



Case Study: Boosting Productivity with Scalable Monitoring at Costa Farms

Homegrown production tracking system reduces downtime and streamlines processes across multiple farming facilities

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CASE STUDY: BOOSTING PRODUCTIVITY WITH SCALABLE MONITORING AT COSTA FARMS

Homegrown production tracking system reduces downtime and streamlines processes across multiple farming facilities



Growing millions of plants is no easy task, but at Costa Farms®, it's a daily operation.

With production facilities spread across Florida, North Carolina, South Carolina, Virginia, and the Dominican Republic, Costa Farms produces a wide variety of houseplants and ornamental plants—from foliage and flowers to succulents and cacti.

Over the years, Costa Farms has expanded significantly through organic growth and strategic acquisitions. Now operating on over 5,200 acres, the company manages a complex network of greenhouses, shade houses, and open fields to meet the growing demand for their plants.

As one of the largest horticultural growers in the U.S.—supplying over 150 million house and garden plants annually to major retailers like Home Depot®, Lowe's®, Walmart®, and Amazon®—Costa Farms has shifted its focus toward optimizing operational efficiency to keep up with its large-scale production needs.



Costa Farms' 2-acre perennial flower test garden in Trenton, South Carolina

GROWING PAINS: GAPS IN PRODUCTION TRACKING

You can't manage what you don't measure, and for years Costa's engineering team dealt with a diverse set of machinery with no direct interface for real-time data collection:

"It's a mixed bag of machinery...we weren't able to access production data without jumping through hoops."

- Karl Yeager, Costa Farms

- **Transplanters**—Automate the process of planting seedlings into pots
- **Robotic systems**—Handle tasks like moving pots and transferring plants
- **Conveyor systems**—Transport plants through production stages
- **Irrigation systems**—Automatically water plants as needed
- **Climate control systems**—Regulate temperature and humidity to ensure optimal growing conditions

As Karl Yeager, Automation and Technology Manager at Costa Farms explains, "It's a mixed bag of machinery. Some use traditional PLCs for control, but without expensive

Case Study: Boosting Productivity with Scalable Monitoring at Costa Farms



Experimenting with lighting and temperature in an indoor test garden at Costa Farms

software licenses and in-house platform-specific expertise, we weren't able to access production data without jumping through hoops."

Without live production data, Costa Farms lacked the visibility needed to truly understand where inefficiencies existed.

As Yeager points out, "We weren't necessarily fixing a specific problem, but rather coming to the realization that without accurate, real-time data, we couldn't manage or optimize our operations effectively."

Most competitors in the industry rely on outside vendors for SCADA solutions, but Costa Farms couldn't find an

offering that would easily integrate with their Sage® ERP platform, so they began experimenting with a custom homegrown solution.

SIFTING THROUGH THE SOIL: FINDING THE RIGHT EDGE DEVICE

"The goal of the project was to implement a standardized PLC system that was easy to deploy, reliable, and maintainable without requiring specialized expertise," Yeager recalls.

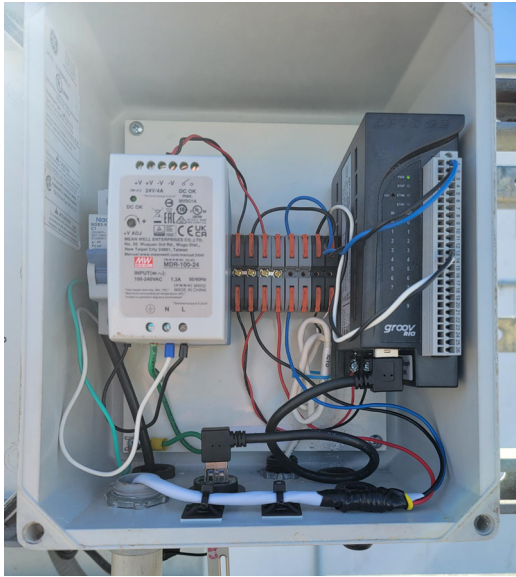
Costa Farms evaluated several PLC options, but according to Yeager, "Many were inexpensive systems with unreliable overseas support, poor compliance, and lacking durability. Others were more costly, requiring expensive software licenses and highly specialized training."

With 30 years' experience in automation, Yeager had a clear vision for the product he was looking for: *Simple, Scalable, Survivable, and Supportable*. This is otherwise known as his 4-5 philosophy.

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Opto 22's groov RIO measuring well pump readings

THE MOVE TO groov

After evaluating options, Costa Farms chose Opto 22's *groov RIO*® for its ability to meet their growing production needs. The system provided a range of features that allowed Costa Farms to not only address their current challenges but also future-proof their operations.

Physical I/O

Connecting to existing machines with closed control platforms often requires Costa Farms to use *groov RIO*'s digital inputs. Some examples include using proximity sensors to track the movement of pots down a conveyor or tracking a relay that monitors cycle counts on robotic arms.

Analog inputs are also used in some cases to monitor parameters like flow rate, temperature, and humidity.

Communications and connectivity

Where communication to existing machines is an option, *groov RIO* has no problem communicating over standard protocols like OPC UA®. In some cases, Banner® wireless sensors and Dragino® LoRaWan® gateways are integrated with MQTT communications.

When legacy serial protocols, like RS-232 and RS-485 are available, *groov RIO* is up to the task through the use of inexpensive USB-to-serial adapters.

"One of the largest deciding factors was that my maintenance man with hardly any PLC education can deploy a RIO to the field."

- Karl Yeager, Costa Farms

Moving data upstream to Costa's cloud-based Microsoft® Azure® instance also relies on MQTT, and, in some cases, HTTPS SQL writes to Azure's Microsoft SQL cloud server®. SQL is also the interface used to get work orders, job descriptions, and production schedules from Costa's Sage ERP system.

Software support

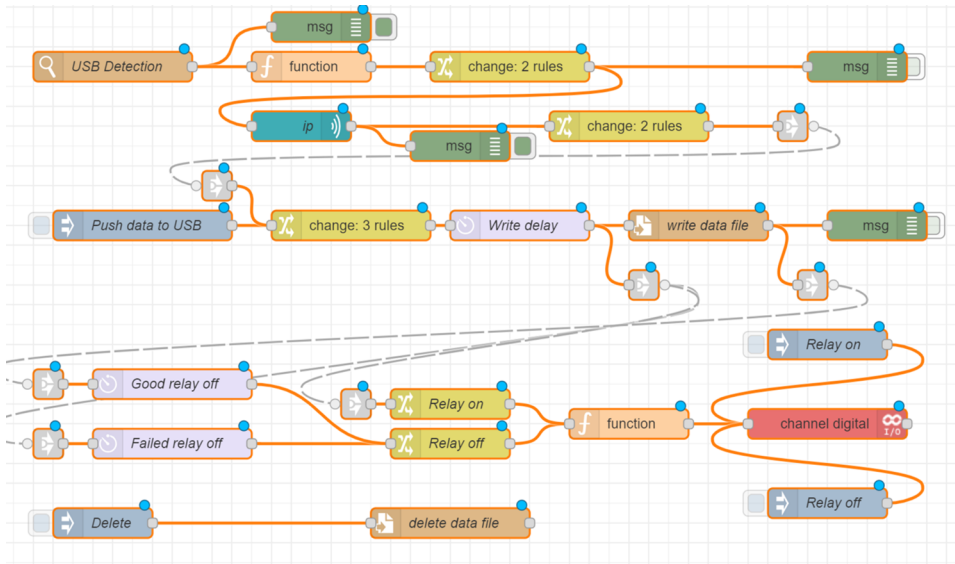
groov RIO supports a variety of programming options, from custom Linux® programs to IEC 61131-3 compliant PLC development platforms like CODESYS®.

For Costa's application, Yeager chose Node-RED®, a flow-based programming tool for IIoT applications, which runs natively on all *groov* devices. Node-RED's ease-of-use allows Costa Farms to quickly deploy small applications



A counter system using the groov RIO

Case Study: Boosting Productivity with Scalable Monitoring at Costa Farms



A Node-RED flow that detects a USB drive in a *groov* RIO and transfers the data without user intervention.

and seamlessly expand them to larger systems without the need for extensive coding or technical expertise.

Additionally, the *groov* RIO's edge computing capabilities enable Costa Farms to process data locally, reducing latency and contextualizing data before sending information to the cloud.



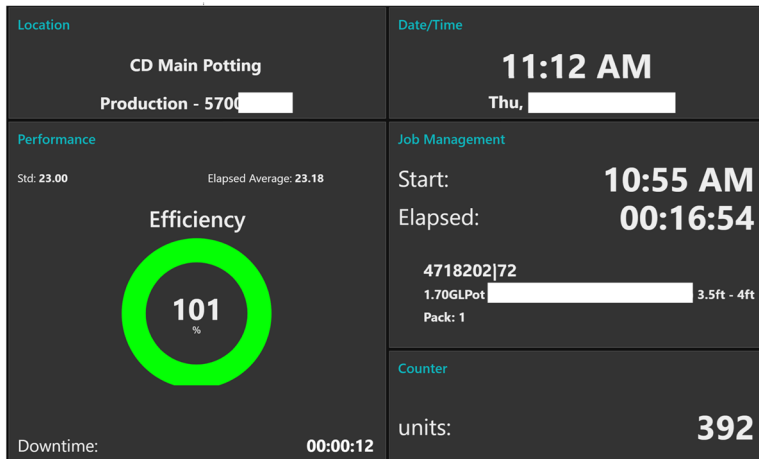
Using *groov* RIO to bridge the communication gap

Conforming to 4-S Philosophy

And of course, no system would pass muster without conforming to Yeager's 4-S philosophy:

- **Simplicity**—*groov* RIO is easy to install and maintain, requiring no specialized expertise. As Yeager explains, "One of the largest deciding factors was that my maintenance man with hardly any PLC education can deploy a RIO to the field."
- **Scalability**—The system started with simple tasks, such as counting pots and tracking robotic equipment moves, but can scale up to handle complex production monitoring and data collection across multiple facilities.
- **Survivability**—*groov* RIO's robust design ensures it can withstand tough production environments (-20°C to +70°C) and continue operating reliably, reducing the need for frequent maintenance or replacement.
- **Supportability**—Opto 22 offers free comprehensive support through a variety of resources including [OptoForums](#), live chats, and direct customer service. Costa Farms has access to timely, U.S.-based assistance whenever needed. They can also take advantage of Opto 22's free online training through [OptoU](#).

Case Study: Boosting Productivity with Scalable Monitoring at Costa Farms



A Node-RED dashboard displays process efficiency, which is sent to Microsoft Azure using SQL nodes.

SPROUTING EFFICIENCY: 30 *groov* RIOs IN ACTION

Costa Farms now has 30 *groov* RIO units deployed across multiple facilities, each customized to meet specific operational needs. While every RIO serves a unique purpose, they share key characteristics that make them invaluable for Costa's production tracking and monitoring.

Network Configuration

Each *groov* RIO device is set up using DHCP for dynamic IP assignment, enabling quick integration into the existing network infrastructure without manual IP configuration, simplifying deployment across multiple facilities.

Once the RIO comes online, a homegrown Node-RED flow pulls the RIO's DHCP network configuration and writes to a SQL database, alerting Costa's IT administration of a new installation.

Custom integration

Each *groov* RIO is connected to different sensors based on the facility's requirements. Some are network connected, over either Ethernet or serial networks, while other sensors are hardwired to *groov* RIO's flexible I/O.

Some sensors monitor environmental conditions like temperature and humidity

while others track the flow rate of irrigation systems or monitor proximity sensors on conveyor lines to track plant movements.

Node-RED

Each *groov* RIO is configured for real-time edge processing, enabling Costa Farms to perform calculations directly at the source such as production counts, environmental metrics, and even more complex measures like heat stress on employees and *black globe temperature*, which is a measure of radiant heat from surrounding systems.

By processing data locally before sending it to the cloud, the system reduces both latency and bandwidth usage, ensuring timely and efficient decision-making across all facilities.

Node-RED's built-in UI dashboard nodes also provide a live user interface to each RIO and the current operation of each machine.

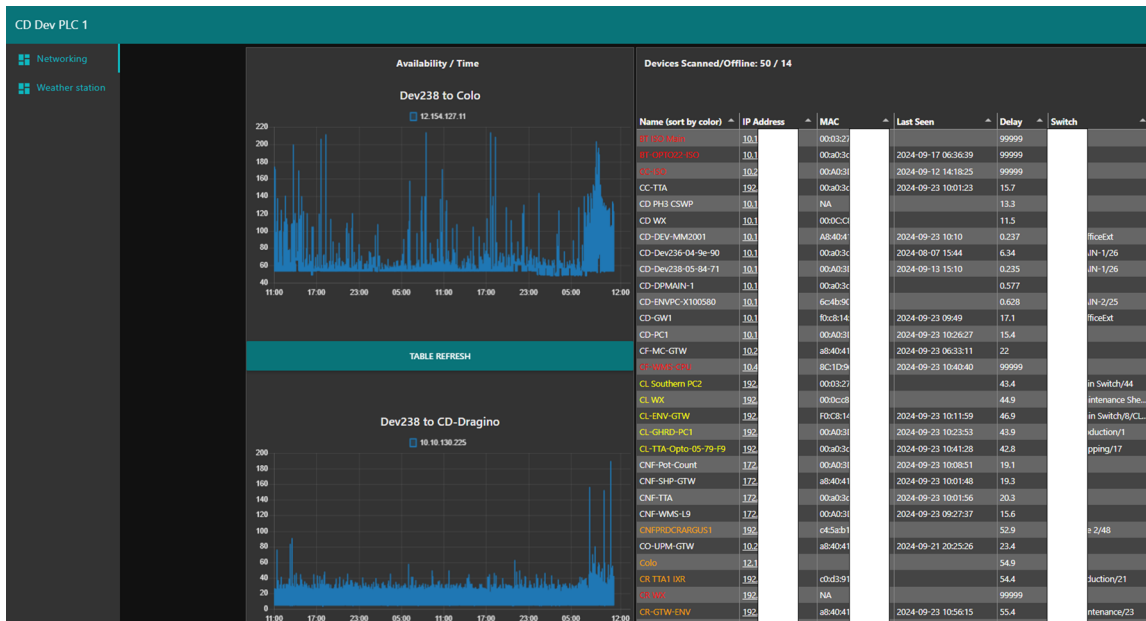
Cloud integration

Every *groov* RIO sends data to Costa Farms' Microsoft Azure instance. Saving historical data using Microsoft SQL Server



A dashboard displays soil temperature, electrical conductivity, and volumetric water content.

Case Study: Boosting Productivity with Scalable Monitoring at Costa Farms



Costa Farms monitors network traffic to bring new groov RIOs online securely.

and analyzing it with Microsoft's Power BI® has led to the discovery of unexpected inefficiencies that Costa Farms is eager to explore.

SOWING SUCCESS: RESULTS TAKE ROOT

Since adopting *groov* RIO for production tracking, Costa Farms has made significant strides in efficiency and opportunity recognition. Instead of focusing on mistakes, they now find ways to improve and streamline operations.

As Yeager notes, "It's not about saying, 'You're doing something wrong,' but rather, 'How can we do better?'"

Streamlined Changeovers: Labor Savings

Before, product changeovers were inefficient, especially when switching between products with different settings.

For example, products X and Z have similar machine settings while product Y requires a more complex changeover. Previously, Costa Farms would switch from X to Y, then to Z, resulting in two time-consuming changeovers.

By reordering the production sequence to group similar products, they now save 2 man-hours per changeover. Across a facility with 5 production lines, this adds up to 10 labor-hours saved every time!

Reducing Risks: Safer, Smarter Workflow

The system has also improved safety by reducing the need for manual interventions during machine adjustments. With fewer physical changeovers, workers are less exposed to potential hazards. By aligning production schedules with machine readiness, Costa Farms has lowered the risk of injuries and kept workflows efficient and safe.

As Yeager says, "If they don't have to physically change equipment and parts as often, workers have a lower chance of getting hurt."

Cultivating Uptime: Predictive Maintenance in Action

Yeager says, "Keep it simple," when describing Costa's simple but effective approach for predictive maintenance.

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He warns against overly complex system monitoring. "More complicated means more can go wrong. Sometimes, all you need is a simple cycle count on a robotic arm to determine when to perform maintenance instead of waiting for it to break. It's inexpensive and reliable."

Their proactive strategy has reduced unexpected downtime and repair costs, keeping operations running smoothly.

"For under \$1,000, copying and pasting code that I already wrote, we can get a new RIO deployed in just a few minutes."

- Karl Yeager, Costa Farms

A FUTURE OF FLOURISHING OPERATIONS

"Every piece of equipment we get is going to have a *groov* RIO installed for production tracking because the machine manufacturers don't want you in their software," says Yeager. "We may even use a *groov* EPIC® in applications where we need more I/O. My Node-RED flows will run on either device."

The flexibility and reliability of *groov* devices make them ideal for the wide range of machinery Costa Farms uses, allowing them to sidestep restrictions from manufacturers that limit software access.

"For under \$1,000, copying and pasting code that I already wrote, we can get a new RIO deployed in just a few minutes," he says.

When asked about his overall experience with Opto 22's *groov* products, Yeager says, "Positive. Enlightening. Educational."

ABOUT COSTA FARMS

Headquartered in Miami, Florida, Costa Farms is a 60-year-old, family-owned company with a deep passion for plants. They grow over 1,500 varieties on 5,200 acres across the southeastern U.S., making them one of the

world's largest horticultural producers. Costa Farms specializes in tropicals, succulents, houseplants, and perennial flowers, supplying some of the top retailers in the world.

For more information, please visit: <https://costafarms.com>

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:**

Phone: **800-321-6786** (toll-free in the U.S. and Canada) or **951-695-3000**

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