



# Case Study: Plant Extraction OEM Brings Control Systems In-House

*Scaling custom chillers with smarter  
automation and remote diagnostics*

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## CASE STUDY: PLANT EXTRACTION OEM BRINGS CONTROL SYSTEMS IN-HOUSE

### *Scaling custom chillers with smarter automation and remote diagnostics*

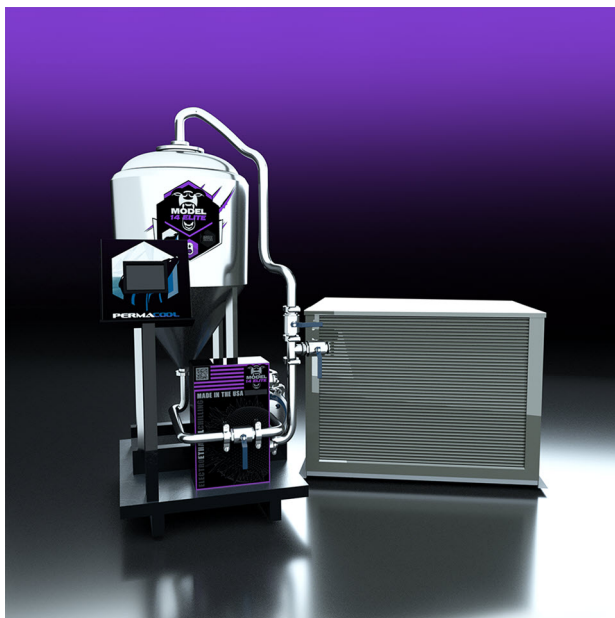
Plant extraction—separating useful compounds from plant material—relies heavily on temperature control. While key to extracting essential oils for fragrances and pharmaceutical compounds for medicines, temperature control is particularly critical in cannabis extraction, where precise chilling determines both product quality and process efficiency.

Different extraction methods require different cooling strategies. Some need extreme cold to condense vapors back to liquid for reuse. Others depend on pre-chilling solvents to avoid extracting unwanted compounds from the plant.

Whatever the method, PermaCool™ (officially Perma Cool Systems, Inc.), a busy OEM in the extraction industry, never struggled with refrigeration. Their challenge was control systems.



**PermaCool designs advanced chillers for efficient, high-capacity temperature control in industrial extraction and cooling applications.**



**The PermaCool Model 14 Elite™ system—an all-in-one chilling solution for extraction**

### FROM CANNABIS PIONEER TO GLOBAL OEM

PermaCool officially launched in 2018, but its story goes back further. Founder David Schaefer began developing cannabis processing equipment in 2012, when the industry was still finding its footing.

“I was the fifth person to make any sort of cannabis processing equipment,” he recalls. “We began with butane extraction equipment, and as we developed our understanding of the process, it became clear that scaling to meet cannabis industry demands presented new challenges.”

Today, PermaCool designs ethanol chillers, butane recovery units, walk-in freezers, and even custom refrigeration systems. They operate lean, with



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**A PermaCool chiller vessel under assembly showcases the company's custom-built, industrial-grade design.**

just six core employees, relying on contractors for manufacturing and installation. Their systems are used by extraction companies around the world.

As the product line evolved, the company hit a bottleneck—outsourced control systems that couldn't keep up.

### WHY OUTSOURCED CONTROLS STOPPED WORKING

In PermaCool's early days, outsourcing control systems seemed logical. As a small company focused on refrigeration expertise, letting specialists handle the controls made sense.

"We originally had our control systems outsourced to a controls company," explains Schaefer. "Making changes

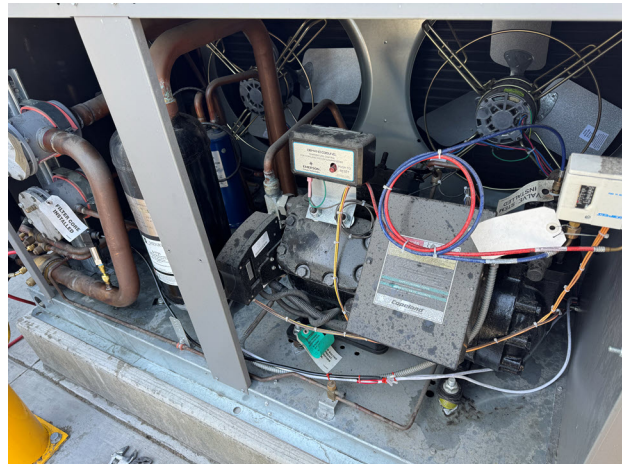
was hard to do. We couldn't troubleshoot or repair because they weren't our own. My old controllers were basically glorified on/off switches."

**"Remote troubleshooting, system warnings, app control—these would have been incredibly valuable features, but they didn't exist with other control companies at a reasonable cost."**

**- David Schaefer, Founder of PermaCool**

By 2020, these limitations had led to serious business constraints:

- **Reliability issues and vendor dependency:** Their traditional PLC systems required frequent power cycling and had ongoing stability issues. Any software update—no matter how minor—could take weeks to implement through a third party.
- **Bulky, complex hardware setups:** Separate processors, I/O modules, network interfaces, and HMIs required large control cabinets that were expensive to build, hard to install, and tricky to support.
- **No remote access or troubleshooting:** When something failed in the field, Schaefer's team had no way to look into it without physically going onsite—or waiting on a controls vendor that didn't understand the process.



**A PermaCool outdoor condenser unit houses compressors, fans, and refrigerant piping—all managed by the in-house controls system**

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"It was our dream to connect to our customers' units and see what's going on," Schaefer recalls. "Remote troubleshooting, system warnings, app control—these would have been incredibly valuable features, but they didn't exist with other control companies at a reasonable cost."

When the COVID-19 pandemic forced many companies to examine operations, PermaCool saw an opportunity to make a change.

### SEARCHING FOR A SMARTER, LEANER SYSTEM

In early 2021, Schaefer and a colleague started researching control system alternatives. Key requirements included:

- Ability to handle complex process and refrigeration control
- Simplified programming and maintenance
- Built-in networking and remote access capabilities
- Cost-effective scaling and flexibility to add features without hardware overhauls



**PermaCool's process plumbing shows insulated lines and mounted precision temperature sensors for accurate feedback control**



**PermaCool's stainless steel chiller assembly integrates precision pumps, valves, and heat exchangers to maintain consistent process temperatures.**

During their research, they discovered the Opto 22 [groov EPIC system](#). The difference was immediately apparent. The *groov EPIC* system offered all of these capabilities in a compact, integrated package.

"Before, we would build huge 24"x24"x8" boxes full of equipment that this compact unit can do all by itself," Schaefer explains. "Plus, the modularity allowed me to customize systems easily and cost effectively. The built-in networking capability was huge, and plugging an HDMI monitor directly into the *groov EPIC* made local display a breeze. Everything integrated in one unit."

### **SOLUTION: *groov EPIC* AT THE CORE**

Working with Opto 22 Application Engineer Selam Shimelash starting in 2021, PermaCool began standardizing their own control systems around the *groov EPIC* platform.

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Although they make different types of refrigeration and extraction equipment—butane extraction chillers, ethanol extraction chillers, and walk-in freezers, each available in three sizes—they use the same hardware and software across the board, allowing them to scale systems up or down while maintaining consistent control logic and support processes.

### Hardware Configuration

The hardware included:

- [GRV-EPIC-PR1](#) controllers to serve as the main processor for each system.
- [GRV-ODCSRC-24](#), [GRV-ODCIS-12](#), and [GRV-OACIS-12](#) digital output modules to control compressors, pumps, valves, and solenoids.
- [GRV-IMA-24](#) analog input modules to interface with pressure, temperature, and flow sensors.
- [GRV-MM1001-10](#) mixed I/O modules to provide flexible digital and analog capabilities.



**In-house control panels with the *groov* EPIC system combine processing, networking, and I/O in a single compact enclosure**

**“[The] modularity allowed me to customize systems easily and cost effectively....Everything integrated in one unit”**

**- David Schaefer, Founder of PermaCool**

### Software Stack

The software included:

- [PAC Control](#)—Opto 22's free flowchart-based programming software—to handle both refrigeration and process control logic.
- [groov View](#)—a web-based HMI platform built into the *groov* EPIC—to provide operator interface and system monitoring accessible from any device with a web browser.
- OpenVPN®—virtual private network software onboard the *groov* EPIC—to enable secure remote access for troubleshooting and support.

PermaCool designed their systems with modularity in mind. A single *groov* EPIC can control multiple extraction units, and they designed their software to allow for additional controllers as needed. Using Ethernet to communicate with motors and variable frequency drives (VFDs), instead of multiple conductor cables, cuts wiring complexity and cost.

### REMOTE DIAGNOSTICS AND SUPPORT

One of the biggest improvements is remote support capability. Using OpenVPN, PermaCool can now connect to customer systems anywhere in the world for troubleshooting and diagnostics.

“They [customers] don't know the difference, except whenever they have an issue I can troubleshoot so much easier,” Schaefer explains. Remote access allows him to examine system parameters, check control logic, and diagnose issues without costly site visits.

Compared with his prior control system, even basic troubleshooting is easier. “The LEDs on the I/O modules tell me a story,” Schaefer explains. “Just by looking at which lights are on or off, I can figure out what's happening. If the unit's not turning on but the right LEDs are lit, I know the control system is working—it must be something on the refrigeration side.”

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## MEASURABLE RESULTS

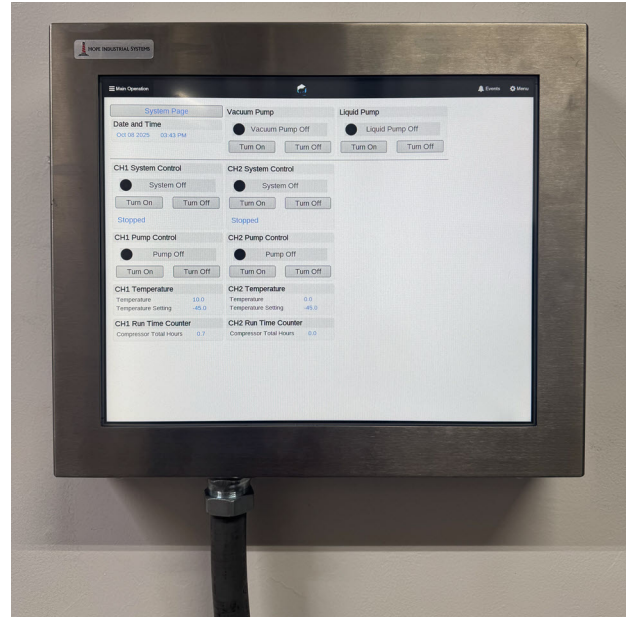
Switching to *groov* EPIC has improved PermaCool's operations in concrete ways.

"Costs [for control systems] are one-third and capabilities are 10 times," Schaefer reports. Where they previously needed separate components for networking, display, and I/O handling, the *groov* EPIC integrates everything in one unit.

This cost reduction extends to customer solutions as well—the flexibility to add touchscreens anywhere in a facility at \$200 instead of \$1,500 for traditional HMI displays has been popular with customers, giving them more control options without breaking budgets.

Building control systems in-house has eliminated the weeks-long delays they faced with their previous vendor. "Customers asked to add in a button on *groov* View—and boom! It's on there," Schaefer explains. Simple modifications that once took weeks now happen immediately.

The modular design and clear diagnostics have also streamlined maintenance. If a card fails, it can be swapped out immediately without system downtime. Remote access through OpenVPN has reduced costly site visits



**A touchscreen HMI running *groov* View gives operators full control and access to real-time data both locally and remotely.**

while improving response times, allowing PermaCool to support customers worldwide more effectively.

## LOOKING FORWARD

PermaCool continues to push the boundaries of what they can accomplish with *groov* EPIC systems. Their most ambitious project yet is a wiped film distillation system that demonstrates the platform's ability to handle complex, multi-component processes.

"We built a prototype and we are about to build five more," Schaefer explains. "Integrating 10 various pieces of equipment, 20 thermocouples, lots of VFDs, motors, and getting everything talking to the PLC is really an art."

PermaCool has come a long way in developing sophisticated control applications that would have been difficult and expensive with their previous vendor-dependent approach.

Future plans include implementing [Node-RED](#) for advanced data processing, expanding cloud connectivity for continuous monitoring, and adding data logging capabilities. PermaCool is also exploring the idea of offering maintenance contracts to their customers. Supported by remote diagnostics, this new offering could create new revenue streams for PermaCool while also providing



**PermaCool's chillers maintain ultra-low operating temperatures critical to efficient plant extraction**

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customers with better support for more reliable operations.

### A PARTNERSHIP THAT WORKS

Beyond the technical capabilities, PermaCool values the support relationship with Opto 22. When a miswired control box caused hardware failures, the team worked together to quickly diagnose and resolve the issue.

"We had random little things happen; everything was solved really easily," Schaefer recalls. The responsiveness extends beyond just technical support. "One day I drove to Temecula, and someone even stayed at the facility late to get me an I/O module after hours," he notes. This level of support has been crucial for a small company taking on complex control system development.

**"One day I drove to [Opto 22 in] Temecula, and someone even stayed at the facility late to get me an I/O module after hours."**

**- David Schaefer, Founder of PermaCool**

As the extraction industry continues to evolve, PermaCool's investment in *groov* EPIC-based control systems positions them to adapt quickly to new requirements while delivering the performance and support their customers expect.

### ABOUT PERMACOOL

Founded in 2018, PermaCool (or Perma Cool Systems, Inc.) is an OEM that specializes in plant extraction and refrigeration, which includes being pioneers in cannabis processing equipment. Operationally lean and efficient, PermaCool builds ethanol chillers, butane recovery units,

walk-in freezers, and custom refrigeration systems used in a variety of applications for customers worldwide.

For more information, visit: <https://perma.cool>

### 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.

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