

From Forest Nursery Notes, Winter 2009

109. Prepare your greenhouse for installation of a climate-control computer. Labbate, E. Greenhouse Management and Production 28(11):30, 32-34. 2008.

Initial planning and consulting can ensure you install the climate-control computer that meets your needs.

Prepare your greenhouse for installation of a climate-control computer

WHEN DESIGNING A NEW GREENHOUSE OPERATION or retrofitting an older greenhouse for computer control, you should consult a climate-computer supplier before starting the project. In many cases, growers locate the computer on a table in a boiler room or in a warehouse where dust can quickly create problems. For a comfortable working environment, set up the climate computer in a dust-free office.

If you're also controlling the irrigation and fertilizer systems with a computer, planning is required for housing the injector equipment and

fertilizer tanks. Additional wiring for the control cables is needed. The easiest way to install a computer and fertigation system is to contract for a turnkey system. However, if you know what has to be done, there is no reason why you cannot do the installation yourself and contract the final termination and startup with the climate and fertigation computer supplier.

Cable installations

The control cable distribution routes have to be carefully planned. In most cases, low-voltage (LVT)

control cables and sensor cables are run along trusses or strapped along electrical tubing routes. Be careful to avoid cables touching heating pipes or installing cables where they could get pinched by pipes that expand and retract with hot and cold weather conditions.

It is important to know what types of cables and relays to use. When selecting LVT cables, make sure the PVC jacket is ultraviolet-radiation rated. The cables should be rated at the same voltage rating as the highest electrical voltage in the control panels (usually 300 or 600 volts).

Always use at least 18-gauge low-voltage control wiring for controlling relays up to 600 feet. It is important to use the right relay for the specific cable length. You should always use plug-in 24 volts of alternating current (VAC) relays such as the Omron MY-2-US24 or comparable. These relays draw approximately 50-80 milliamps so they take very little current to operate.

You can also use electrical tubing to house the LVT cables, but this can be a disadvantage if you plan to expand. It is difficult to run additional cables inside the same tubing.

When retrofitting an existing greenhouse, I've found the best way to install low-voltage control cables is to install cable trays with a hinged cover down the center walkways mounted to the green-



If you're going to control your irrigation and fertilizer systems with a computer, planning is required to house the injector equipment and fertilizer tanks.

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house trusses. This increases costs slightly, but it offers the flexibility to easily add cables.

Many manufacturers have improved cables with UV-rated PVC jackets that protect the cables exposed to direct sunlight.

LVT cables will need to be installed between the computer-control panel and each control point. Some control points will require a 2-conductor LVT control cable for on-off control. All modulating valves with forward-reverse motors, such as vent motors and shade curtain motors, require 3-conductor LVT cables.

Communication protocols

Climate-computer manufacturers use many different communications protocols. Some use serial communications between the computer and control panels such as RS 422 or RS 485 communications protocols. Others use Ethernet and Internet-based communications protocols. These all require different types of communication cables between the control panels in the greenhouse and the PC in the office.

The climate computer system you select determines the communications protocols used. Your computer supplier can help you choose the proper communication cables.

You should also be aware there are different types of control strategies between the control panels and equipment in the greenhouse. Some manufacturers use 24 VDC circuits to control greenhouse equipment, they're limited in the distance they can control a relay. I prefer not to use DC control circuits since they only work satisfactorily at a limited distance of 100-200 feet. The 24 VAC circuit easily controls a low-voltage relay 800-1,000 feet using 18-gauge LVT cables.

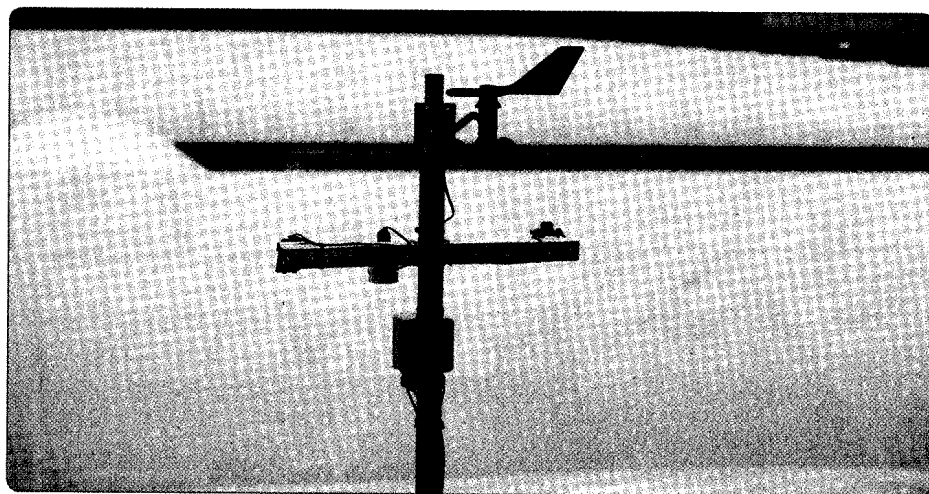
To overcome DC voltage limitations, some suppliers offer multiple panels with a central processor unit (CPU) and analog and digital input/output that reads and controls greenhouse equipment. This adds cost and labor to the project

as there are multiple CPU panels to work with instead of one central unit. I recommend a 24 VAC control platform since it reduces the amount of panels required because of the 24 VAC low voltage control method.

Typically, each zone you need to control requires measurement with a temperature and humidity sensor. In most cases, these sensors are aspirated with a low-voltage 12 VDC or 24 VAC fan. The cable requirement for these sensors is typically eight-conductor, 20-gauge stranded wire (two conductors for temperature, three conductors for humidity, two conductors for a fan and one conductor for a ground). Weather station wire requirements, in most cases, need a multiple conductor cable for the wind speed and wind direction, outside temperature, solar sensor and rain sensor. Each supplier has different requirements.

Design a flexible system

Several years ago I designed a new climate and fertigation software program with Ethernet and Internet communication protocols. The system uses CAT 5 Ethernet cable between the PC and the main control panel in the greenhouse connected through an Ethernet



In most cases, greenhouse weather stations require a multiple conductor cable for wind speed and wind direction, outside temperature, solar and rain sensors, and possibly outside humidity monitoring.

switch. Each port from the hub can control individual mini-computers in each control panel. The PC is used as a terminal to send information to the mini-computer in the panels that do the measurements and control. If the PC goes offline, the mini-computers in the panels keep working.

The weather station is designed with all sensors interfaced with a custom transmitter on the weather station mast with a single three-wire circuit to the computer-control panel. This makes the installation much easier to work with.

An Ethernet system can be configured as a centralized or decentralized

system. In a decentralized system, communication can occur with a CAT 5 cable to each control panel connected to an Ethernet HUB. This configuration is very flexible allowing for connection of office and home computers and is easily accessible over the Internet using laptops, PDAs, I-phones or Blackberry phones.

If there is no Internet service at the greenhouse location, it is now possible to get this service linked to your operation via wireless private networks. These networks are now available to link distances 10-15 miles away. Covering longer distances is possible using repeaters. This ser-

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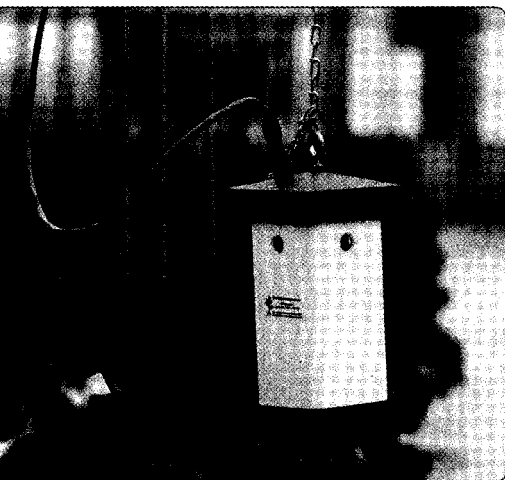
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Equip each computer-controlled zone with an aspirated temperature and humidity sensor.

vice is available without licensing requirements.

Number of zones

Zone requirements vary. If you have individual stand-alone greenhouses, each greenhouse should be

wired as a separate zone. A block of four polyethylene-covered houses can be considered one zone.

If each house in the block is equipped with individual heaters, it makes sense to create four heating zones. If each house has separate vents, vent control can be considered for each separate zone. If cost is a factor, the block of houses can be wired as one zone to control all four heaters and all four vents from the same sensor.

Plug-in modules

The most recent system I have worked with has all plug-in modules with removable connectors so if a module has to be changed there are no wires to disconnect. A grower can simply unplug the connector with the cables, remove and replace a module and reconnect the connector. The system is completely

modular and easy to maintain.

Each output control module is a plug-in, optically-isolated relay with a built-in fuse, LED and a manual override switch. This also saves a lot of installation time because the manual override switches are built into every module.

Choosing a computer system

When evaluating a new climate and fertigation computer control system you should not make your final decision based on price alone. You should consider the system's software flexibility, if it meets your requirements and is it easy to use. Another consideration is the technical support and service capability of the supplier.

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