Climbing silos to take inventory measurements are not always this easy.

Remote & Vendor-Managed Inventory Management Systems for Bulk Solids

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Introduction

A Remote Managed Inventory (RMI) system allows more efficient management of product between supplier and customer. A RMI system collects and centralizes inventory measurements at the customer's facility (or facilities) and gives various remote users access to this data as needed. RMI ensures a reliable and timely supply of raw materials. An alternative methodology that returns similar results is called Vendor Managed Inventory (VMI). The customer retains responsibility for inventory management with an RMI solution, while the vendor assumes that responsibility for VMI. The measurement data base is maintained at the supplier's site or some agreed upon third party location for the VMI approach.

RMI/VMI applies to the management of liquid and bulk solids inventories. The final solution will have similarities in either case, but the measurement services and some other system details will differ. There is more published information on RMI/VMI solutions for liquids, with resulting benefits documented in various trade magazines, as well as conference papers and publications. Systems were traditionally used for higher-cost, non-commodity items such as specialty chemicals. It is reasonable to believe that similar benefits are available for bulk solids applications as well.

Elements of an RMI/VMI System

Every RMI/VMI solution contains onsite inventory measurement, centralization of measurements, and remote access to collected measurement data. The first step is the automated collection of accurate inventory measurements. Electronic inventory measurement can be provided for bulk solids using any one of a variety of technologies. The selection of a level measurement device depends on a variety of factors, including desired accuracy, vessel design, raw material characteristics, budget, etc.

The inventory data, available as digital signals, must be transferred to a collection point. This can be a single PC. This PC is called the "master" or "server" and contains proprietary software. The local inventory signals can be brought into the server PC via a hardwired or wireless connection. Hardwired "smart" sensors typically use a 2-wire RS-485 communications format to connect to the server PC. A typical system can accept inputs from up to 128 "smart" sensors using multiple RS-485 networks. The expense of running cable to connect the various sensors to the network(s) may be prohibitive, calling

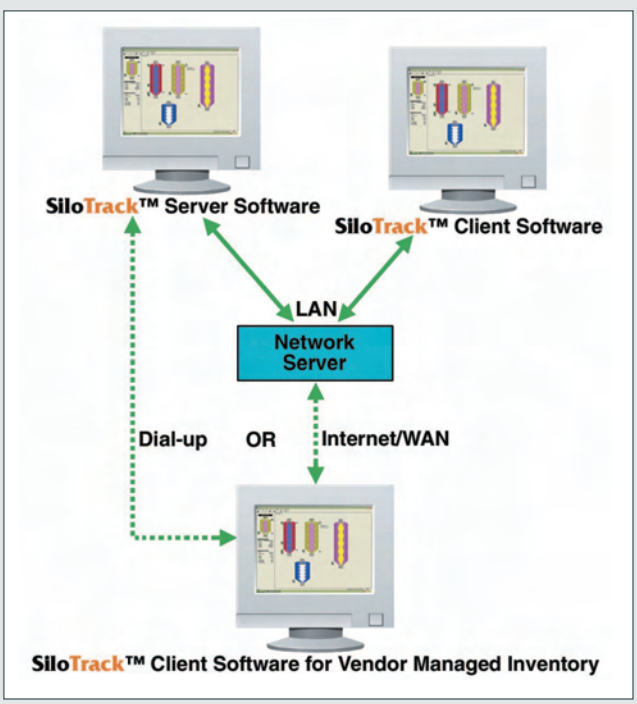
Silo farm for large plastic processor.

for a less expensive wireless solution.

Frequency-hopping spread-spectrum wireless technology operates in the FCC license-free 900 MHz band and provides the longest range and reliable communications. A wireless sensor network can consist of up to 16 sensors connected to a single wireless transceiver. Multiple sensor networks communicate to a wireless transceiver(s) located at the server PC.

Once the data has been collected, the next step is to provide access for remote users. Remote users can be located within the site(s) where the materials are being ordered/delivered, at other sites owned by the same customer, the supplier's site, or the sites of other interested third parties. Access can be provided via LAN, Internet/WAN, or dial-up modem. A remote user must also have proprietary software installed on his PC to allow access to inventory data. A remote user can not gain access to the collected data without the proper identification information. The remote user will have to enter the name or IP address of the server PC. For added security for LAN/Internet/WAN applications, the server PC software can be setup to require transmission of the computer name or IP address from each remote user PC. Dial-up applications can have added security via a dial-back fea-

Inventory monitoring sensor with wireless interface.



Architecture for remote/vendor managed inventory system.

ture that requires the server PC to call a phone number in memory for that account in response to a dial-up request. In addition, each user can be limited to read-only or be given access to requesting measurement updates. The server PC can even allow control over which silo(s) each user can access.

Proprietary software provides a flexible graphical interface to the "smart" sensors. Software typically provides simple intuitive operation, like other Windows-based programs. Software typically provides simple and "client" in computer network jargon. The software at the server PC must setup user names and security intuitive operation, like other Windows-based programs. There are multiple ways to access and change setup parameters or perform system functions. Functions can be activated from drop down lists or by left-clicking a mouse on displayed icons. Software features include the ability to configure alarms for each silo and generate reports. An alarm can be configured so that specific actions are taken when a certain condition exists. Alarm notification can be sent to e-mail addresses, cell phones, faxes and pagers. Any vendor can be notified automatically when a low level alarm indicates a reorder condition. RMI/VMI software can generate reports on measurements that can be automatically scheduled for transmission to remote users via e-mail or fax. This tool can be used to notify management of inventory usage or trends, or vendors of a replenishment need. Measurement data can generally be viewed in tabular or chart form.

Benefits of RMI/VMI solutions

• A RMI/VMI solution provides insight into raw material usage patterns, seasonal variations, etc. This understanding minimizes confusion associated with order details and lessens the need for rush shipments, or excess "safety" inventory. RMI/VMI benefits can include a reduction in man hours related to inventory management. This includes man hours spent manually making silo level measurements, and maintenance man hours required to handle overfilling. These costs alone can justify the expense of implementing an inventory management solution.

• Safety is always an issue when someone has to climb atop tanks to make manual inventory level measurements. A RMI/VMI system automates the measurement process and reduces the company's risk of employee injury and Workman's Compensation claims. An independent insurance broker consulted on this subject noted that any programs adopted by a company that reduce the potential for accidents will make that company more attractive to insurance providers and eligible for long term savings for insurance costs at the facility.

• A reduction in change orders and administration costs are associated with inventory management. These are the man hours spent each month by various departments analyzing inventory needs based on history or available measurements, gathering inventory data from other facilities, placing orders, coordinating and expediting delivery, resolving inventory discrepancies, etc. It is reasonable to estimate that administrative costs can be reduced by 10% to 20%.

• The elimination of production down time (and associated costs) due to raw material shortages.

• A reduction in excess inventories. Some companies maintain enough raw materials on hand to satisfy weeks of production time because they do not have any other reliable means of preventing down time. A company can lower its operating cost by investing in a RMI/VMI system that will provide reliable delivery of product as needed, and avoid having money tied up in excess or "safety" inventory.

• A reduction in delivery costs. There are significant costs associated with expediting emergency material shipments. There are also costs to have trucks/rail cars stand idly by because there is no room to store incoming material or to send back partially full trucks, etc. An effective inventory management system can reduce delivery costs by 5% to 25%.

• VMI solutions also open the door to additional benefits via "consignment" inventory. For the consignment model, the supplier retains legal ownership of the inventory until it is used up by the customer. This extended vendor ownership introduces a "just-in-time" purchase opportunity for inventory management. The customer is billed for their actual consumption as it occurs (as opposed to when it is delivered). The consignment model has advantages for the customer, in the form of reduced capital requirements, and the vendor, in the form of complete flexibility in scheduling product delivery. Suppliers have the ability to optimize delivery schedules to minimize logistics costs and arrange for product delivery to minimize transportation costs.

Examples of RMI/VMI Solutions in Bulk Solids Applications

Example 1:. A company had six silos that contained various raw materials used in their manufacturing processes. They originally sent a technician out to measure the level in each silo once a day. It was costing the company 312 man hours per year to make these measurements (assuming 10 minutes per silo, 6 days a week and 52 weeks per year). This resulted in a cost of $15,600 per year (using a burdened rate of $50/hour for the technician). The company was able to implement an RMI solution for $10,000. It took 30 hours to install the system (equating to a cost of $1,500), making the total expenditure $11,500. The system paid for itself in less than a year. Not taking into account any other benefits due to tighter inventory control, the sys-

tem generated a positive contribution to the bottom line each year thereafter by eliminating the man hours dedicated to gathering measurements.

Example 2: A manufacturer of plastic garden products has facilities in Pennsylvania (corporate headquarters), California, Oregon and Florida. They have several silos at each facility for plastic pellets. Central Purchasing, located in Pennsylvania, had to consistently call the other facilities to keep track of inventories and place orders for more material accordingly. The company installed a RMI system that enabled Central Purchasing to poll the inventory levels at each plant on-line at their convenience. The system paid for itself by lowering administration costs associated with ordering raw materials.

Example 3: A bakery in Illinois had four truck-sized silos for storage of flour. The bakery produces bagels for national distributors. They made manual inventory measurements using a tape measure lowered into each silo. This method of gathering inventory measurements was costly (refer to example #1 above) and not reliable enough to prevent overflow of material from the silos when truck deliveries of flour were made, or having the truck leave the bakery with extra (undeliverable) flour. The bakery installed a RMI solution that eliminated the manual measurements, overflow and unnecessary deliveries.

Example 4: A manufacturer in Mexico uses plastic pellets for making housings for electrical devices. This manufacturer asked their vendor to provide a VMI system at its facility to monitor silo inventory and schedule deliveries as needed. The vendor purchased equipment that took advantage of instruments already installed at the customer's site. A more dependable supply of material resulted.

Example 5: VMI systems are especially attractive to companies that manufacture plastic parts for the automobile industry. These companies traditionally maintain enough raw materials on site to satisfy weeks of production. Demands for parts are based on consumer demands for finished cars. “Safety” inventory can represent a significant cost if a consumer demand spike does not occur, or occurs later than anticipated by the car manufacturers. Many such companies have implemented VMI systems with their suppliers, and have adopted more of a “just-in-time” philosophy regarding material inventory on hand. These companies have been able to reduce capital expenses by eliminating the need for “safety” inventories of raw materials.

Example 6: A mill in Texas supplies flour to a nationally known bakery. The bakery operates six days a week, 24 hours a day. The bakery's management traditionally used previous patterns of flour use to forecast requirements and schedule delivery. This system lacked continuous level monitoring, and resulted in numerous partial deliveries, or even silo overfilling. If they ran out of material (empty silo), production ceased and forced the bakery to order emergency shipments of flour at a higher cost. The mill looked for a way to improve inventory management at the bakery and manage deliveries more reliably.

Remote managed inventory system with four facilities in use at nursery supply products.

A VMI system was installed at the bakery. Authorized mill employees, using the Internet, were able to monitor bakery silo levels and view data or trend information. The mill now provides a value-added inventory management service that has eliminated empty silos and idle production lines. The mill has saved money by reducing its operating costs, using trend charts to anticipate the lines the bakery is running and sending a full truck of flour at the right time. The mill avoids sending a truck too early, and then getting one back partially full. Management estimates they have saved approximately $3,500 per month using the system on one silo at the bakery.

Example 7: A company provides dry donut mix in bags to franchise locations from their mix plant. Its experience over the years allowed the company management to anticipate peak demands and slowdowns and place raw material orders accordingly. They manually taped

and monitored their receiving silo levels daily. Suddenly, the regional franchise "exploded" into a nation-wide phenomenon. Demand soon overcame the traditional methodology for inventory control. Bin inventory measurements were incorrect or obsolete and never seemed to match throughput.

Operations needed more information, but breaking someone away from another job to take silo measurements was a problem. More material would be ordered than possible to store when usage estimates were underestimated, and silos overfilled when usage rates where overestimated. The company made the decision to install a RMI system. Cost was initially justified based on plant production interruptions due to outages and maintenance costs due to overfill. Outages would idle production for 3-5 hours. Overfill costs included man hours to physically clean up and dispose of wasted material and fix the bag filters. Incidental costs included lost maintenance hours for production line maintenance, hours of administration time to coordinate and expedite material shipments and resolve inventory discrepancies, man hours required to tape silo levels, and insurance risks for access to high areas.

Conclusion

The advent of LANs (Local Area Networks), WANs (Wide Area Networks) and the Internet, combined with a trend towards leaner manufacturing by which inventories are more tightly controlled, have accelerated interest in RMI/VMI solutions since 1998. The economic incentives for tighter control of bulk solids inventories can be such that the cost to install a RMI/VMI system can generally pay for itself within two years, and most typically within one.

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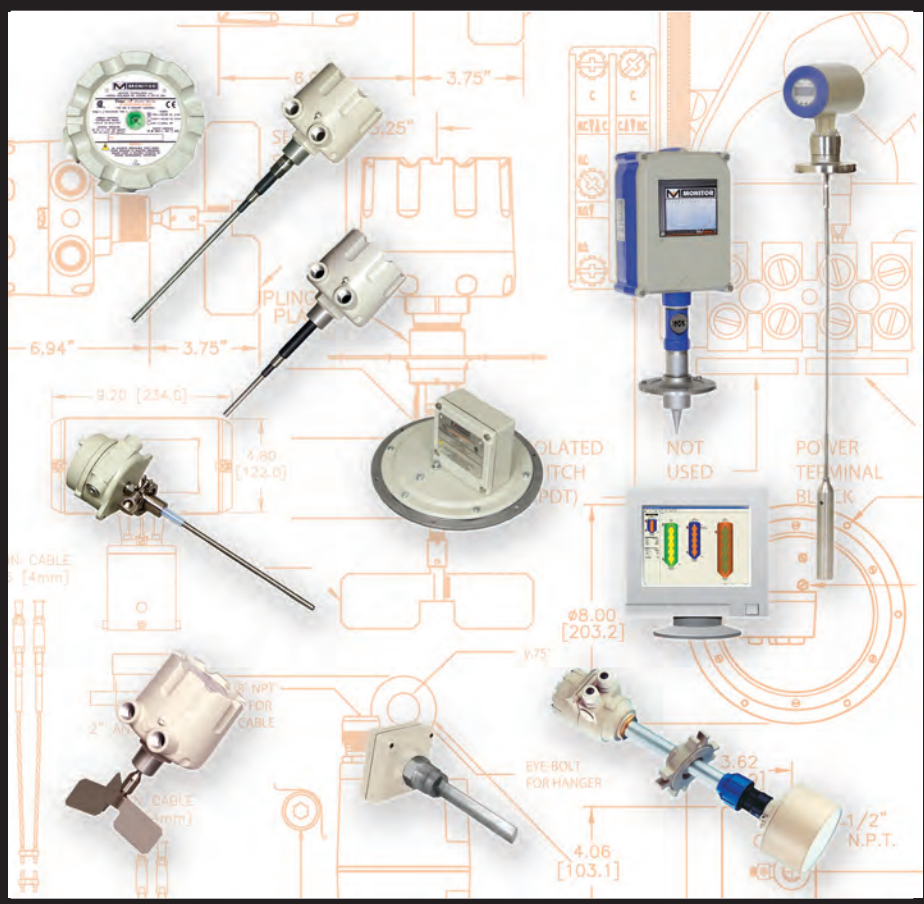

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