT broker on the Ignition server.

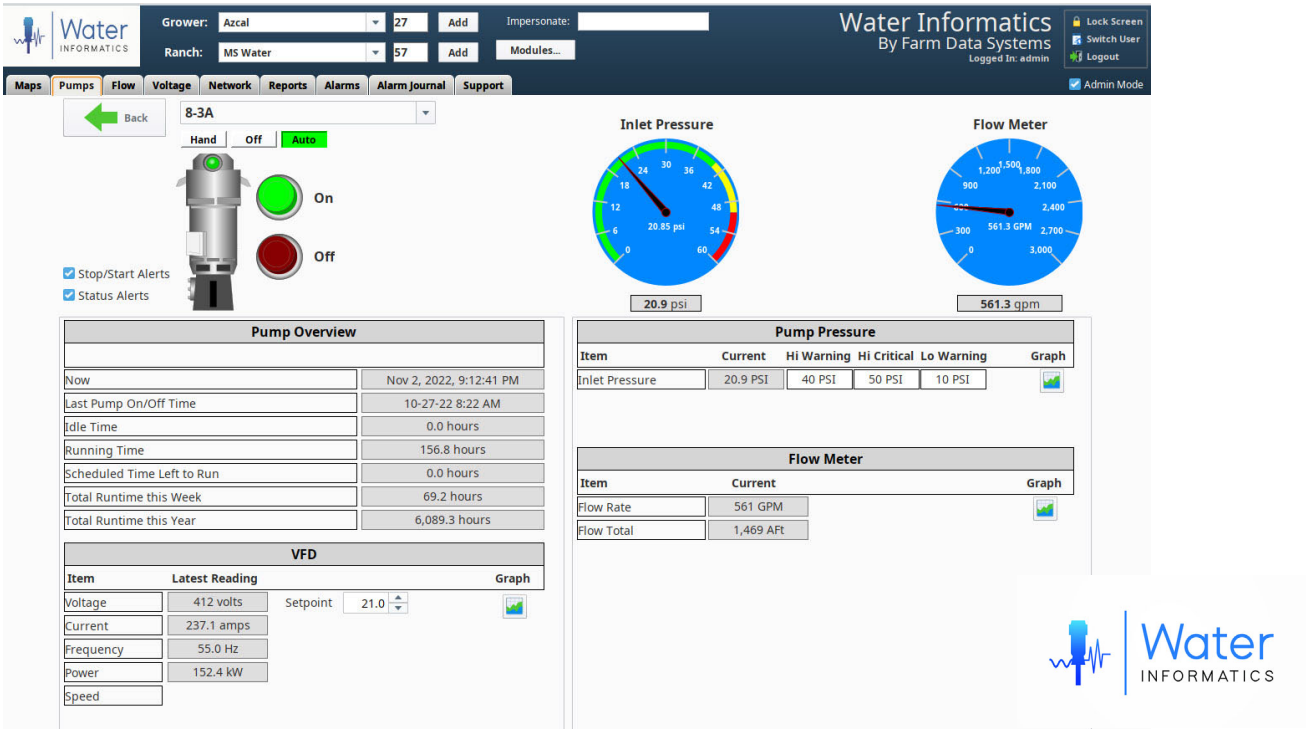
THE SOFTWARE

A key part of Farm Data Systems' installations is their Ignition project software, Water Informatics. With a UDT library of all the features they provide—pumps, flow meters, moisture probes, every physical device—new assets can be easily copied and pasted to build out a new project in minutes. Once added, every feature can be expanded to other customers.

Because the architecture is hosted, FDS just needs to turn on the customer's access to their individual pages. Adding a new client is "super fast," as John notes. "The software part can be completed in a few days. Installing hardware is the bulk of the work."

Using industry-standard controller hardware and SCADA software, FDS offers almost 30 different modules hosted on a secure web server, from soil moisture monitoring to full irrigation automation. And they constantly add new modules based on customers' needs.

For Azcal, FDS began by installing Opto 22 SNAP PAC I/O units at five well pumps. As soon as *groov* RIO was



Farm Data Systems' software, Water Informatics, gives customers like Azcal data and control from PCs and mobile devices.

available, they installed *groov* RIO modules at an additional seven well pumps. The well pump I/O reports data on voltage transducers, virtual speed potentiometers, remote setpoints, current switches, VFDs, and flow meters at each location, sending that data over WiFi via an Ethernet switch and a Ubiquiti bridge to the main tower location.

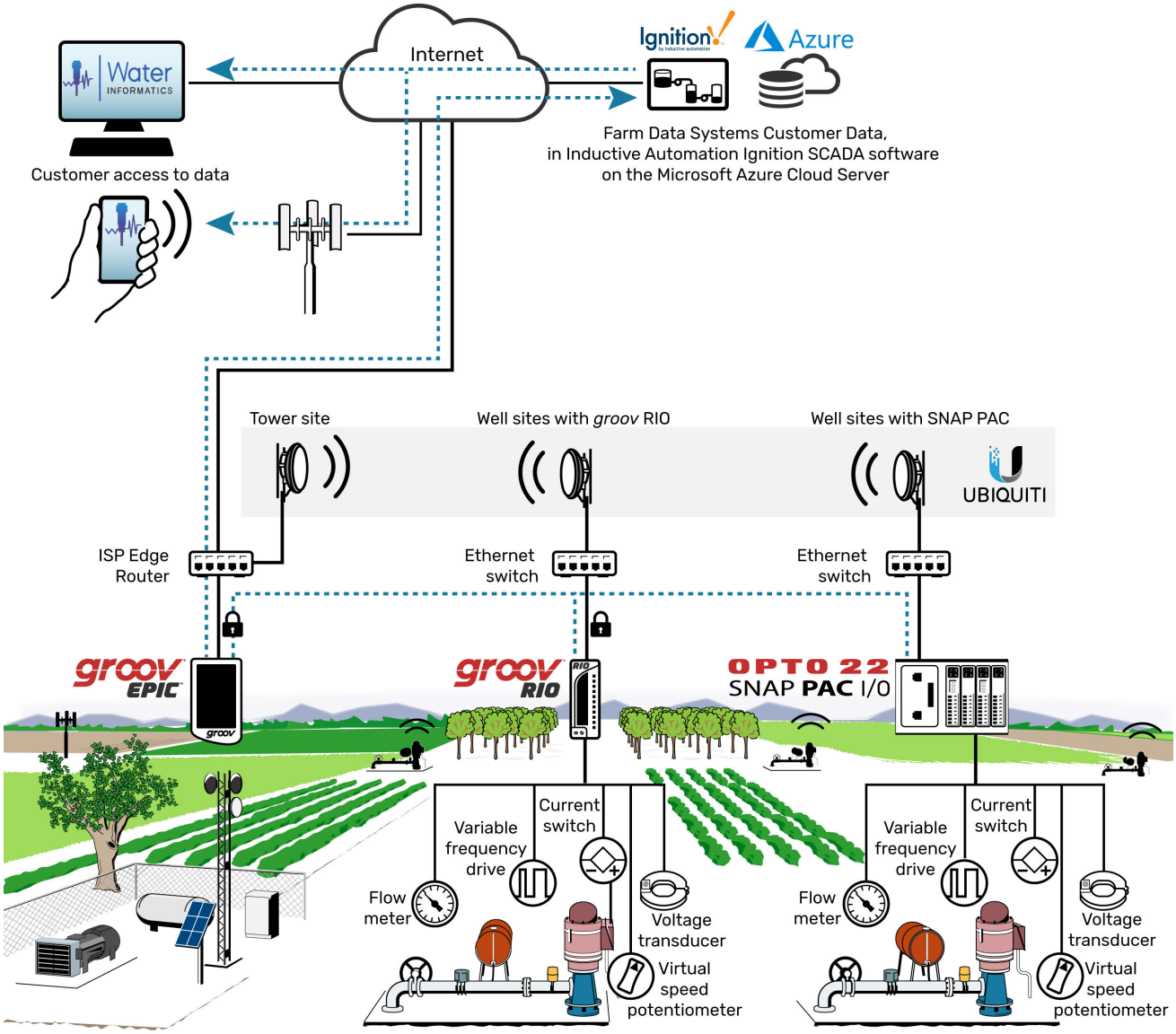
At the tower location a *groov* EPIC acts as the central controller, running an Opto 22 PAC Control strategy. From a dedicated network at the tower site, data is shared over a VPN from the EPIC, through the internet. The customer data lives in Inductive Automation's Ignition SCADA software on the Microsoft Azure Cloud Server.

The Water Informatics software gives Azcal the ability to access their system via mobile devices. From their phones or other devices with a web browser, Azcal can:

- Remotely start and stop pumps
- Control VFD frequency on four pumps using a virtual speed pot
- Control pressure setpoint virtually on the remaining eight VFDs
- Continuously monitor pump pressure & flow rate
- Track VFD frequency, voltage, current, and power
- Monitor incoming line voltage and well health

Jake Sheely and Marty Rhoads of Azcal Farm Management are big proponents of Ag Tech.

Azcal M&S Ranch system architecture



- Receive alerts on critical operational issues and general pump activity
- Receive reports on pump activity and water usage

THE RESULT

The manual monitoring and adjustments that used to take Azcal six or seven hours per day now take just a few minutes a day.

"We are thrilled with the FDS solution. I am on top of pump management first thing in the morning before the day gets going. It just works!" says Jake Sheely.

From day one, Jake and Marty have been able to use the FDS Ignition client app for Water Informatics on their phones to power up any of their pumps within seconds. Moreover, they can see the pressures and flows continuously changing and make adjustments without having to jump into their truck to visit any of the sites directly. They also have visibility into their incoming

voltage for the first time and receive text alerts any time the system loses power.

And as John notes, every part of the platform, from the Opto 22 I/O, to the Ubiquiti communications, and finally to the Inductive Automation SCADA, can be trusted to be secure and reliable.

THE FUTURE

"The combination of Opto and Ignition is very flexible," John says. "I can just keep adding features all day. We've already proposed to come back to add cascading PID control so they don't have to do the remote control themselves. It will do it for them."

Each addition builds Farm Data Systems' ability to help existing and new customers. Says John, "Every time we do something for them, we just add more features for all our customers."

Azcal has exactly the solution they needed at an affordable price. The latest industrial control technologies adapt well to an agricultural setting and start delivering ROI immediately. As a result, Azcal is already rolling out the same technology across their other ranches, with additional features including valve control and irrigation scheduling.

ABOUT FARM DATA SYSTEMS

Farm Data Systems in Madera, California, brings industrial automation to the farm through pump monitoring and control, irrigation automation, crop and climate monitoring, and custom projects.

Their Water Informatics software improves farm efficiency and reduces costs by getting the right data to the right person at the right time. Data on soil and climate conditions, water usage, pump status, and much more are available through mobile devices, so problems can be immediately diagnosed and fixed.

Designed by farmers for farmers and based on off-the-shelf, field-proven parts and technologies, FDS systems are a cost-effective bridge to the future of farming.

For more information, visit the Farm Data Systems' website or call: **888-227-4035**

"The combination of Opto and Ignition is very flexible. I can just keep adding features all day."

- John Williamson, Farm Data Systems

ABOUT OPTO 22

Opto 22 was started in 1974 by a co-inventor of the solid-state relay (SSR), who discovered a way to make SSRs more reliable.

Opto 22 has consistently built products on open standards rather than on proprietary technologies. The company developed the red-white-yellow-black color-coding system for input/output (I/O) modules and the open Optomux® protocol, and pioneered Ethernet-based I/O.

Famous worldwide for its reliable industrial I/O, the company in 2018 introduced *groov* EPIC® (edge programmable industrial controller). EPIC has an open-source Linux® OS and provides connectivity to PLCs, software, and online services, plus data handling and visualization, in addition to real-time control.

groov RIO Ethernet-based edge I/O modules, introduced in 2020, include I/O and IIoT software in a compact industrial package that goes anywhere.

All Opto 22 products are manufactured and supported in the U.S.A. Most solid-state SSRs and I/O modules are guaranteed for life.

The company is especially trusted for its continuing policy of providing free product support, free online training, and free pre-sales engineering assistance.

For more information, visit opto22.com or contact **Opto 22 Pre-Sales Engineering**:

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