TEMPERATURE FLOW AND PRESSURE MONITORING HELPS KEEP PRODUCTON AT MAXIMUM RATE

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Abstract

Common operating practice at most gins is straight forward: Have the operator run the gin at maximum speed possible, without causing too many chokes and mishaps, while maintaining acceptable lint quality and value for the customer. Most operators use their knowledge and experience to perform just that. The ginning process however is rather complex involving many parameters to be controlled, many with contradicting attribute. An automated control which monitors all gin parameters should be capable to resolving the control algorithm where the outcome is optimized for grower and ginner benefit. Parameters such as moisture, temperature, flow and machine status must be monitored so they in turn be controlled for best performance. Advance Sensing and Controls has developed over the last 10 years most of the specialty sensors needed to monitor the critical gin parameters and operate the cotton gin with optimal condition and achieving maximum benefit to both the grower and the ginner.

Central Control - Description

ASCI automated control monitors multiple gin parameters and controls FLOW, MOISTURE, TEMPERATURE and LEAF while maximizing production and optimizing lint value.

The algorithm running by a central control unit is fed with flow measurements from several key locations, such as feeder, stands, and flue, and provide motor speed signals to the feeders which regulate flow.

Moisture measurements from incoming seedcotton before ginning and of the lint are used to control the moisture contents, either by drying or by moisturizing the cotton. ASCI provides atomized spray for seed cotton and lint.

Moisture level readings are considered when maximizing the gin flow rate. In the event that high moisture is detected at the incoming seedcotton the processor may reduce the overall flow to accommodate for the additional drying requirement, if the gin dryers are at full capacity for the task.

Chocking conditions are continuously monitored in attempt to eliminate slow-down or down time. When choke condition is detected, the feeding apparatus are slowed down to accommodate the access material and clear the ensuing stoppage.

Leaf grade is controlled through several possible gin machinery: moisture, flow rate, and cleaning. ASCI's leaf grade analyzer provide an input which help bypass cleaners, adjust speed and moisture contents, so that the leaf grade will not, if possible, degrade the value of the product.

ASCI control system is designed to operate under CENTRAL CONTROL where central processor determines the operating parameters (such as speed, temperature, moisture, etc) of the gin machinery, or under DISTRIBUTED CONTROL where each machine or process is adjusted separately (its own closed or open loop control).

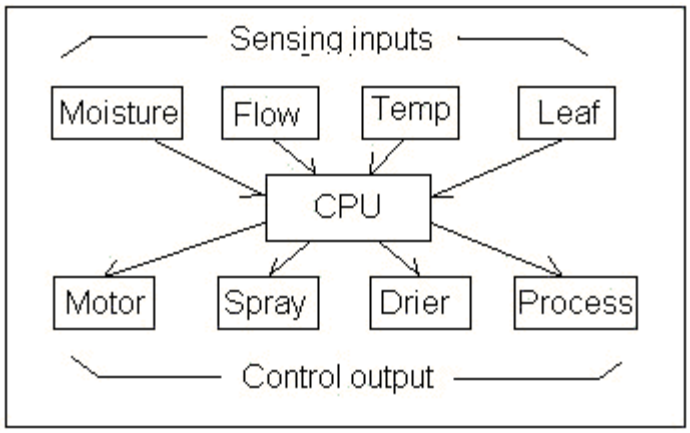

Figure 1. Control Diagram

Sensors Description

Advance Sensing and Controls has developed the following specialty sensors needed to monitor the critical gin parameters:

Moisture sensor for seedcotton and lint

A new design of resistive moisture sensors for lint and seed cotton. The sensor is designed with variable sensitivity so that its measurement range extends from very dry cotton of approximately one percent of moisture contents to very wet cotton of more than 20 percent moisture. The sensor takes into account the pressure which is applied against it and the length of time the lint makes contact with the sensor.

Figure 2. The Snail - Moisture sensor for lint and seedcotton

Flow sensor for seedcotton and lint

Originally design for the AGRIplan cotton yield monitor, the sensor use optical detectors and emitters to measure flow. The sensors consist of a light emitting component _ emitter _ and a light detecting one _ detector. The emitter and the detector are mounted on opposite sides of a cotton conveyor or duct such that the cotton passing between the emitter and the detector blocks the emitted light from reaching the detector. The light received at the detector is converted into the estimated weight of the cotton passing through.

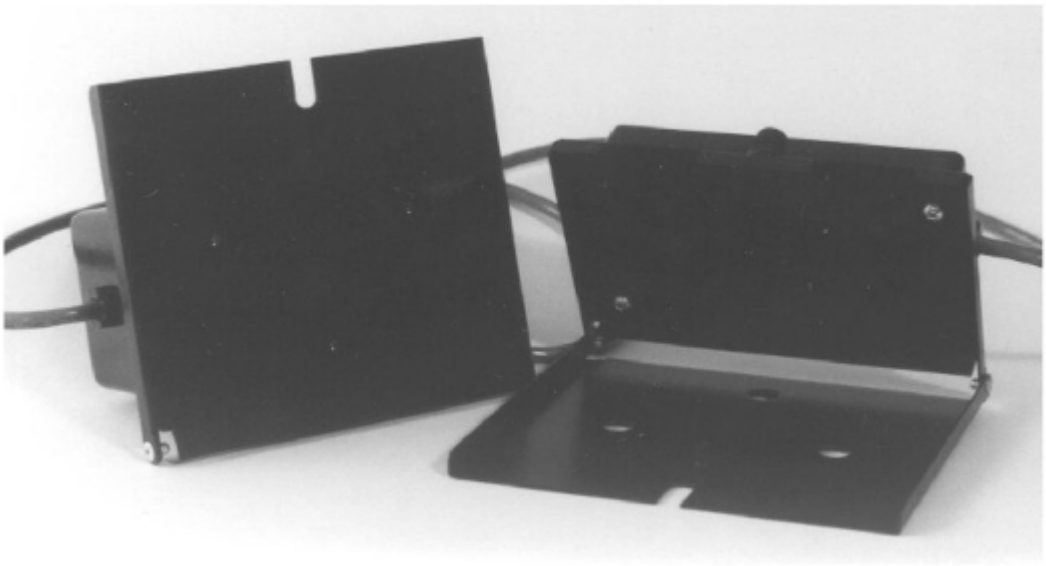

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Figure 3. Flow sensor.

IR temperature sensor for seedcotton and lint (non-contact)

A fast response to radiated IR waves is used to construct the non-contact temperature sensor for monitoring machine temperature (such as rollers) and also built to monitor and detect start of fires.

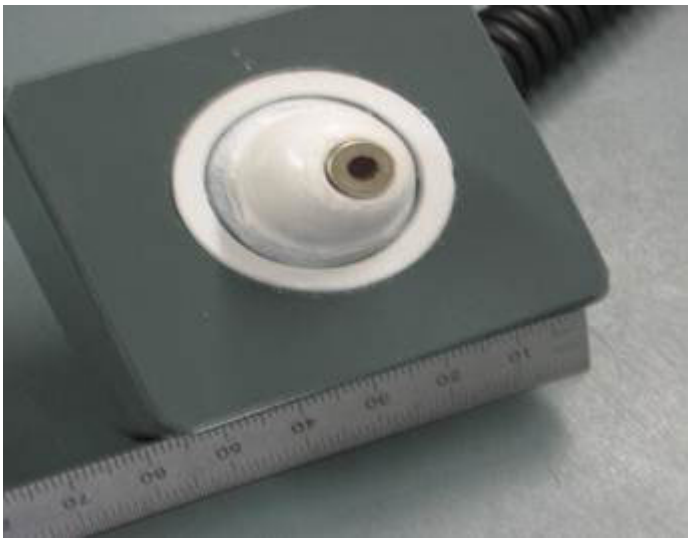

Figure 4. IR temperature sensor.

Final Bale moisture

The sensor consists of a radio transmitter and a receiver with antennas positioned at the opposite sides of the bale in process. A signal Processing Unit analyzes the radio signals received and calculates the moisture in the bale. During the measurement the transmitter sends radio signal from the transmitting antenna, through the bale, to the receiving antenna. The detected signal is delayed in proportion to the presence of moisture in the bale. The moisture content is then calculated as a function of the measured delay.

Figure 5. Microwave bale moisture sensor.

Machine monitoring - shaft, temperature, airflow

Commonly available devices are harnessed to monitor the operational status of the gin machinery. Shaft rotation, lint and air temperature, air flow and air pressure are all monitored and the signals are used to control the operation and speed of the gin.

Central VS Distributed Control

ASCI control system is designed to operate under central control where central computer determines the speed of all gin machines, or in Distributed Control where each machine or process is adjusted separately. In the Central Control mode the computer has the capacity to coordinate the performance of the various machines while in Distributed Control, each machine is controlled separately to its specified target parameter.