

Chapter 11 - MONITORING AND CONTROL SYSTEMS

Content:

- Introduction
- Overview of typical monitoring and control systems
- Fundamentals of conventional and computer-based control and monitoring systems
- Typical monitoring and control systems
- System components
- Transient suppression
- Backup systems

A. Introduction

As poultry production systems become increasingly automated, monitoring systems are being integrated with **control systems** to provide growers with real-time and historical information on how various systems such as environment control, feeding, egg handling, and water are performing. The use of buildings that are 400 or more feet in length and which may be from hundreds of feet to miles away from the farm office presents a number of technical problems to the farm manager who wants to carefully monitor and control the conditions in poultry houses.

The evolution of electromechanical and electronic equipment used in poultry facilities has been continuously progressing. The reason is simply economics. Monitoring and control systems greatly **reduce labor costs**. They can provide improved environmental conditions and air quality, improved broiler performance, and opportunities for improved management. For example, it is sometimes desirable to provide a feeding in the middle of the night. Lights and feeders can be scheduled by the control system to introduce this special event. Some ventilation control systems provide hourly house temperature targets. This allows for the house to be cooled at night to maintain daily house temperature targets during hot weather. Automatic control systems, if properly used, make flock management more consistent, since **humans tend to forget**.

A distinction is made between electronic and electromechanical devices. An example of an **electronic device** is an environmental controller with one or more temperature sensors and one or more relays that are used to activate equipment. An example of an **electromechanical device** is a conventional thermostat, which is a temperature-activated relay used to turn on or off equipment such as heaters or fans as air temperature varies. Either of these example devices can be used to operate a fan. The type of control system used will also affect the troubleshooting options and approaches when problems arise.

Table 11.1 lists the operation and use of electromechanical and electronic components which are typically found in poultry production facilities. The common feature of these

items is their ability to turn a piece of equipment (fan, heater, feed auger) on or off according to some set point or schedule based on temperature, time, feed level, etc.

The most common control device used to activate or deactivate electrical equipment is a relay. A **relay** is a remotely actuated switch, and it is usually switched on/off by switching power to the relay coil. The coil, when activated, sets up an electromagnetic field that pulls the switch closed. A relay's switch points are usually called 'contacts' or 'poles,' and it is quite common to provide more than one set of contacts. For example, to switch 240 VAC circuits, a 2-contact relay (commonly called a double-pole relay) is necessary.

Table 11.1 - Operation and use of electronic and electromechanical devices

Device	Classification	Description	Typical operation	Typical use
Relay	Electro-mechanical	Acts as a remote switch	Switch power to fans or heaters	Used by electronic controller to switch a power device
Solid-state relay	Electronic	Same functionality as a relay		
Thermostat	Either	Acts as a switch based on air temperature	Directly switch on/off of a power device such as motors	Ventilation fans and heaters

A **thermostat** can be thought of as a relay whose contacts are switched automatically in response to air temperature. A mechanical timer is a relay which is switched according to a pre-set timing sequence. The term '**electronic controller**' can be used to describe anything from a self-contained solid-state thermostat which contains no moving parts and a remote temperature sensor to an intelligent computer-based controller which controls and monitors many parameters with control and monitoring strategies which can be changed at will be the operator.

Most controllers are not built to directly switch large electrical loads such as fan or feed auger motors. Instead, they typically have a control relay which is activated by the controller. The **control relay** is connected to coil of a so-called power relay which switches the larger load of the actual equipment on or off. At least one per ventilation stage is needed. Several companies manufacture relay boxes consisting of several power relays pre-wired with auto/on/off switches. The on position provides a manual override of the controller, the off position is used to disconnect, and the auto position is used during normal operation.

For environment control systems utilizing centralized controllers, attention should be paid to how the controller interacts with the building's air inlet system. In many older facilities there is no **air inlet control** except perhaps one or more hand cranks to adjust inlet (or curtain) width. New facilities typically use air inlet controllers that work to maintain a **constant static pressure** difference between inside and outside. This type of system is

easy to use with virtually any environmental control system because the air inlet controller automatically adjusts inlets as the number of fans operating changes.

Some environmental controllers have a feature to adjust air inlets or curtains based on inside temperature. This may be beneficial for buildings using curtains as part of a ventilation strategy. Another method is to connect an independent curtain controller to one stage of an environmental controller, so that the inlets are only controlled during certain ventilation stages.

More recently, tunnel ventilation has become popular as a means to alleviate heat stress in very hot weather. By placing all fans at one end of the building and admitting fresh air at the other end, relatively high air velocity provides additional cooling for broilers. For totally enclosed buildings, tunnel ventilation presents a difficulty for the operator to decide when to shut air inlets and open tunnel curtains at the end opposite the fans. Some environment control systems are available to automate this feature.

B. Overview of typical monitoring and control systems

Ventilation, heating and cooling

A properly designed monitoring and control system should be capable of maintaining preset environmental conditions in the building. **Baffles** are usually controlled by motor controllers, **fans** may be either on-off or variable speed, **heaters** require on-off control, and **evaporative coolers** may require water supply to be automatically turned on and off. Static pressure is usually controlled by regulation the air inlets on negative pressure houses or the air outlets on positive pressure houses.

Some air quality factors such as temperature are essential to monitor and control. Others such as ammonia or carbon dioxide may be expensive to monitor (although periodic sampling may be desirable), and they may be controlled indirectly. Relative humidity, although a very important parameter in terms of broiler performance, dust control, and growth of microorganisms, is typically not monitored or controlled in the U.S. where most poultry houses use curtains and dirt floors. In Western Europe where the houses are typically fully enclosed and often have concrete floors, monitoring and control is usually done with computer-based control systems which monitor and control temperature, humidity, static pressure, and lights. Management must control the benefits, risks and costs associated with maintaining good environmental conditions inside poultry buildings. Different building designs, geographical regions and poultry management practices determine the air quality factors that need to be considered and that are practical to deal with. Environmental control can be complicated at times by competing objectives. For example, it is desirable to heat a pullet house to 90°F and to provide fresh air. In cold weather, levels of ammonia and carbon dioxide might reach harmful levels if the control system does not provide a certain level of minimum ventilation.

Feeding

A feeding control system requires some way of knowing when to turn the feeders on and off. It is important for the same amount of feed to be available at all locations along the feeder and, especially with some systems, for the desired amount of feed to be presented to the broilers. Feed monitoring systems are available to measure the amount of feed consumed by broilers. This can be accomplished in a number of ways: with electronic load cells on the feed bins that record pre- and post-feeding weights, with an auger run-time monitor, or with a dump scale in which feed passes into a container that is balanced to a certain weight, and the monitoring system counts the number of times the container dumps the feed into the surge bin. This may be desirable, for example, to increase calcium levels for night time feedings.

Lighting

A monitoring and control system should provide scheduling of lights that is easy to use. It is especially important breeding facilities for precise lighting schedules to be followed. A system that can pre-program lighting schedules over the life of the flock is very useful for management. It is also important to provide the desired intensity of light. Dimmers are available in existing control programs, but it is more common for light intensity to be manually adjusted. Low light levels require light meters for calibration and checking the light dimmers and levels in the house.

Water

Water flow monitoring can be used to track how much water the broilers are consuming to quickly detect changes in flock behavior, or to spot problems with the water supply or distribution system (such as a leak in the water line). By interfacing with appropriate alarms, the monitoring system can report a 3:00AM water leak to an appropriate farm employee, minimizing potential losses, wetting of litter or floors, and damage to equipment.

C. Fundamentals of conventional and computer-based control and monitoring systems

There are many options for controlling and monitoring a poultry house. Depending on the application and the needs of the use, the controls can vary from simple on-off switches to a fully automated computer-based control system. It is important that those involved in specifying or using control and monitoring systems for poultry houses understand the basic operations, capabilities, and limitations of existing equipment as well as the potential benefits and limitations of more advanced equipment. Since the primary application of control technology in a poultry house is for control of environment, this application will be used for most of the following discussion. Similar control and monitoring concepts could be applied to most other applications in a poultry house (e.g., feeder operation, water monitoring, egg counting, etc.).

Control systems for poultry houses can usually be classified as conventional or computer-based. **Conventional controls** include simple electromechanical devices

such as on-off thermostats, pressure switches, single and multi-stage fan controls, and timers for light scheduling. Self-contained, solid-state controls are also available for these types of tasks. Most conventional electromechanical controls have sensors which must be located close to the control, they do not have displays for the controlled variable, and the user who wants to know how well the control is working must use a second device to monitor the conditions (e.g., a thermometer may be required for the typical electromechanical thermostat). In contrast, **conventional solid-state controls** do have displays for the controlled variable, but it is usually only a local display.

Computer-based controls have several advantages over conventional controls including the following:

1. They can be programmed for almost any desired type of control including simple on-off, proportional, time proportioning, diurnal (e.g., a light program that varies lights in a house on a cycle similar to natural outdoor light), etc.
2. The control program can be set up with numerous logical interactions, e.g., turn the evaporative cooler on if the temperature is $> 80^{\circ}\text{F}$ and the humidity is $< 70\%$ or if the temperature is $> 85^{\circ}\text{F}$ regardless of the humidity.
3. Changes in control strategy require only a change in the program (software), whereas similar changes in conventional controls require re-wiring the system.
4. The computer-based control system can incorporate local and remote text, graphics, or animation displays of controlled or monitored conditions at selectable intervals. It can also record the conditions on removable or permanent disks, and on a print out.
5. The computer-based control system can be designed for phone access or networked to other computers by wired or wireless systems including one in the home.
6. The computer-based control system can be expanded to include other sensors, functions, houses, etc. in the future.
7. The computer-based control system has a high reliability and very few or not moving parts.

Advantages of conventional controls over computer-based controls include:

1. Conventional controls, especially the electromechanical ones, tend to be less susceptible to damage by electrical surges (although computer-based systems can be protected by appropriate surge suppressors).
2. Conventional controls are more readily available, easy to replace by unskilled labor and relatively cheap.

Considerations that need to be taken into account prior to selecting a control and monitoring system for environmental control include the following:

1. What control accuracy is needed?
2. Will the set points be fixed, cyclic or stepped?
3. How and where will the controlled variables (e.g., temperature, humidity, static pressure, light, etc.) be sensed by the controls and how will they be monitored and/or recorded?

4. Do the displays need to be local or remote or both?
5. Is it desirable to record some of the environmental parameters like temperature, humidity, and light level on a permanent record that can be used to develop trend graphs, etc.?
6. Is it likely that the producer will want to change the control strategy in the near future, and if so, will he/she be willing to re-wire the system to accomplish the new control strategy?
7. What is the potential for improving performance and minimizing losses with optimized control and monitoring of environment?
8. What is the potential for energy savings with optimized control?
9. Considering the risks of failure in critical parts of the system, what level of reliability is required?
10. What level of user friendliness is required?

D. Typical monitoring and control systems

Conventional monitoring and control systems

Poultry house control systems in the U.S. typically consist of single or multiple stage thermostats which control ventilation rate by regulating the **position of curtains** or **damper inlets** along the side of the house and/or the **number of fans being operated**. For hot weather, a separate thermostat or one of the upper stages of a multiple-stage thermostat may be used to control evaporative coolers – usually by turning water supply valves or pumps on or off. Lights are typically controlled by electromechanical timers. Other variables like humidity, static pressure and ammonia are not usually controlled.

Monitoring is usually restricted to house temperature using glass or dial thermometers hanging in the house in the exhaust air stream. Light levels may be spot checked with hand-held meters. Humidity and ammonia are usually not measured, but producers usually try to make adjustments in ventilation rates or set points based on perceived humidity levels or ammonia levels in the poultry house. **Alarms** are usually limited to audible devices which can be heard at nearby farm offices or homes, and which can be triggered by power failures (which would result in a loss of ventilation in the event of powered ventilation systems), high temperatures, or failure of the watering system. Some alarm systems use regular wired or cellular telephones with automated dial out triggered by out-of-range variables to deliver trouble messages stored on tape or in solid-state memory.

Electronic and computer-based monitoring and control systems

A variety of commercial monitoring and control systems are available which utilize electronic controls and remote sensors. The remote sensors may be located anywhere from a few feet from the controller to several hundred feet depending on the application. Excellent, highly reliable sensors are available for temperature, humidity, light level, and static pressure measurements – the most commonly monitored variables in poultry houses.

Dedicated electronic monitoring and control systems

Depending on the configuration, these systems are used on individual houses to provide anything from an electronic version of the electromechanical thermostatic with a readout at the unit, to multiple sensor systems that can control temperature, humidity, static pressure, evaporative coolers, supplemental heaters and/or brooding systems, lights, and ventilation rate with readouts at the unit.

Distributed electronic monitoring and control systems

Depending on the configuration, these systems can provide the same functions as the dedicated electronic controls described above, and they can also be linked together to a central computer which can be used to monitor and record events and conditions at various locations. Conditions can usually be monitored on the dedicated controller at each house or at the central monitoring point which can usually be located anywhere from several hundred feet to miles from the houses being controlled, or monitoring and control can be done by telephone using dedicated lines. Environmental conditions can usually be logged at the central location. Alarms for out-of-range variables can usually be indicated (visually or audibly) at both the individual and central locations. Failure of one or more of the dedicated control systems or the communication link between the central location and the remote buildings does not affect any of the other systems in a multiple house system.

Central computer-based monitoring and control systems

These systems can control single or multiple houses, and they usually use remote input/output boards at each location to interface to sensors and control outputs. Monitoring, logging and alarming are all programmed and controlled from the central computer. Failure of the central computer or a communication link between the computer and the remote input output boards will cause loss of control unless appropriate backup systems are provided. Automatic backup systems for computer-based control systems are readily available, and they have been proven to be very reliable in recent years.

An example of a commercially available, computer-based central monitoring and control system is given below. In this system, a PC communicates with equipment located throughout a typical poultry farm. A farm manager has the ability to monitor conditions and operations in each broiler. Schedules for temperature, lights, and feeders in each house are set at the central computer. At any time, a farm manager can monitor conditions remotely, change current set points and schedules, and get reports. With a modem in the control computer and a remote computer and access to a telephone line, these capabilities are available to a farm manager anywhere.

E. System components

- **Power supply** – A heavy duty linear 12 volt DC power supply provides regulated and protected power to the system's micro-processor boards, called Data Gathering Panels (DGP). The power supply also provides fuse protection for this

power supply, and the 24 volt AC power transformer which is used to operate the system's Relay Control Units. The power supply includes an On/Off switch, indicator lights, and fuses for both voltages.

- **Control voltage transformer** – The transformer provides 24 volt AC power relay to the Relay Control Units and other low voltage relays.
- **Communications spider hub** – The spider hub is the central distribution point for RS422 communications throughout all aspects of the system. Each spider hub can communicate to 12 or more houses. Additional spider hubs are added for larger installations. There is a smaller version for 1-6 house installations. Every spider hub includes complete lightning protection.
- **Data gathering Panel** – This enclosure contains the specific data gathering panels (DGPs) needed for the functions used in each house. The DGP boards collect the sensor information, communicate it to the central computer, relay the control commands to the various relay control units (RCUs), operate On/Off fans and variable speed fans, feeders, etc.
- **Relay Control Panel** – This is an 18 channel interface between the equipment being controlled, the computer control signals, and manual backup signals from thermostats and time clocks for automatic back-up protection in the event any computer problem. Also included is the computer watchdog signal which provides automatic switching of the devices being controlled in the event of a malfunction or power failure. It also provides for isolation of different control voltages, and source voltages.
- **Backup Thermostats** – These thermostats are wired into the Relay Control Unit and are used only if the computer integrity signal is lost. If this happens, all the watch dog signals go away, and the thermostat runs the ventilation directly. This is the first level of backup protection. If any communication problem exists in the system, an alarm is issued by the System Watch Dog Timer Unit, and sent directly to an outside alarm system (the second level backup protection).
- **Fail Safe Thermostat** – This thermostat goes in the warmest part of the house, so that in the event the temperature gets warmer than is safe, it breaks the computer integrity signal, and forces the ventilation back to manual thermostats. If someone were to enter an incorrect temperature target into the system and ignore all the alarms and warnings, this thermostat would interrupt the computer signal and cause the fans to run based on the thermostat settings (Third level backup protection).
- **Feed Auger Relay Control Unit** – The Feed Auger RCU provides the controls signals to the feeders, and coordinates the feed times, the activation of the feeders, the inside cross auger, a surge bin, and the outside bin augers.
- **Feed Auger Monitor** – This device connects to and monitors a feed auger to insure the auger is stopping and starting within a specified time during a feeding. Normally, the fill auger will stop and start. If it runs continuously, the feed bin may be bridged, or out of feed, and the broilers would not get their complete feeding. If the proximity switch to control the feed auger malfunctions, the auger may never start, again causing the broilers to go without feed. This device will cause the computer to issue an alarm if one of these problems occurs.

- **Power Monitor Panel** – This panel provides input signals to the control system for the following events:
 - **Control voltage failure.** If the voltage that engages the fan contractors is shut off or overloads, fans will not run. It provides an immediate alarm for this condition. There should be more than one control voltage source for ventilation. All voltages are monitored.
 - **Three-phase power monitoring.** It provides input signals to insure that 3-phase power is present with the proper voltage, and phase balance.
 - **24 Volt AC Monitoring.** It monitors its own voltage and alarms if our control voltage fails. If this occurs, building ventilation automatically goes back to normal control.
 - **Fail-safe thermostat.** It monitors whether its Fail-safe thermostat has activated, and issues an alarm for this event.
- **System Watch Dog Timer Unit** – This is an independent timer that is tied directly to an alarm system. It is powered by the 12 Volt DC power supply supplying power to the data gathering panels. It is reset, and kept activated by a 3-second relay signal from the output of a data gathering panel. In the vent the timer loses power, or is not reset with 3 minutes, its issues an alarm indicating a computer malfunction. If the control computer were shut off, for instance, the timer would no longer be reset, and would time out and send the alarm. If any data gathering panel in the system does not communicate properly with the control computer, the control computer does NOT send the signal to reset the system water dog timer, and an alarm is issued as soon as the timer times out.
- **Variable Speed Motor Controller Device** – This is a frequency drive that controls the variable speed of a 3-phase motor. It is used on fans that are controlled by variable speed.

F. Transient Suppression

Transient voltage is a sudden or momentary over voltage condition. Transient suppression should be provided for all critical electronic and electromechanical controls as well as for electronic sensors which extend outdoors. Several things can be done to minimize transients that might get into a control system. One of the first things is to provide suppression at the breaker box or at the front end of a controller to protect against surges on the AC supply. Devices for this include **varistors, gas diodes, transorbs**, and combinations of these. The energy rating of these devices, usually given in joules, indicates how much energy they can absorb or shunt to the ground. For a given price, a higher rating would be preferred. Some devices are designed for installation in a breaker box, others may be mounted in a control box, and others are designed to be mounted on or near electronic circuit boards. It is also helpful to keep low-voltage sensor cables and control wires separated by several inches from AC power lines to avoid transients being induced into the low-voltage wires by motor starts, solenoid operation, etc.

Some key definitions

A **varistor** is an electronic component used to protect circuits against excessive transient voltages by incorporating them into the circuit in such a way that, when triggered, they will shunt the current created by the high voltage away from the sensitive components. The most common type of varistor is the Metal Oxide Varistor (**MOV**). MOVs react very quickly to electrical surges but have the tendency to allow the voltage between power lines to get further apart.

A **gas diode** is also known as a 'glow lamp' which is a glass envelop filled with gas which contains two or more electrodes. They are cold-cathode devices which require no heater or filament. Glow lamps produce a very interesting, mild, beautiful colorful glow with the color of the glow dependent on the gas combination used. Pure neon produces an orange/red glow while pure argon produces a purple glow. Diodes are used to prevent reverse current flow in circuitry.

Transorbs are components that carry current after a certain voltage is exceeded. This is called the trip voltage. The transorb keeps the voltage between the two lines at a set voltage and won't allow it to go any higher. This prevents your appliances from being damaged by the application of too great a voltage at their inputs. Transorbs can absorb a lot of current but turn on more slowly than MOVs.

The key points where protection is needed are:

- On the power line before it reaches the controller,
- On cables coming from sensors which extend to the outside of the building, and
- On communication lines going into or out of a building to a controller or input/output board in a building.

Many electronic controllers have built-in transient suppression for external sensors, incoming and outgoing communications lines, and their power supplies. Packaged transient suppression devices are readily available at reasonable cost for both power line and low-voltage applications. The cost and effect of protecting controllers is well worth the effort compared to dealing with random and unexpected damage that comes without protection.

G. Backup systems

All control systems using electronic and electromechanical equipment serving a critical life support function should include backup controls. Failures of any component in a primary control system can render the entire system useless and lead to catastrophic losses. Typical failures include those caused by power losses or surges, hardware, or software. Failures can occur in the computer, an Input/Output (I/O) device, an individual input or output module, or in sensors. Failure detection techniques include looking for

computer lockup, toggling a symbol on the screen, setting up error messages, setting alarms for failed I/O boards, looking for sensor outputs that are significantly out of range, watching for toggling of the least significant bit on a sensor output, monitoring serial communication activity with another computer, and using an expert system.

In addition to the backup system, an independent and reliable alarm system is also essential. While a controller failure is fairly uncommon, it is possible. Equipment which may be used for backup control of critical systems includes uninterruptible power supplies, battery backed non-volatile memory, auto execute programs, manual switch over systems, automatic switch over systems, watchdog times, conventional controls, backup computers and connecting backup equipment in electrical parallel with the controller. Life support should be the primary focus of the backup systems. For example, some method of providing heat during brooding should be available even if the main control thermostat has failed. Similarly, during hot weather, a means to provide ventilation independently from the control system is essential.

In the case of central computer controlled systems, which provide many control functions in one unit, failure of a single component can have more serious impact than would failure of part of a distributed electronic control system or a single thermostat amongst many thermostats used to control fans or heaters. For this reason, designers of backup systems must take a 'worst-case' approach when selecting which support functions to backup. This is not to imply that centralized control systems are inferior, but rather it must be stressed that backup systems should be viewed as an essential component of these systems.

For poultry facilities there are as many as four different critical backup functions that must be provided for short term life support. These include providing heat during cold weather for young broilers, providing minimum ventilation during brooding, providing minimum ventilation for older broilers, and providing maximum ventilation during mild to hot weather.

Note that these backup system schematics indicate that double-pole timers and relays should be used on all 240 VAC circuits. This is necessary because a properly installed controller should also switch both legs of 240 VAC circuits. If the controller were to fail and a single-pole backup thermostat were used (on one leg of the power circuit), it is quite possible that power would not be provided on the other leg of the power circuit.

If single-pole timers or thermostats are used, note that the same leg that is switched by the controller must also be switched by the backup device. This does not provide a safety disconnect because there is a power available at the fan motor via the in-switch leg.

Low temperature safety override

The most common backup system for young broilers is for heat in the event of control system failure, because young chicks cannot survive cold temperature. A low temperature safety override should be connected in electrical parallel with the control system wiring. Use two thermostats if more than one heater circuit is desired.

The low temperature override circuit provides power to heaters if air temperatures at the thermostat drops below the thermostat's set point. Proper adjustment of this safety thermostat is crucial to proper operation. For example, setting the safety thermostat set point to a low temperature (e.g., 40°F) effectively removes it from the circuit and makes it worthless. For brooding it is common to include the backup thermostat set point adjustment in periodic control system adjustments.

High temperature safety overrides

During hot weather it is essential to activate several fans if a controller fails. In principal this is identical to the low temperature safety override, except that the mechanical thermostat is wired to activate on temperature rise. At least 2.5 CFM/broiler should be provided for emergency use, thus more than one high temperature override thermostat may be necessary depending on fan size and broiler density. For example, two 48-inch fans rated at a nominal 20,000 CFM each at 0.08 inch water column provides 20,000 broilers with about 2 CFM/broiler.

An alternative high temperature safety override is to provide an automatic drop curtain in the building. This system consists of a bimetallic thermostat which when activated, releases a safety catch on the cable holding a curtain running the entire length of both sides of the building. These drop curtains also must be adjusted properly and tested at regular intervals to ensure operation. Consideration should also be given to ensuring that curtains drop even if fans are still running, as can often happen if the drop curtain thermostat is out of calibration or incorrectly set.

Override systems using variable speed fans

Although fan speed controls are not commonly found in poultry facilities, they are quite common in HVAC systems used for office and industrial applications, and they can provide precise control of ventilation rate for conventional AC fan or blower motors. If variable speed fans are used, these should also be provided with a backup system. One approach is to provide a manual override switch which can be used to bypass the speed controller so that the motor will operate at full speed. With computer controlled systems, one approach is to allow a watchdog timer to switch over a proportional thermostat when the computer communication link is broken (due to a failure of the computer or one of the components between the computer and the output to the speed controller). If the speed controller itself fails, the controlled fan will usually be turned off which can be sensed by some loss of temperature or static pressure control. Most speed controllers also have alarm outputs which can be used for audible or visual alarms at the location or remotely sensed by a computer.