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Connected Controls for Hot and Cold

How controls enable equipment connectivity and help drive foodservice efficiencies

By Steve Weiss
Vice President,
Business Development
Emerson

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The integration of embedded (custom) and standard (parametric) equipment controls has become commonplace in modern restaurant operations. Used on both the hot and cold sides of commercial kitchen equipment, controls serve a variety of purposes, from basic temperature regulation and monitoring to more sophisticated equipment instructions and performance optimization. But while most modern controls are enabled with communication capabilities, the majority of restaurant operators are not utilizing them to their full potential.

Today's foodservice operators are faced with a convergence of market challenges — from consumer demands and new formats to food safety and energy regulations. Whether you're running a small restaurant, convenience store or major retail chain, your ability to consistently deliver high-quality fresh food is a major factor of your reputation's foundation. At the same time, your bottom line is directly impacted by how effectively you maintain equipment and achieve operational efficiencies, both in individual stores and across the enterprise.

The internet of things (IoT) is permeating nearly every aspect of modern life and transforming the way devices and people interact. And the commercial kitchen is no exception. Some leaders in the foodservice space are already leveraging the power of controls to connect critical equipment used in the storage and preparation of their fresh food offerings. By doing so, they're addressing the complexities of day-to-day restaurant operations — while maintaining a competitive edge in the marketplace.

Keeping the cold side cold: standard controls

Standard electronic controls were primarily developed for use with commercial refrigeration equipment, where food safety and quality require maintaining set temperatures within tight setpoint parameters. Early models were designed to remove the manual aspects of equipment control and monitoring in reach-in units and some food-warming cabinets.

These off-the shelf, application-specific controls were panel-mounted in standard ⅛ DIN or 32 x 72 mm instrument cutouts. The first versions of these controls connected two temperature sensors and two to three power relays to regulate a variety of components, including: compressors, defrost heaters, evaporator fans, lights and alarms for exceptions to set parameters. User interfaces were utilitarian, and generally displayed the temperature, settings and alarm conditions.

The switch from mechanical to electronic parametric controls was partially driven by regulatory concerns about energy use and food safety. In the United States, the Department of Energy (DOE) mandated the first minimum energy standards for reach-in

refrigeration, while the Environmental Protection Agency (EPA) established tighter requirements for equipment to achieve the coveted Energy Star® status. In addition, the Food and Drug Administration (FDA) also adopted the Hazard Analysis and Critical Control Points (HACCP) methodology for retail and foodservice operators.

As standards tightened, additional relays and probes were added to manage doorframe heaters, drain heaters, condenser fans, and the emergence of variable-speed compressors and fans. The latest controls have incorporated communication ports to accommodate connectivity between kitchen equipment and refrigeration systems.

Hot side quality control: embedded controls

Embedded controls were primarily developed for equipment used on the hot side of the kitchen, such as fryers, ovens and microwaves. Unlike off-the-shelf standard controls, embedded controls are customized and integrated as a complete internal equipment control system. These include hardware and circuit boards programmed to control specific equipment functions.

As a rule of thumb, if the equipment has a touch screen, it also has an embedded control behind it — complete with a circuit board and a communications port. Today, you'll find these in human-machine interfaces designed for menu-driven applications. For instance, when an employee selects a picture of waffle fries on the screen, the control executes precise pre-heat, heat and cook time instructions in the fryer, oven and holding equipment.

As foodservice equipment manufacturers and end users explore the potential of IoT connectivity, communications capabilities have become a prerequisite for both standard and embedded controls. As an industry, we're just scratching the surface of what that potential might be.

Adding up the advantages of connectivity in the commercial kitchen

Controls with communication capabilities help allow operators to connect equipment on both the hot and cold sides of the kitchen to achieve some of their primary objectives: improve food quality and safety. Keeping food cold or frozen within narrow temperature ranges and validating the freshness and safety of prepared foods are imperative to an operation's success. Connected controls help manage exceptions to these conditions.

Cold side benefits

Managing the controls on the cold side is essentially a "set it and forget it" proposition. Once initial temperature setpoints are configured and connected on a control network (such as a facility management system), the system polls negative

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temperature coefficient (NTC) probes, alarms and relay status of the equipment. This information is automatically stored and recorded in the cloud (or local storage such as an FTP), and the system issues alerts when it detects an alarm status.

Store owner/operators can remotely monitor temperatures and set up their systems to receive email or text alerts when issues arise. Whether it's an equipment malfunction, temperature deviation or door left open, the controls help operators and their staff manage these exceptions.

To improve energy management, today's refrigeration controls offer increasingly more advanced functionalities, such as smart defrost systems, door heaters and drain heaters. Walk-in coolers and freezers are more frequently connected into facility management networks, not only to help address the DOE's energy efficiency requirements, but also to protect valuable product inventory.

In contrast, legacy mechanical time clocks and thermostats, which are often installed in the field, do not offer energy optimization. Other connected, control-based refrigeration technologies, such as electric expansion valves and advanced automatic defrosts, can also provide significant reductions.

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One advantage of refrigeration connectivity is as simple as getting an alert when a walk-in door is left open. An open door not only lets cold air escape, but it also causes a ripple effect of issues: allowing moist kitchen air to be sucked into the evaporator; causing ice build-ups, which reduce efficiency and potentially damage the entire refrigeration system; putting an entire inventory at risk. All could have been prevented by a simple "door open" alarm and fast operator response.

Hot side

On the hot side of the kitchen, connected embedded controls are more about automating kitchen preparation and helping operators ensure food safety regulatory compliance. Even in the most basic food factories, there are many steps in the cooking process. Controls allow these steps to be pre-programmed to simplify preparation and ensure menu consistency. Easy-to-use, touch-screen interfaces are often all a worker needs to initiate a series of cooking instructions.

Most recently, embedded controls have been used to push menu changes from a corporate headquarters across a network of stores. Without connectivity, this process requires menu changes to be manually uploaded into the equipment control — a complex task to coordinate across an enterprise. With connected controls, an executive chef can send menu updates from headquarters to each location, and the new instructions would automatically load on the affected equipment.

And because the network automatically collects data from kitchen equipment controls, employees no longer have to inspect kitchen equipment and manually record HACCP data. Instead, this information is logged and available for reporting and compliance purposes as needed.

Building a connected infrastructure

Building the architecture needed to connect these controls and enable communication among kitchen equipment is not as complex as one may think. The NAFEM Data Protocol, now in version 3.0, helps simplify the process and bring the connected network within reach.

Today's communication ports are connected either through a direct RS-485 connection or, for some devices, a small RS-485 adaptor for transistor-to-transistor logic (TTL). For hard-wired connections, these allow a two-wire "daisy chain" network of appliances to easily connect to a facility management system.

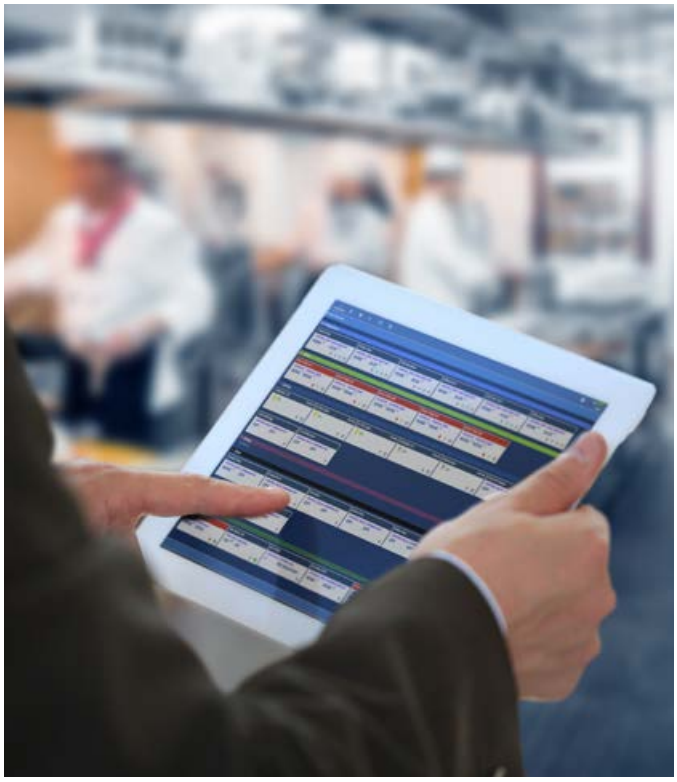
Most refrigeration equipment pieces manufactured in the last seven years are connectable. If an OEM control is not networkable, there are suitable upgraded models available. The good news is that most of the major refrigeration control suppliers are now using a ModBus protocol, which makes network connections even easier.

With the growing availability and affordability of wireless devices, it can be more economical to set up a wireless network using various RF frequencies, such as 800 or 2.2 MHz. Wireless equipment connectivity can also be used to extend the reach of wired networks. Bluetooth® communication is also rapidly becoming a wireless standard across many industries, including the foodservice industry.

Bringing the kitchen under the same umbrella as the building's HVAC and lighting systems will require the integration of a facility management system. This enables centralized, enterprise-level facility optimization and control via IoT, cloud storage and analytics software — while providing real-time monitoring and capabilities for store owner/operators.

Balancing your investment with the desired return

The sophistication of your connected controls depends on your needs, and those will dictate the level of investment required. Monitoring-only systems are a common starting point for the cold side of the kitchen and offer a low cost of entry. By simply adding temperature and door sensors on a wireless system, you can benefit from automated alarms and HACCP information. To enable automatic menu updates, you need a higher level of connectivity (and investment).



For companies seeking to drive energy improvements and maintenance savings across their operations, a facility management system and the supporting infrastructure are important assets. But this level of investment offers vastly greater opportunities for returns.

Many utilities throughout the country offer energy management program rebates that could help foodservice enterprises and operators lower their energy costs. Facility management systems that automatically monitor and record a building's total energy use are essential to qualify for and sustain these programs.

One often overlooked benefit of a facility management system is the potential for maintenance savings. Let's look at the open freezer door scenario: The system starts by sending an alert. If that's ignored or missed, it would trigger a high-temperature alarm. At this point, a service technician could remotely log into the system, review the temperature and evaporator data, correlate it with the door alarm times, and then initiate a remote defrost cycle (from their smartphone). In a matter of minutes, they'll have solved the problem and may have prevented a $200 truck roll.

This facility- and enterprise-wide management approach also affords a much deeper analysis of data that ultimately supports proactive or condition-based maintenance programs — where problems can be anticipated and resolved before they disrupt your operations.

Although food safety and quality may be the initial goals of kitchen connectivity, standard and embedded controls provide the foundation for improved operational efficiencies within restaurant operations. Whether you're simply monitoring equipment to meet HACCP requirements or implementing enterprise energy or maintenance programs, it all starts at the controls.