



## Cloud-Based Apps Transforming Grain Storage

A Cloud-based inventory system using intuitive software, level sensors, and network devices is an investment that will help to optimize the storage and processing of grain, flours and feeds. It offers simplicity and speed, while enabling grain and milling operations to keep their personnel safe from the risks of climbing and more efficient at their jobs.

Inventory management at milling and grain storage facilities used to mean climbing bins and taking manual measurements with a tape measure, writing down measurements, and transferring them to a spreadsheet. Grain inventory today can be a highly automated process where a level sensor replaces climbing bins and cloud-based software applications replace spreadsheets.

Facilities today can benefit from very timely and accurate inventory viewed anywhere there is internet access. Whether on-site or working remotely, real-time data is accessible to workers from a phone, tablet, or personal computer.

Cloud-based applications provide advanced features and convenience compared to spreadsheets. Enhanced software features enable facilities to optimize capacity of storage bins, provide data for use in preparing audits and governmental reporting, assist in valuing grains, oilseeds, and other commodities for overseas export or transport via railcar.

A Cloud-based system can be adapted for small to

very large operations. It is not necessary to install the system on all bins or at all locations initially. It may be applied over a period of time to allow for budgetary approval, installation by employees or contractual workers, and future expansion of operations.

Each bin is set up with a unique name and the vessel dimensions, which are used for estimating the percentage full, volume, and bushels or metric tons. The different grains stored are named and assigned to vessels, allowing the user to sort bins by the grain it contains. Any number of locations may be established based upon the size and scale of the overall operation. Data can be viewed by site, contents, or alert status.

Readings for each bin can be presented as mass in tons or bushels, available capacity or headspace in tons or bushels, the volume of grain in cubic feet or meters, the height of the grain in the bin, and the distance to the grain from the sensor. Each bin can be set with alert notifications via email or text message to a phone to notify specific personnel if a high- or low-level condition has been met.



### POPULAR LEVEL SENSOR TECHNOLOGIES FOR GRAIN AND MILLING

Over the past decade, there have been advancements in level sensor technology that allow for non-intrusive, non-contact measurement of the contents of storage bins and process vessels. Instrumentation is designed for precise measurement in very dusty environments with little or no maintenance of the sensor being required.

Radar using the 80 GHz range is among the most popular type of level sensor being installed at milling and grain facilities today. Unlike radars using the 26 GHz range, these sensors are accurate despite heavy dust that can be present when filling bins or milling flour. They



Grain monitoring on phone or PC.

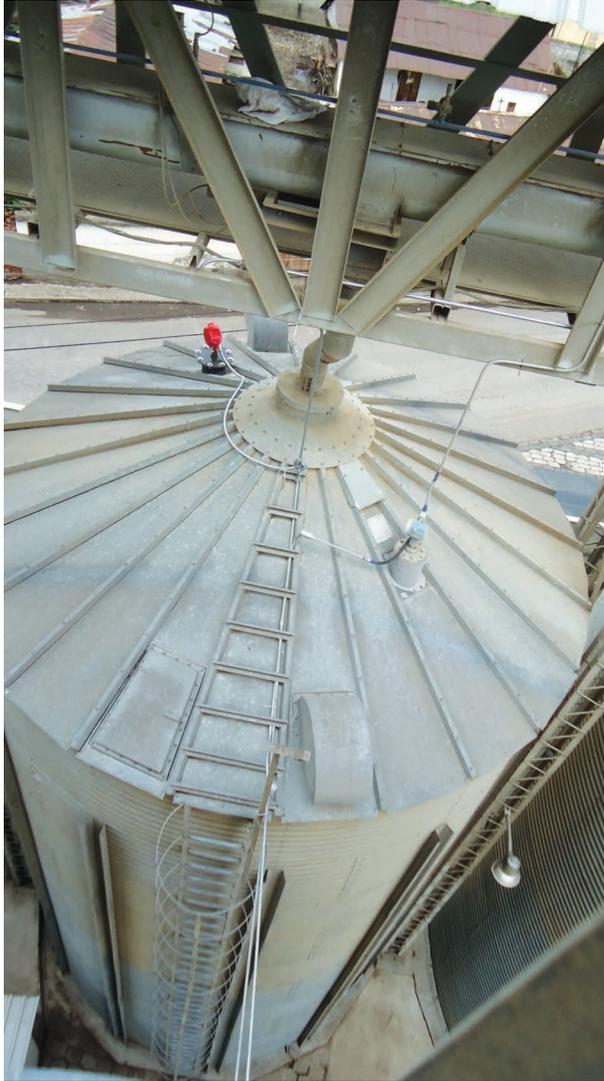
employ a narrow beam technology that enables them to pinpoint a specific measurement location on the material surface whilst avoiding any structure that may interfere with measurement, such as bracing or ladders.

For large diameter bins or those where grain piles unevenly due to poorly flowing material or the use of multiple filling or emptying locations, a sensor using three-dimensional measuring may be beneficial. A sensor using acoustics to survey the grain material topography at multiple locations within the bin will be able to consider surface variations when calculating the volume of grains or flours in the vessels, thereby making the reporting more accurate than a single point measurement. Three-dimensional level sensing and visualization can also attribute for conditions such as the buildup of material along the sidewall or detect areas where grain is hung up due to moisture or compaction and has resisted flowing from the vessel.

Cost-sensitive facilities may consider a plumb bob or weight and cable style sensor. This sensor acts as an automated tape measure dropping a weighted cable to a surface of the grain at timed intervals. It is an extremely reliable technology that is minimally intrusive in the bin and is proven to be extremely long lasting.

### IMPROVE OPERATIONAL EFFICIENCY BY AUTOMATING GRAIN BIN INVENTORY

Combining Cloud-based software applications and ad-



3D Sensor on Large Bin

vanced level sensor technology requires fewer people and processes and is therefore, a very cost-effective investment providing a high ROI.

Inventory information is portable and available to any authorized user at any location wherever they may be locally or globally situated. Personnel in functional areas such as shipping, logistics, finance, and purchasing or processing can be provided data access to prevent the need for preparing and sending reports. Users will all have access to identical data at the same time, ensuring total transparency and fewer bookkeeping and accounting discrepancies. The volume of grain available for shipment can be viewed across multiple locations. Enhanced access to in-depth information allows individuals to make informed decisions regarding the timing of

buying and selling traded commodities.

Cloud-based applications ensure centralized digital control, require minimal human intervention for routine processes, and lead to faster and timelier outputs with a small number of staff. Employees will be more satisfied in their positions as they will perform less mundane clerical work, which will allow more time for planning and problem solving. Streamlining vital communication between people and devices and getting everyone on the same page allows for optimizing processes such as filling bins during harvest, or railcar or ship loading when grain is sold or exported.

### **SIMPLICITY, SPEED AND COST CONTROL**

Automation also helps to contain both direct and indirect costs. This can lead to the need for fewer workers, less overtime payroll expense, and greater productivity. The automation of daily tasks will result in fewer inefficiencies, and fines or reparation fees charged for non-compliance or late deliveries.

Continuous updates are performed effortlessly with no human invention. The software updates automatically with real-time reports of on-hand supply and can be used to forecast when inventory will be depleted based upon usage trends. This also allows for improvements while processing grain and ingredients for animal feed, such as projecting shortages that result in production stoppages. Ensuring adequate supply of all ingredients will result in fewer batch processing errors and lead to less waste and consistent quality.

Adapting a Cloud-based application does not require on-site installation or remote hosting of servers or employing an IT department. Programming updates are developed, tested, and released by the host provider. Users do not need to be trained in programming to effectively use the software. The data related to business transactions and production processes is stored securely and safely.

Corporate headquarters, remote workers, business partners, or ingredient suppliers can be assigned login credentials and for broad or limited viewing rights, so they can monitor inventory remotely or utilize vendor managed inventory. Providing direct access reduces the amount of time spent on the phone, managing spreadsheets, fewer trips to remote sites, and less time doing routine, or redundant tasks. Expedited reporting is possible due to consolidated data that can be segmented by fields in the software application.



Plumb Bob Sensor



Radar Sensor

### ACCESSING OPERATIONS FOR A CLOUD-BASED SYSTEM

**Identify the type, size, or number of bins:** Embark on the design of a system by creating a list of the bins, their dimensions, the material stored inside, and any existing equipment installed or used on the bin like a temperature cable, ladder, or sweep. Nuances such as access to, or structure in, the vessel may also be contributing factors to sensor specification. Also note if the bins are grouped in any way by location.

**The type of level sensors installed or needed:** Begin with the level sensors you already have. There are communication devices such as gateways, analog expansion hubs and HART consolidator modules that can connect your existing sensor network to the Cloud. For bins without a sensor, the next step is to ensure the sensor is a good match for its job. Bins with structure to be avoided are well-suited for a radar with a narrow beam focus. Wide bins or bins with irregularly piled material might be candidates for three-dimensional measurement.

Bins grouped together physically can be addressed with wiring configurations such as daisy-chaining, which can save on wiring costs. Bins distanced far apart from one another may benefit from the use of a long-range wireless transceiver. Dryers, day bins, fuel and chemical tanks on premises are also excellent contenders for level sensors and inventory monitoring. They can be easily added to the same system as bins.

**Determine the frequency of measurements updates:** Consider if measurements from the level sensors are required to be updated continuously or if readings at

intervals throughout the day will suffice. Radars update rapidly in just seconds, while 3D sensors can take up to 10 minutes. Readings taken at preset time intervals or on-demand may also work for your plant. A plumb-bob can be programmed to take measurements at set time intervals such as marking the beginning or end of a shift. A bob also can take a measurement at a set time period such as every hour or taken on demand using a push button console.

**Consider where people will view the data:** Cloud-based software applications offer the option to log in to view inventory anywhere there is an internet connection to a PC, tablet or phone. The flexibility afforded by the Cloud offers visibility from a control room, office, remote location such as corporate headquarters, from home or while traveling.

Another common device to provide convenience is a control console or digital panel meter. These devices can be installed for walk-up or drive-up access, indoors or outdoors. For example, a driver delivering grain should check the bin level before they start filling it. The driver can confirm the entire load will fit into the bin and prevent the risk of overfilling. These push-button devices are easy to operate and can be used for view-only access to level data.

A Cloud-based inventory system using intuitive software, level sensors, and network devices is an investment that will help to optimize the storage and processing of grain, flours and feeds. It offers simplicity and speed, while enabling grain and milling operations to keep their personnel safe from the risks of climbing and more efficient at their jobs.