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Electronic Approach Leads to Economical Alternatives for Refrigeration Temperature Control

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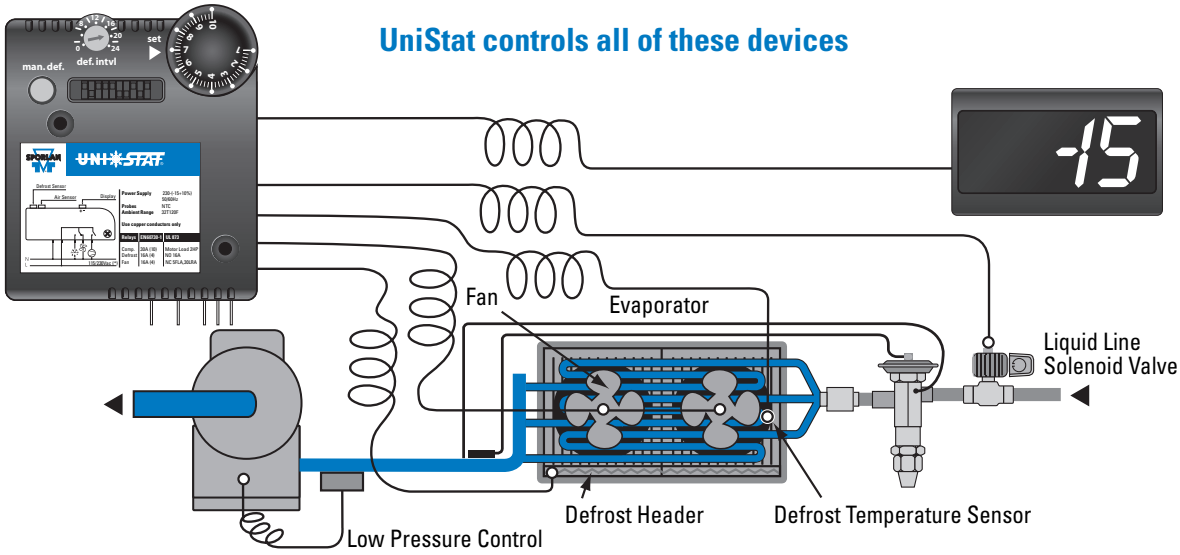


Traditional control of refrigeration equipment, especially self-contained food service equipment, has relied on a piecemeal approach. Each control function is carried out by a discrete control; such as a defrost time clock, thermostat, defrost termination switch, etc. Recent advances in electronic technology have integrated these functions into a single device that is both economical and compact.

The smaller size and electronic reliability of this new device can be best appreciated by understanding its predecessors. For years, defrost initialization was controlled by large, mechanical time clocks. The clocks were equipped with pins or other triggers that cycled switches for defrost heaters or compressors. While the operation was intuitive, the great number of mechanical parts lead to wear-out while the large size limited location. Mechanical thermostats, with their bellows or diaphragms, were also vulnerable. After a certain amount of use, they ceased functioning. Additional components added to complete the control of most systems include defrost termination sensors and thermometers. While not all systems have all these components, most have some combination of them.

Figure 1

The Sporlan UniStat® mimics the look of a mechanical device, while providing precise electronic control and a defrost function.

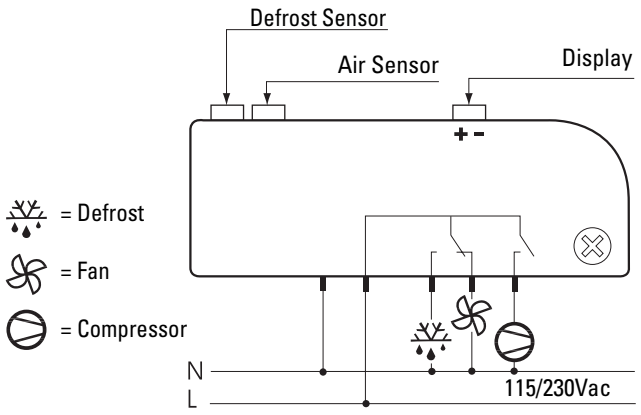
Figure 1 shows a device that appears to be a traditional mechanical thermostat. Two differences are not readily apparent: the device is totally electronic and it includes defrost timing functions. Furthermore, this device, with its simplified wiring, is easy to install, and offers more adjustments than its mechanical counterpart.

In application, the unit shown is mounted near the compressor and wired to control compressors up to 1 horsepower directly. To control larger compressors (or for some unusual conditions) the control can cycle a relay or contactor that will, in turn, cycle the compressor. A sensor in the controlled space cycles the compressor off when the desired temperature is reached. The temperature differential may be set by the user to match that needed for best system operation. For the control shown, the power used for the compressor is used to power the control also, so no additional transformer is required.

The unit provides additional contacts for use in instances where fans and defrost heaters must be controlled, see Figure 2. Electronic timers inside the control keep track of elapsed time and start defrosts at the interval set by the user. To initiate a defrost, the unit shuts off the compressor, shuts off the evaporator fans, and turns on the defrost heaters or opens the hot gas defrost solenoid. When defrost termination temperature is reached, the control turns off the heaters and resumes fan and compressor operation. If, for some reason, termination temperature is not reached, the unit will end the defrost cycle on time. This failsafe feature will prevent product loss.

While the description above covers the basic operation, these electronic controls can handle many other functions as well. For instance, if the control is connected to a liquid line solenoid instead of the compressor, then the system will be

Figure 2 Wiring diagram illustrating defrost, fan and compressor connections.



pumped down and will cycle on the pressure control. This type of control is effective for very large systems because the controller only needs to switch the relatively low current to the solenoid rather than the much larger current of a contactor or compressor. This type of control is also appropriate for central or rack systems where several coolers are connected to a common suction line and liquid supply. In that case, each room can have independent temperature and defrost control.

The unit is also suitable for use on hot gas defrost type systems. The compressor can be set to remain on and the hot gas solenoid is opened until termination temperature or time limit is reached. Temperature termination of defrost requires a separate, inexpensive, solid state sensor but, if time terminated defrost is used, then only the space sensor is needed.

The use of electronics in the new generation controllers permits functions unheard of, or impossible, in traditional mechanical controls. One of the most interesting is the ability to set the upper and lower limits to which the device may be adjusted. For example, a beverage cooler must not only cool the product but it must also prevent the product from freezing. With a mechanical thermostat, the end user may set the temperature below the freezing point of the product. (Although thermostats of a higher range may be purchased, inventory is greater and flexibility is limited.) With the electronic device, the installer narrows the control band to temperatures above freezing but below those that would be objectionably warm. The control is then electronically locked to prevent unauthorized adjustment. Of course, the installer can modify the control band when required.

Further novel features include digital readouts, see Figure 3. Many pieces of equipment are purchased with thermometers, but their use is almost always problematic. Many inexpensive vapor pressure or bimetal thermometers are just not very accurate, and ultimately, warm food will spoil whether or not the thermometer indicates it is cold. Additionally, in cases where hot gas, or even off-cycle defrost is used, air temperatures may rise for a short time towards the end of the defrost. In most instances, this rise will not affect product temperature or quality. If the consumer sees the thermometer registering this high temperature, he or she is unlikely to understand that the unit is in defrost. The consumer may decide that the food has been improperly stored and will not buy it creating lost sales for the store owner.

Electronic controls can be purchased with an integral or remote readout, but in either case, the controller can be set so that during defrost the last cold temperature reading remains on the display during defrost and until the original temperature is re-attained. To the consumer the product is always at the correct temperature. Of course, should the temperature rise for causes other than defrost, the readout will reflect the actual temperature and will trigger an alarm, if so equipped.

Flexibility, economy and new features are the hallmarks of the newest generation of refrigeration controls. Mechanics and service people who may have been wary of the "programming" required by some of the first generation electronic controls will be pleasantly surprised by the power and user-friendly aspects of the newest ones. Consider them for your next application.

Figure 3

An optional digital readout acts as a thermometer and setting tool.

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