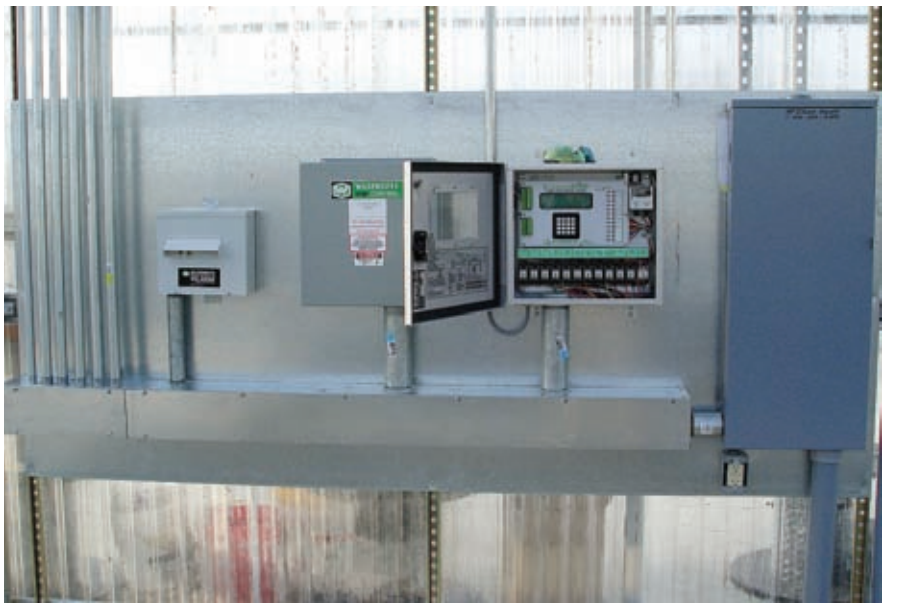
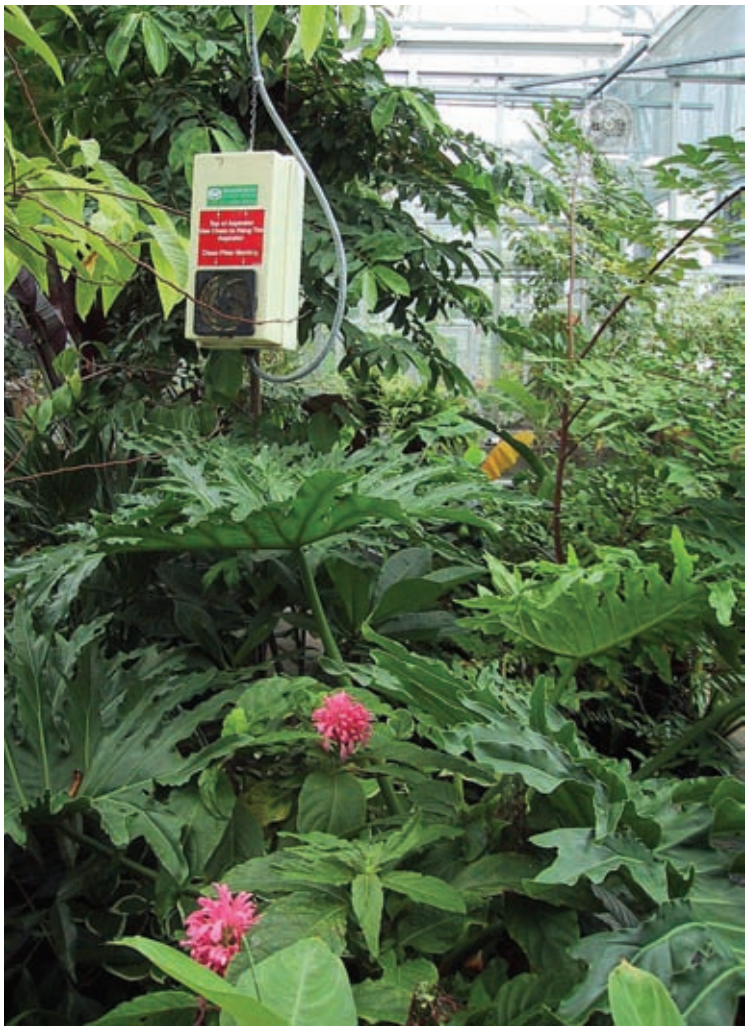
Grower 101:

Controlling Your Environment

Environmental controls can be very helpful for growers who want to manage greenhouse environments, control energy costs and maximize labor inputs.

By Patricia Dean





In 1955, if growers had any controls at all, they used thermostats. In the 21st century, thermostats are still a rugged, reliable choice but time and technology have brought other options to the greenhouse. Today's environmental controls are tools to save labor and energy as well as manage quality and time to market.

A modern environmental control can help growers in three ways:

1. It can change the environment based on time of day. Basic models know the difference between day and night. Advanced controllers can change the control strategy three or more times a day for DIF height control, pollination or degree-day averaging.

2. It can respond to conditions besides temperature. Basic models add a humidity response to help with propagation or disease control. Advanced controllers consider light, carbon dioxide and weather in control decisions.

3. It coordinates multiple equipment systems with readings from centralized sensors. Thermostats can disagree on temperature readings, sometimes enough to make heaters and fans run at the same time. Advanced controllers even keep records that give a strategic view of the crop life.

None of these improvements matter unless they help your business survive and thrive. Environmental controls give you added power to manage quality and yield, contain energy costs and maximize the value of labor inputs.

Changing The Temperature

Consider the case of switching

Top: *Environmental controls can determine when the equipment needs to turn on. In this example, the contactor panel is the muscle that tells the equipment to turn on; it's also known as motor starters. The vent control box has small relays to signal the drive unit (motor) to operate.* ***Left:*** *This is an aspirated temperature sensor. It is housed in a solar-guarded box with a fan that pulls air across the sensor. It should be hung at crop level as the temperature higher in the greenhouse can be a lot warmer. It is important to clean the filter monthly to ensure sensor accuracy. (Photos: Wadsworth Control Systems)*

from thermostats to a basic environmental control that automatically changes temperatures between day and night. Lower night temperatures mimic the plant's natural growing environment, a tool for growing a quality plant. In the winter season, a lower night temperature can cut a heating bill by 5 percent or more. To lower night temperatures with thermostats, an employee has to visit each one and change the dial, then revisit it in the morning to change it back.

If you'd like to use a DIF height-control program, using thermostats becomes more complicated: three dial changes a day, with one at or near sunrise when it's hardest to get reliable help in the greenhouse. An environmental control can manage this automatically. The benefit lasts the life of the control system, which can be 20 years or more.

Addressing Humidity

Too much or too little humidity can make the difference between a profitable crop yield and a money loser. Controllers can keep greenhouse humidity below the range where microscopic condensation on plants forms a nursery for fungal disease. On a large scale, it can keep the glazing from fogging over and cutting light. It can also stop dripping condensation before it builds on the structure. For a propagator, the control can manage the high-pressure fog that raises humidity and keeps unrooted cuttings from wilting and even dying.

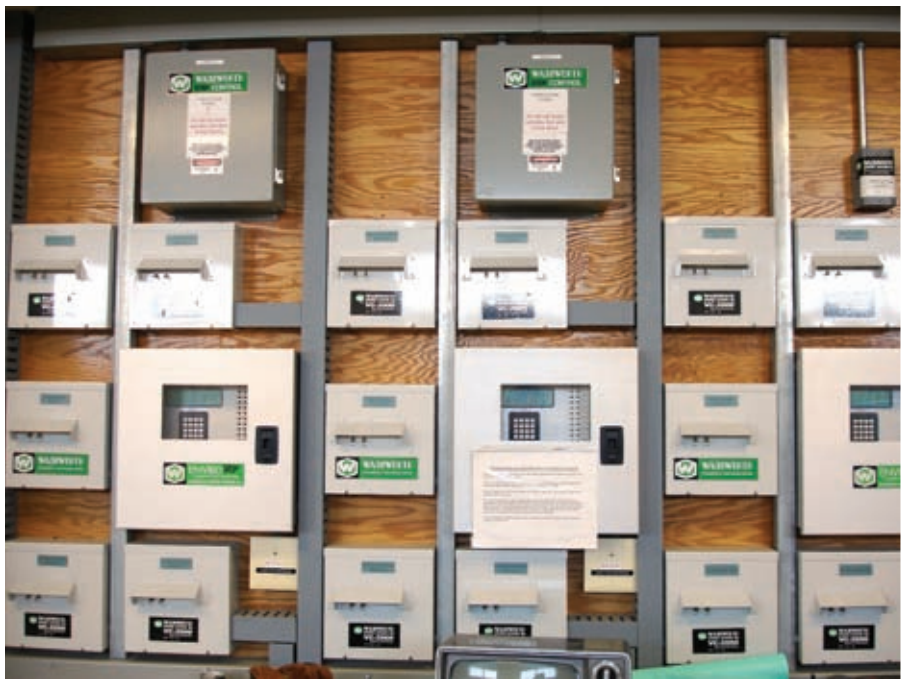
Staged Control

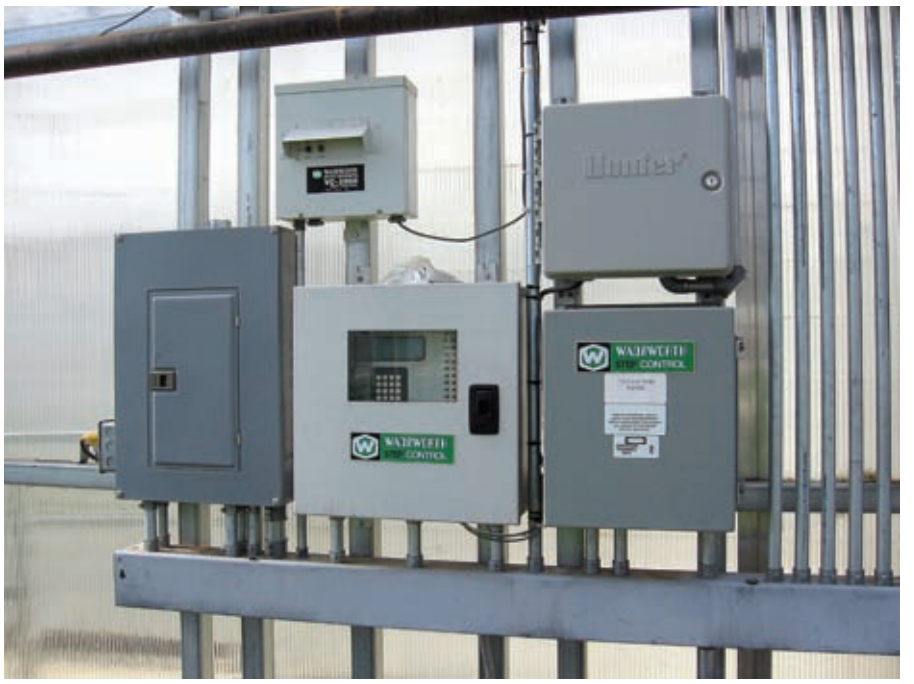
A grower constantly coordinates and integrates people, time, raw materials and space and produces a product that grows and changes every day. Modern environmental controllers serve those skills and help make a manager more productive.

The first step is staged control. These devices react to temperature and — optionally — humidity. They replace multiple thermostats with a single control that coordinates heating and cooling in a way that's proportional to temperature. When conditions are close to ideal, little or no equipment operates. When the greenhouse becomes too hot or too cold, the control gradually turns on more equipment. On the hottest and coldest days, everything works its hardest, but most of the time, you save energy costs and maintenance by using only a portion of your equipment.

Staged controllers make possible a more uniform crop because they create a more uniform environment. Many models include aspirated sensors that provide more accurate readings than are possible when the sensors are only shaded or even exposed to sunlight. That's important when you consider that every degree of improved temperature accuracy can save 3 percent on energy consumption.

Staged controls have some limitations. Their lack of weather sensors and computing power means they have little ability to anticipate ➧





Left: *These controls each have their own contactor panel, power pull energy curtain control box and four vent control boxes. This is a complete system.* ***Right:*** *This is an EnviroSTEP control, contactor panel and vent control box at a garden center.*

what they will need to do next to maintain the greenhouse climate. They consider the current temperature and humidity in the greenhouse but can't factor in outside conditions like wind or light level. The stages they use to group equipment are chosen by the manufacturer rather than by you. Almost all can manage only heating and cooling equipment.

Integrated Control

The next step to take is integrated controls that use microprocessor technology to measure and control the widest possible range of variables that affect the growing environment. Temperature, humidity, time, light and weather are all factors they can use. This broad power to sense the environment means they can make meaningful decisions not just about equipment that affects temperature and humidity but about curtains that control light intensity and save energy, carbon dioxide injectors, watering valves and fertilizer injectors and lights to extend day length or control flowering. They manage boilers to save energy and control bench heat to create microclimates that make each square foot of greenhouse more versatile.

Integrated controls combine a centralized temperature and humidity sensor with the ability to add sensors that measure what you need to control at any point in the greenhouse. Each system has its own settings. Multiple setting periods per day go beyond simple day/night changes to periods triggered by sunlight intensity, day-length prediction or DIF. Just as easily, they handle artificial day-length schedules in garden centers and exhibition greenhouses where human comfort is the primary goal.

Integrated controls can operate virtually any equipment in the greenhouse, and they use multiple sensors to make decisions. For example, irrigation can usually be set based on time, sunlight intensity or calculations that predict how quickly plants are drying based on changes in humidity and temperature. Shade curtains can react to light intensity, temperature and time of day to close for heat retention. The integrated controller manages the shade position to leave an air circulation gap for natural ventilation.

These controls can report alarms when the readings from any sensor go outside your allowed range. Audible and visible indicators on the control panel are basic. Inexpensive options add the ability to report alarms via E-mail or a telephone call.

Today's integrated controls do double duty as data loggers. They record not only the sensor readings but also the equipment-use decisions they make based upon the readings. All can store a week to a month of data at some level of detail, and all offer the ability to interface with a personal computer. While PCs won't survive in the greenhouse environment, they provide enormous capacity for data storage and data analysis — and do so at a commodity price. Because integrated controllers can connect to distant PCs using wired or wireless networks, they can make use of the power of today's best computing value.

Options

Start deciding which option is best for your greenhouse by assessing your needs. Ask yourself these questions:

- What equipment do you have?
- Do you have future plans to add other equipment:
  - — Curtains
  - — Bench heat
  - — Watering control
  - — Lighting
- How many temperature settings do you want (day, night, DIF)?
- Do you want humidity control?
- Do you want irrigation?
- Do you want access to data?
- Do you want to have access from your PC or remote locations?
- How about an alarm system?

When looking at a feature, determine if you'll benefit from it. It's tempting to buy features for the sake of features, but will you need or use a weather station if you don't have roof vents or a shade system? Perhaps just an outdoor temperature sensor will meet your needs.

Cost

- What options must you buy to make the control work?
- Are the sensors and cables you need included in the price?
- You'll need a contactor panel to connect the control to most greenhouse equipment.
  - — What will it cost?
- Consider the lifetime cost of the equipment.
  - — Will you need to purchase software upgrades?

Just as important as price is considering the company's reputation:

- How is the reputation for service?
  - — Is it toll free, 24 hours a day and seven days a week, how experienced is the staff, etc.?
- How long has the company been in business?
  - — Will they have support in five, 10 or even 20 years?
- Do they continue to service products or stop support so you have to buy the latest product? GPN

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