Case Study: California Controlled Atmosphere

Controlled atmosphere specialist CalCA provides energy efficient and reliable industrial refrigeration systems for produce storage

Opto 22

43044 Business Park Drive · Temecula · CA 92590-3614
Phone: 800-321-6786 or 951-695-3000
Pre-sales Engineering is free.
Product Support is free.
www.opto22.com

Form 2180-180606

CASE STUDY: CALIFORNIA CONTROLLED ATMOSPHERE

Controlled atmosphere specialist CalCA provides energy efficient and reliable industrial refrigeration systems for produce storage

A casual stroll through a neighborhood supermarket is sure to turn up some type of fresh produce on the shelves.

What most people don't realize is that the produce seen on the supermarket shelves today was likely harvested anywhere from two weeks ago (peaches) to twelve months ago (apples). And it may have made a long journey from the location where it was grown to the location where it is purchased.

Ensuring a constant supply of fresh produce to markets across the country is possible through controlled atmosphere storage systems. Controlled atmosphere (CA) storage is a method fresh fruit producers use to extend the seasonality of their fruits. It's the reason we can enjoy apples and pears well past traditional harvest seasons.

Controlled atmosphere storage began before World War II in England, when farmers discovered their produce kept longer in airtight rooms. Controlled atmosphere storage is not a chemical process but involves keeping temperature, natural gases, and humidity at controlled levels. Certain varieties of apples can be stored for up to 12 months, while certain varieties of pears can be stored as long as 10 months, all through the use of CA storage facilities.

KEEPING PRODUCE FRESH

Fruits such as apples and pears convert their natural starches into sugars by absorbing oxygen and giving off carbon dioxide. In sealed CA rooms, this respiratory process is reduced by lowering oxygen levels in the sealed room.

Controlled atmosphere storage rooms can store produce for months at low temperatures and oxygen levels.

Case Study: California Controlled Atmosphere

The fruit essentially goes dormant and the ripening process is put on pause until the market requires more produce.

To lower oxygen levels, nitrogen gas is infused into the sealed CA room, typically lowering the amount of oxygen from the usual 21 percent found in the air we breathe all the way down to 1 to 2 percent.

Temperatures in CA rooms are also controlled and kept at a consistent 32 to 36 degrees Fahrenheit. Humidity is kept at approximately 95 percent. Carbon dioxide levels are tightly controlled.

Maintaining Control

An industrial control system maintains all this and controls each room's conditions based on the type of produce inside. A great deal of research has gone into defining the specifications for each produce type to keep fruit quality at an optimum level. The length of time fruit can be stored is determined by analyzing starch levels in the fruit at the time it's harvested. The higher the starch levels, the longer the fruit can be stored.

Storage facilities take great care to ensure fruit reaches stores at its optimum level of crispness and flavor. Timing is critical, since as soon as a CA room is opened for packing, the fruit comes out of its dormant state and the starch-to-sugar conversion process begins again.

Central California, the nation's top producer of fruits and vegetables and the primary source for tomatoes and grapes, is a hotbed for CA rooms. Keeping CA rooms within specifications requires engineering expertise and application-specific knowledge, and the industry is heavily regulated for food safety.

One such expert in the controlled atmosphere market is California Controlled Atmosphere (CalCA), headquartered in Dinuba, California, southeast of Fresno. Opened in 1984, CalCA has grown from a small family business to an employee-owned corporation that is widely recognized as Central California's leader in industrial refrigeration services.

CalCA specializes in mechanical systems design, installation, and maintenance for product cooling and cold storage/freezer facilities. Their engineering and controls team provides advanced automated control and energy management systems not only in California but throughout the world, reaching to India and China.

Also, to help their clients navigate the complicated maze of government regulations, CalCA's sister company Resource Compliance, Inc. offers consulting services to help clients comply with Risk Management Program and Process Safety Management regulations.

THE CHALLENGE

Doug Gerdts, Pomologist (a specialist in fruit growing) and Programmer at CalCA since 1991, knows the challenges that CA room design can present. As with most industrial systems, long product life is a requirement. Flexibility is another, as no two CA facilities are the same. Scalability is also a concern, because CA facilities often add additional rooms over time or rapidly expand or contract based on production yields. The ability to modify or add on to an existing CA facility control system without having to rewrite an entire program or upgrade hardware is vital.

In the past CalCA used PLCs for CA room and facility control. But they often found that either the PLC or its software was obsoleted and unsupported after five years, forcing CalCA to pay high prices for new software and hardware they just didn't need.

"We'd install a PLC-based system for a customer, then come back to support it a few years later, only to find that the manufacturer that built the PLC no longer supported the hardware or the software we used to program it," says Gerdts.

CalCA needed a product with a longer operational life—around 20 years—that had the flexibility for changes on the fly, and the scalability to be deployed in small control environments and scaled up when the application required.

THE SOLUTION

After researching the market, CalCA chose Opto 22's SNAP PAC control and I/O system for automating and controlling CA facilities and rooms. Opto 22 offers hardware and software products that have an operational and

> **CalCA was looking for a flexible and scalable control system with a longer operational life—around 20 years.**

OPTO 22

supportable life of over 20 years in most cases. CalCA knew that if they installed a system today, they could still get free technical support and replacement parts for Opto 22 products for many years to come.

The SNAP PAC System consists of programmable automation controllers (PACs), I/O modules and racks, and "brains" (I/O and communication processors) that interface physical I/O signals with Ethernet networks. To develop control programs and an HMI, the SNAP PAC System comes with the PAC Project Software Suite, which includes PAC Control for control program development and PAC Display for building a PC-based HMI.

The PAC Project Software Suite allows CalCA engineers to develop control programs in both a flowchart-based interface and a scripting interface. Flowchart and scripting can be combined for maximum efficiency and flexibility in control program development.

CalCA implements many Opto 22 PAC features during control system design and rollout, and the PAC handles

CalCA incorporates Ethernet-based Opto 22 control systems, shown here at the top of equipment deployed at a customer's location.

> **The SNAP PAC controller's robust set of communication features lets CalCA refrigeration systems interface with demand response programs set up by local utilities.**

many different tasks, including logic, process control, discrete control, motion control, monitoring, and data acquisition.

The SNAP PAC System also uses a distributed control architecture to reduce single points of failure, increase scalability, and to push intelligence to the edge of the network where I/O brains handle PID loop control, pulse generation, and TPO (time proportional output). This distributed intelligence takes some of the processing load off the central controller.
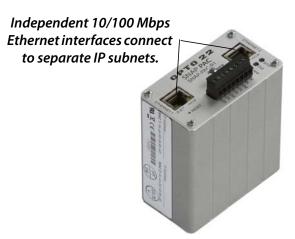
CalCA uses the data logging features of the SNAP PAC System to record information related to food safety regulations and verify that food stored in CA rooms has stayed within certain atmospheric parameters. With the addition of the *groov* mobile operator interface system to the SNAP PAC control and I/O system, operators have real-time situational awareness of CA facilities right from their smartphone or tablet.

CalCA also takes advantage of the SNAP PAC controller's dual Ethernet interfaces. These two independent interfaces allow CalCA to separate the operations side of the CA facility's network from the IT side, thereby increasing network security and lowering network traffic levels. Keeping the operations and IT sides of the network segmented is important to allow data to flow to the computer network while still securing control system uptime and availability. If the CA room was accidently switched off, for example, large amounts of product and revenue would be lost.

Reducing Energy Use

Using the SNAP PAC System, CalCA can also offer reduced energy usage programs to their industrial refrigeration customers. With the SNAP PAC controller's robust set of communication features, CalCA is able to interface their Opto 22 control systems with demand response programs set up by local utilities.

CalCA configured the Opto 22 PACs to automatically turn off certain systems in CA facilities to reduce energy usage

Case Study: California Controlled Atmosphere

Independent 10/100 Mbps Ethernet interfaces connect to separate IP subnets.

Dual independent Ethernet network interfaces on a SNAP PAC controller can increase network security by isolating operations and IT sides of a network.

during peak demand events, all with supervisory control from onsite operators.

For example, pre-cool systems require the largest amount of energy. During peak grid events these systems can be automatically turned off to reduce demand on California's utility grid. In several cases the cost savings obtained through these energy management programs have paid for a control system upgrade or retrofit.

Using the PAC Display HMI screen CalCA has built, when an energy demand event occurs, operators can select individual CA rooms to turn off. If the utility notifies operators of a scheduled demand response event ahead of time, operators can schedule CA rooms to automatically turn off. No matter what time of day or night, the SNAP PAC control and I/O system automatically take care of everything.

A Higher Service Level

The SNAP PAC product line also has many built-in troubleshooting and debugging tools.

"If there's a problem with our control system, we can use the data logging and trending tools in PAC Display to troubleshoot and identify the problem. We can even use PAC Project tools to narrow down problems in a system to a specific I/O point," says Gerdts.

"Quickly identifying and resolving problems is key to maintaining a good relationship with our customers.

"Data logging and trending also come in handy for insurance companies, so they can see exactly what went wrong in the system if product is lost," Gerdts adds. PAC Display offers a wide range of tools to help identify exactly what's going on with all components of a SNAP PAC control system at any time.

CalCA designs each customer system specifically for the customer's application. No two applications are ever the same. After installing the SNAP PAC control systems, CalCA then works with the customer for the first year to dial in system performance at no extra charge.

"It's just another way we can provide our customers with outstanding service and support—and provide delicious ripe fruit all year round," says Gerdts.

ABOUT CALIFORNIA CONTROLLED ATMOSPHERE (CALCA)

California Controlled Atmosphere (CalCA) is a California industrial refrigeration company dedicated to providing clients with a one-stop resource for all of their industrial refrigeration needs. For over 30 years CalCA has specialized in mechanical systems design, installation, and maintenance for product cooling and cold storage/freezer facilities. CalCA provides advanced automated control and energy management systems. To help clients navigate government regulations, CalCA also offers consulting services through sister company Resource Compliance, Inc. to help clients comply with Risk Management Program (RMP) and Process Safety Management (PSM) regulations.

www.calca.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.

In early 2013 Opto 22 introduced *groov* View, an easy-to-use IoT tool for developing and viewing mobile operator interfaces—mobile apps to securely monitor and control virtually any automation system or equipment.

OPTO 22

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.

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 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**
Email: systemseng@opto22.com

OPTO 22 www.opto22.com
43044 Business Park Dr. Temecula, CA 92590-3614

SALES sales@opto22.com
800-321-6786 • 1+951-695-3000

SUPPORT support@opto22.com
800-835-6786 • 1+951-695-3080