MALCAM SYSTEMS TOTAL QUALITY GINNING CONTROL SYSTEM

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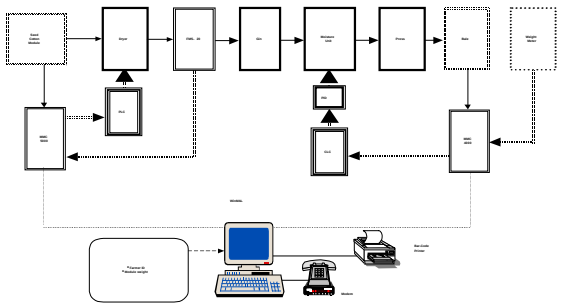
Abstract

A review of the MALCAM systm of controls and optimization for ginning processes is given. With this system, moisture sensing is located at critical points in the ginning process. Through process control, the moisture content of the cotton be ginned can be optimized, resulting in improved efficiency.

Discussion

System Description

MALCAM's total quality ginning system offers a unique innovative solution for controlling and optimizing the ginning process. Malcam offers modular, real-time moisture measurement systems that use advanced microwave technology, at different stages of the ginning process. The system makes the ginning process accurate, automatic and fully controllable. These benefits have proven to reduce operation costs and increase profitability.



The moisture control system consists of the following modular building blocks:

1. **MMC-5000** - A seed cotton modules-moisture measurement unit.
2. **FMS-20** - A Finger Moisture Sensor, located before the gin.
3. **MMC-4000** - Cotton Bale moisture measurement unit.
4. **WinMAL** - A PC based management software.

Each of these building blocks could be added in stages to the ginning process, allowing a modular quality improvement. Malcam's field proven technology has been operating for more than two years at various gins in the US, Greece, Turkey, Israel, Australia and several West African countries. A large number of Malcam customers, have seen and reported an increase in production speed, energy savings and profitability.

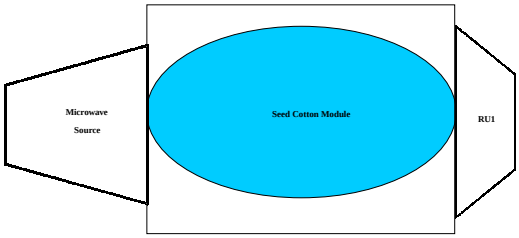
MMC-5000

A seed cotton modules moisture measurement unit. The MMC-5000 is a highly accurate, real-time, microwave-based moisture measurement unit, specially designed for the seed cotton modules.

A field proven device, the MMC-5000 offers the best way to speed up the ginning process, save energy, improve the fibers' quality and increase productivity, by controlling the moisture level.

These benefits could be easily achieved using the following:

- Having an accurate knowledge about the moisture level of the incoming seed cotton module helps in setting the first dryer's level and speeds the ginning process.
- An early detection of wet spots, variable moisture areas or contaminated cotton may prevent various problems in the ginning process. These problems can vary from an uncontrolled stop of the gin machinery, (that normally take place a few times per day), or the risk of potentially inflammable cotton, that might cause fire. Preventing or reducing these problems may save up to a full ginning day per season.
- The MMC-5000 provides a high moisture measurement accuracy of less than ±0.85%, comparing to a low accuracy of ±2%, provided by resistance/capacitance moisture indicators.
- The MMC-5000 provides this high accuracy for variable density modules. In comparison, the resistance/capacitance moisture indicator readings are sensitive to variable density and to the chemical compounds, (which change the cotton resistance and capacitance).
- The MMC-5000 connected to the PLC can provide automatic control of the dryer operation.



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FMS-20

Finger Moisture Sensor. The FMS-20 is an accurate, real-time sensor, specially designed to measure the cotton moisture after the dryers and before the gin stand. Knowing the exact moisture level at this point may be most beneficial in optimizing the moisture level after the dryers. The FMS-20 can be added to the MMC-5000, in order to improve the moisture control by providing automatic control of the dryer, thus turning the moisture measurement to a fully controlled system.

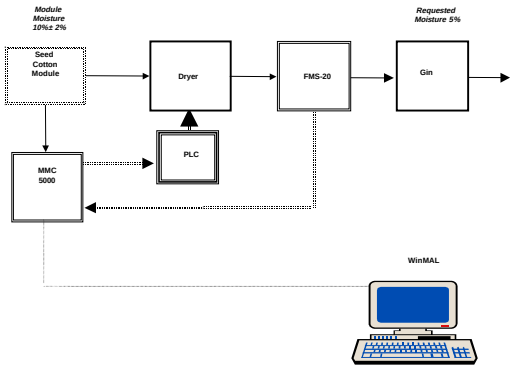
The FMS-20 offers the following features and advantages:

- Accuracy of ±1% STD.
- The dryer's PLC can receive control signals based on the moisture levels before and after the dryers, thus it can automatically improve the monitoring of the drying control. This will optimize the moisture level in the cotton, which will improve the fiber quality. An optimized process will also save energy and prevent over-drying of the cotton.

MMC-5000

Calculating the Return On Investment - ROI. Controlling the dryer with the MMC-5000 provides the following economical benefits:

- **Improving the fiber quality** - by optimizing the moisture for best cleaning on one hand and prevents over-drying on the other hand.
- **Energy saving** - A typical gin consumes 250 ton of gas per year. Thus, a minimum energy saving of 15%, equals $10,000 per season, (for LPG gas).



- Assuming that the seed cotton module moisture level is 10%, in order to lower the moisture at the entrance to the gin stand to 5%, the cotton should be dried by 5%. Since the moisture level of the seed cotton module, measured by resistance/capacitance moisture indicators is known with an accuracy of 2%, the cotton is dried by additional safety margins of 20%.
- Since the MMC-5000 provides an accuracy of ±0.8%, it may be possible to reduce the safety margins by 1.2% - which yield energy saving of 15%.

Over-Drying Prevention - when using a 2% over-drying safety margins, the cotton entering the gin plant may have a moisture level of 10%-(5%+2%)=3%. After the moisture unit, which may add 2% moisture, the total moisture level would be 5%. Using Malcam 5000 may add an additional 1.2% moisture, thus bringing the total moisture level to 6.2%. This 1.2% could be easily factored to the total price of the bales.

Saving in operation time - Having a more accurate and continues knowledge of the incoming seed cotton modules and the entering of the gin stand moisture level, will allow an optimized process. This will ensure a smooth operation of the gin plant, and will significantly reduce the downtime hours. In order to calculate this benefit, one can use the following figures:

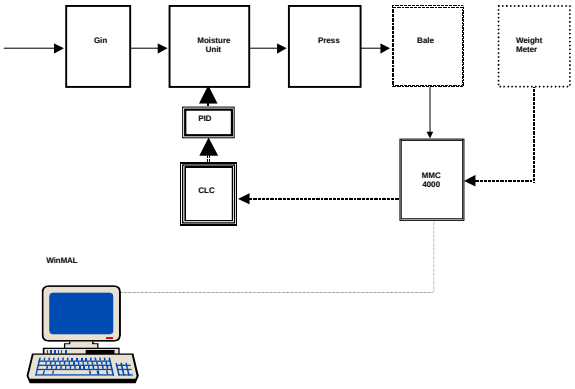
1. A typical gin operation of 80 days per season.
2. An operating cost of $500-$1000 per hour.
3. The Gin is normally stopped 3-4 times per day for half an hour.
4. A smooth operation may save one stop per day, resulting in a saving of: 1/2 hour/day * 80days= **40hours/season**

which equals **$20,000-$40,000.**

MMC-4000

Cotton Bale moisture measurement unit. The MMC-4000 is a highly accurate, real-time, microwave-based moisture measurement unit, specially designed for the cotton bales.

An over three years, field proven device, the MMC-4000 offers the best way to monitor the moisture level of the bales.



These benefits could be achieved using the following:

- Increase the bale moisture level up to the standard required range - Getting an online accurate reading of the bale moisture level can help in easily adjusting the moisture unit air temperature and moisture quantity. Since Cotton is an organic, unstable material, (due to differentiation in the fibers), there are some situations that one or the two parameters should be changed in the moisture unit in order to optimize moistening process. The MMC-4000 can be connected to a weight meter, in order to provide automatic compensation upon gross weight deviation of the bales, and increase accuracy.
- Experience at Ha'emek Gin, Israel, shows that using the MMC-4000, has increased the moisture level, at the bales to 6%, comparing to 4.5%-5%, before using the MMC-4000.

CLC - Closed Loop Control. The CLC is an output that enables automatic control of the moisture unit, in order to achieve an optimized moisture level at the bales.

The CLC sends a control signal to the moisture unit, (via the **PID - Programmable Interface Device**), in order to maintain the optimized moisture level at the bale.

MMC-4000

Calculating the Return On Investment - ROI. Controlling the bale moisture with the MMC-4000 may increase the moisture level by **at least 0.75%.** This higher moisture level means not only better quality cotton, but also additional weight to the bales.

For a medium size gin, this will provide the following economical benefits:

Assuming:

1. A yearly production of 20,000 bales/season.
2. Each bale weights 225Kg.
3. Total production - 20,000*225=4,500,000Kg

- Thus, the added weight to the bales would be: 4,500,000 Kg * 0.75% = **33,750Kg.**
- With a price of $1.5/kg this additional weight has the value of: 33,750 kg * $1.5/kg = **$50,625**

WinMAL

Ginning Control and Management Software. The WinMAL is a PC based control and management software, designed to provide full information, integration, adaptation and improved control of the ginning process.

The WinMAL provides the following benefits during the ginning operation process:

- Provides a graphical display of the cotton moisture levels, based on the MMC-reading.
- Saves all measured moisture reading to a data file, with an included time-stamp.
- Keeps record of the bale ID number - from MMC-4000
- Keep records of the customer and farmer ID.
- Display a graphical histogram of the moisture readings.
- Can be connected to a bar-code reader and printer.
- Can be connected to a weight meter, in order to automatically include the bale weight in the database, and to print it on the bar-code.
- Can be controlled remotely via a modem.