

Knowledge is Power

Sir Francis Bacon, 1597

Co-Founder and CEO Ofir Perl explains APM's new process level measurement technology and how it enables managers to make informed decisions that go right to the bottom line.

Large-scale manufacturing in industries ranging from food and beverages to cement to chemicals, plastics and others must overcome challenges of accurately assessing and controlling inventory in order to successfully manage the entire production process. Hundreds of different kinds of storage bins and silos around the globe of different shapes and sizes store materials with widely varying basic characteristics – dielectric constants, particle size, particle type, chemical make-up of particles, and more. Conditions inside bins and silos are often harsh: they are dusty, impacted by extreme temperatures, and subject to anomalies of irregular surfaces and unbalanced filling and emptying.

Existing Approaches – Limitations

Until recently, four major technological approaches have been employed to measure the continuous levels of solid materials inside silos and other storage containers: three – electromechanical (yo-yo) level sensors, ultrasonic level sensors, and radar level sensors – measure the height of the materials at one point only and hence do not provide sufficiently accurate measurements of the average level and volume of contents. The fourth approach, load cells, subtracts the weight of an empty container from a partially filled one, arriving at the weight of stored solids and liquids with a high degree of accuracy. The container is mounted on top of the load cells, which are calibrated to measure the tank level. While accurate, this method is on the one hand expensive as the load cells must be built-in and installed underneath the silo/container, and on the other it is impossible to apply to silos which are not standing on four metallic legs (e.g., concrete silos).

The APM 3DLevelScanner™ - Empowering Managers to Make Informed Decisions

First introduced in 2007 is APM Automation Solutions' APM 3DLevelScanner, with several hundred units already installed for various applications in European markets. This innovative new family of devices employs an array of low frequency transducers to measure and map the entire surface area, and a patented algorithm that processes the information to generate a 3-dimensional map. The APM 3DLevelScanner can measure the level, volume and mass of materials in new applications that other technologies cannot reach. It measures practically any kind of material stored in an almost unlimited variety of containers, including large open bins, bulk solid storage rooms and warehouses. It maps loads that randomly form over time inside silos, and many other previously inaccessible applications.

Providing much greater accuracy in its measurements and significantly enhanced overall performance, reliability, durability, ease and speed of installation, and

operating convenience, the APM unit represents very attractive price-features-benefits solutions to continuous level measurement challenges. This translates into major cost savings and faster returns on investment, and allows managers to make informed decisions that go right to the bottom line throughout the entire supply chain.

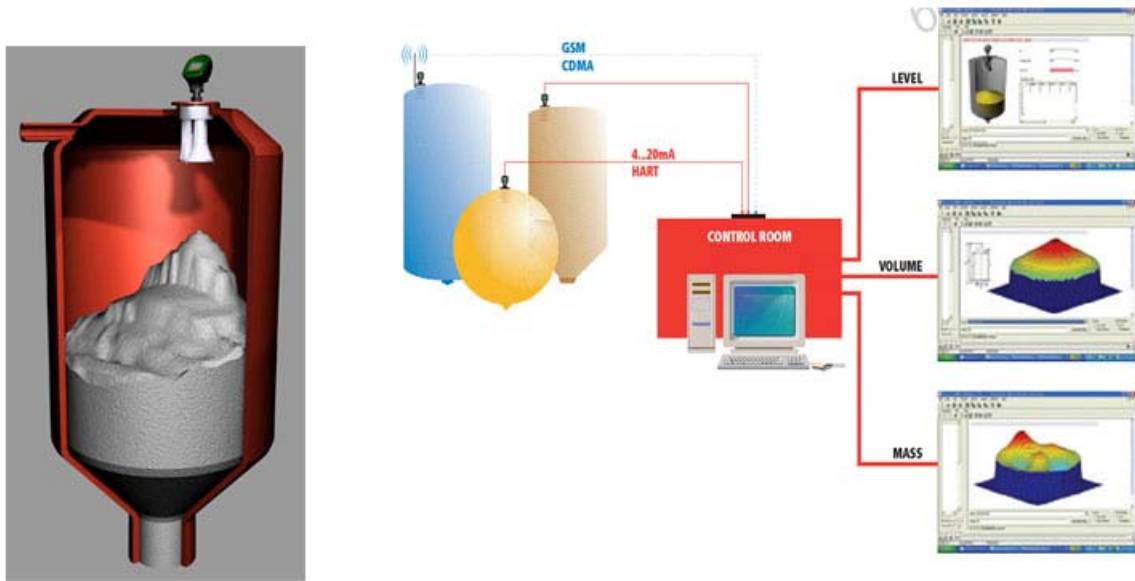
Faced with the limitations and constraints of current process level measurement techniques, entire industries are searching for a new approach that is robust, technologically advanced, accurate, capable of handling different kinds of silos and materials, and have a competitive price that justifies their installation. The APM 3DLevelScanner fits the bill.



The 3DLevelScanner (left), installed on large silos, for cement (top), and together with the APM 3DLinkPro for GSM communications anywhere in the world, for chemicals (Titanium Dioxide, right).

Under the Hood – How it Works

The 3DLevelScanner employs a 2-dimensional array beam-former to send low frequency pulses and receive echoes of the pulses from the contents of the silo, bin or other container. The device's Digital Signal Processor samples and analyzes the received signals. From the estimated times of arrival and directions of received echoes, the processor generates a 3-dimensional image of the surface that can be displayed on a remote screen.



Schematic illustration of 3DLevelScanner and the information it provides.

The APM 3DLevelScanner is unaffected by the type of materials being stored, avoiding the need for special calibration, or by environmental conditions, such as dust, filling “noise”, humidity, or temperature.

Low Frequencies, Added Dimensions, and Proprietary Algorithms

Three factors combine to make APM’s innovative technology the best-of-class solution for accurate measurement of bulk solids, particularly those in dusty environments:

1. Low frequency of transmitted signals (under 5 kHz)
2. A 3-antenna system that measures not only elapsed time between transmission and receipt of acoustic echoes but also the phase between the echoes
3. Proprietary algorithms enabling precise 3-D mapping of the contents inside the silo or storage bin

The large beam angles inherent in low-frequency signals cause traditional ultrasonic instruments to receive echoes from the contents below the beam as well as from the silo walls. Such sensors with a single antenna cannot differentiate between the echoes coming from the contents and those coming from the container walls. To avoid this serious problem they work at high frequencies, which by definition have a narrow

beam angle that never hits the walls of the silos, but cannot penetrate and work in dusty conditions, therefore also yielding inaccurate measurements.

APM's technology actually takes advantage of the large 70-degree beam angle (that results from working at a very low frequency), by using a three-antenna system with proprietary algorithms to add another important dimension, **direction**. The result is that every 10-15 seconds the 3DLevelScanner receives a matrix of x-y-z position coordinates that represent the echoes from the surface of the contents in the silo. Connecting these points together generates a highly accurate profile of the surface area, which in turn yields more precise measurement of the amount of materials being stored.

While traditional sensors with a single transducer are capable of measuring only a single point on the contents' surface, APM's technology implements a circular array of three transducers for beam forming both at reception and transmission. The sensor estimates the echoes' time delay and spatial direction by using DOA (Direction of Arrival) algorithms. By derivation from the geometrical structure of the bin (entered by the user), all echoes from the contents' surface are considered, while those from the silo walls are discarded.

More details on the 3DLevelScanner and APM's technology are available on the company's website: <http://www.apm-solutions.com>.