

Colin Hanson Sensortech Systems, Inc.



The Measurement and Control Company

## 25 years of Sensortech

In January 1983, Colin Hanson and Logan Mosteller, working in a humble garage in Santa Clarita, California, began designing a moisture detection system for use in the gypsum wallboard industry. Along with the sales expertise of Bob Blankenship, the ST-1100 series of on-line moisture analyser was launched in the July of that year. Thus began Sensortech Systems, Inc.

25 years later, Sensortech goes from strength-to-strength, expanding its range of measurement systems to the benefit of other industries.

Sensortech Systems, Inc, based at Moorpark, California, celebrates an important milestone in January 2008, completing 25 years as a leader in the field of moisture measurement and control. Sensortech was founded by Colin Hanson with partners Bob Blankenship and Logan Mosteller in January 1983. The development of a radio frequency moisture analyser began immediately and the ST-1100 series on-line moisture analyser was launched in July 1983.

The new moisture meter was primarily aimed at the gypsum industry, a business Hanson had gained experience in while working for Moisture Register Co (MRC), a division of Berwind Corporation. Two years earlier, while working for another Berwind division in England, he was appointed engineering manager of Moisture Register and transferred to the US. While working for MRC, he was tasked with designing a solid-state RF sensor to replace obsolete vacuum tube equipment in use throughout the gypsum industry in the US and Europe. A patent was awarded for the resulting BSP4000 RF sensor which was also used for the single-point BSP901.

In 1982, Berwind divested itself of the Moisture Register Co. Colin Hanson and Bob Blankenship maintained their positions, but were quickly disillusioned with the new management. Colin presented ideas for new products utilising both dielectric and infrared technology but the new owners wished only to sell the existing products acquired in the purchase of MRC. Considering several options, including his possible return to the UK, Colin sought and found financing from venture capital partners.

### ST-1100 series on-line analyser

The ST-1100 was based on a unique resonant frequency principle in which an inductor in parallel with the capacitive element of the sensing antenna, coupled with the dielectric of the product, forms a resonant network. The resonant frequency of this network changes as the dielectric of the product changes with moisture content. Precision capacitive references are periodically switched in place of the antenna. The resulting signals are combined in an algorithm which eliminates effects of inductor drift and parasitic capacitance changes with temperature. Since resonant frequency is determined purely by the passive components in the parallel LC network, active components such as amplifiers which tend

to drift with temperature and aging, do not affect the measurement. Another advantage to this method is the ease with which both pure dielectric and dielectric loss (absorption) can be separately measured. A further patent was awarded to Colin Hanson for this measurement concept. Having experienced multi-sensor systems, and the subsequent catastrophic loss of all measurement points resulting from a processor failure, it was determined that the ST-1100 would be a single-point instrument.

Sensortech began operations like many, more famous endeavours, in a garage. Hanson and Mosteller tested various prototypes over a period of about six months. Drift testing was accomplished by running instruments in the non air-conditioned garage in Santa Clarita on the edge of the Mojave Desert, where daytime/night-time temperature ranges routinely exceed 25°C (45°F). Hanson would manually record instrument values day and night. An acceptable design was finally agreed upon with the 11th prototype, the ST11. This name did not resonate with Bob Blankenship, sales and marketing director, whose first marketing decision was to rename it the ST-1100.

In July 1983, Sensortech had a product; the next task was to find a customer. While the product was being developed, Bob was calling gypsum plants, introducing the 'new' moisture company. Moisture Register had been pretty much the only supplier of moisture instruments to the gypsum industry in the United States for as long as most people remembered. Moisture analysers were simply referred to as 'Moisture Registers'! It was not going to be easy to break into this market, despite the lack of enthusiasm for the existing products from many users. Further complicating matters was the fact that Bob Blankenship had sold many of those other products and Colin and Logan had installed most of them.

The first break came with the order of a single sensor to be located after the cascade on the single-wide, 14-deck dryer at United States Gypsum, Galena Park, Texas.



**Above:** Colin Hanson (left) and Bob Blankenship (right), who along with Logan Mosteller, founded Sensortech in January 1983



This order was quickly followed by an order for three sensors, one in-kiln and two out-of-kiln sensors for Georgia Pacific Corporation, Sigurd, Utah. At this time, GP Sigurd used an eight-deck steam-powered Coe dryer, one of the last in the US. Further sales efforts brokered a deal with Georgia Pacific in which 12 of its then 13 gypsum board plants agreed to upgrade their moisture meters with the new ST-1100 instruments. The next task was to find a suitable production facility. A 2000ft<sup>2</sup> industrial unit was rented in Santa Clarita, California, a small town located about

detailed definition visit Wikipedia). It is a complex quantity comprising real and imaginary (orthogonal) components. In the frequency spectrum utilised by Sensortech (10<sup>6</sup>-10<sup>8</sup>Hz), the loss or absorptive component is due chiefly to ionic conductance. In many applications this presents a problem since moisture content may contain varying concentration of ions. For gypsum at low moisture levels, this is not a problem since any free water is totally saturated with sulphate ions.

Above a certain moisture content, however, the loss measurement is no longer reliable. In gypsum board this has been found to be around 5% free moisture. Since the typical moisture content of a board entering the dryer is around 30%, the maximum measurement point in the dryer is at the point where 85% of the free water has been evaporated. Traditionally the in-kiln sensor was located at this 85% dry point. Folklore placed the sensor at this point in the dryer as being some optimum position. In truth, it was as far back as a sensor could be reliably placed and still guarantee good measurement.

The ST-2200, as well as having many new features for various (non-gypsum) applications, used real dielectric instead of loss. Real dielectric has no limit on maximum moisture level, enabling measurement anywhere in the dryer. It was no longer unusual in a three-zone dryer to see moisture sensors located at beginning of zone two and the beginning of zone three for more accurate kiln control. The limiting factor then became maximum operating temperature.

The sensor interconnecting coaxial cable is custom-manufactured with TFE Teflon<sup>®</sup> insulated cable rated to operate at temperatures up to 260°C. Above these

temperatures, the insulation degrades, becoming powdery and creating sensor drift. Sensortech developed an ultra-high temperature sensor in the late 1990s using custom-made all stainless steel coaxial cable with silica insulation. The silica is

fused at both ends forming a hermetic seal. This cable, while capable of withstanding temperatures in excess of 1000°C is quite delicate and needs careful handling and installation.

The ST-2200 was phenomenally successful. To date more than 3000 units have been sold and it continues to be a best-seller.

In addition to continuous single-point sensors, Sensortech – almost from the beginning – has manufactured hand-held sensors for quick spot-checking and full kiln audits. The Portable Moisture Tester (PMT) series began with the PMT110 featuring a solid-state bar graph display. The PMT110 was the first of a rugged series of hand-held devices which could be dropped and even on occasion passed through the booker! The PMT 110 was manufactured for a relatively short period



**Above (left to right):**  
**A)** ST1100 processor with various open-frame planar sensors; **B)** The first ST1100 sensor sold to USG, Galena Park, Texas, July 1983.

50 miles north of Los Angeles. This location became Sensortech's home for the next 20 years eventually expanding to 6000ft<sup>2</sup>.

Through the remainder of the 1980s and into the early 1990s, Sensortech sold more than 700 ST-1100 instruments worldwide, mostly to the gypsum board industry. This was achieved despite a severe downturn in the construction industry in the late 1980s.

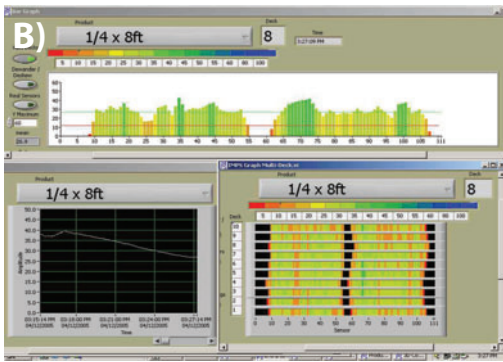
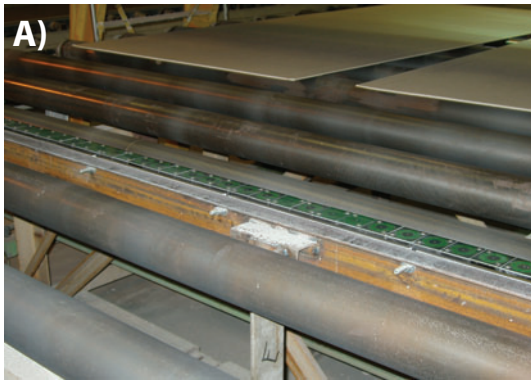
Electronic development has always been rapid and continues to accelerate. Even though five years would be considered a reasonable life for most electronic devices, most industries squeeze as much as they can get out of any piece of equipment and the gypsum industry is no different. A few ST-1100 sensors are still in operation today, some of them more than 20 years old. After eight years of production, many ST-1100 components were becoming obsolete and it was determined a new model was needed.

**The next generation: ST-2200 and PMT110**

New product development began in 1992 and the ST-2200 was rolled out in 1994. Based on the same resonant frequency technique, the ST-2200 was entirely digital and featured a phase-lock loop (PLL) in the sensor to 'lock-on' to the resonant frequency. It was previously mentioned that the resonant network easily separates real dielectric and dielectric loss measurement. The ST-1100, however, only used the loss measurement. Dielectric is an electrical property of a material (for a



**Left:** Three generations of PMT handheld instruments (left-most is the PMT110 serial number #002. It was purchased by Georgia Pacific, Quannah, Texas in 1986 and retired in January 1999).



**Above: A)** IMPS4000 moisture profiling sensor array; **B)** IMPS4000 typical graphics screen

during the late 1980s. The PMT220 was developed at the same time as the ST-2200. Containing a built-in microprocessor and a phase-lock loop sensor, the PMT220 was unrivalled until its recent retirement due to parts obsolescence. Just as the ST-1100 was supported for many years after production was discontinued, so will the PMT220.

2007 witnessed the launch of the latest portable, logically named the PMT330. Technologically superior to its predecessors, the PMT330 has taken on a somewhat different appearance. It is a slim-line device in a plastic case. Do not let the plastic fool you; this unit has undergone extensive testing with repeated drops from a 1.2m height on to a concrete floor. Much customer input has gone into the design of this model. It is still early and several bugs had to be worked out including a too-powerful battery charger which rapidly cooked the lithium-ion battery pack! All units have been retro-fitted and recent months have been problem-free. 2008 will see the promised addition of 'Bluetooth' to the PMT330. Existing units may be returned to the factory for upgrade as soon as the feature is available.

The new millennium saw the emergence of Raytek offering thermal imaging as an alternative technology to moisture measurement. The previously unrecognised need for 'profiling' information was quickly provided by the Instantaneous Moisture Profiling System (IMPS). Consisting of multiple small (50mm) radio frequency sensors arrayed across the board line immediately following the cascade section. Sophisticated software develops various graphic displays showing moisture distribution throughout the board. This profile information is based on a penetrating moisture measurement, and not simply surface thermal image.

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**Expanding its scope**

In the early days, Sensortech was almost totally dependant on the gypsum industry and by extension, the construction industry. Not a very healthy business model, particularly given the construction slow-downs in the late 1980s and 1990s. As a result, the development of the ST-2200 series was largely intended to diversify applications and reduce dependence on one industry. Various wood-panel applications became available, though these also were largely construction-related. Successful food applications included whole grains and confectionary (caramels and candy). Sand, aggregates, coal and many other granular materials were also successfully able to make use of the ST-2200 analyser.

Gypsum still accounted for a significant proportion of total business when, in 2003, the opportunity arose to produce a moisture gauge based on the infrared absorption principle. The partners that had originally financed Sensortech offered to fund the development of a near infrared reflectance (NIR) moisture gauge. While not suited to finished board measurement, NIR is able to measure incoming synthetic gypsum as well as crushed gypsum rock and recycled material.

Away from the gypsum industry, NIR applications include all kinds of food products, granular and powdered products, paper making and converting, tobacco and pharmaceuticals. Measurement of constituents other than moisture is also possible with NIR, including fats, proteins, waxes and other non-aqueous coatings. Since the new business is very different in terms of technology and applications, a separate division was formed, named MoistTech, responsible for these NIR products.

MoistTech products required more manufacturing room and the Santa Clarita facility could not be further enlarged. So in 2004, MoistTech settled into new premises in Moorpark, about one hour west of Santa Clarita, nestled in the citrus and avocado groves of Ventura County. Beginning with administration and engineering, over a two year period the entire RF manufacturing facility was transferred to Moorpark and consolidated with the MoistTech division in a 10,000ft<sup>2</sup> facility.

While no longer solely dependant on the gypsum industry, it still forms a significant proportion of Sensortech's business. Colin Hanson remains actively involved in both commercial and engineering roles as president of Sensortech and remains partnered with two founding venture partners, John Fordham and Roger Carlson and, with the creation of MoistTech a fourth partner, responsible for Asia, Sean Herrington. Bob Blankenship left Sensortech in 1990 to explore other avenues; Logan Mosteller left the company in 1988 and has since passed away.

In addition to the three founders, mention should be made of a few individuals who made significant contributions through the years. Tim Norris – the first employee. Tim joined Sensortech straight out of the Navy. He was the first field service technician. Tim later moved on to a management position and eventually formed his own import company. Brent Valerius, who began as bench technician, moving up to field technician and eventually production manager. Paula Wicall began as receptionist, retiring after 17 years as administrative manager. She now enjoys her retirement in Hawaii. Robert Newton, who became production manager following Brent. He moved to Connecticut to be closer to family after Sensortech relocated. Dave Kelly, appointed as north eastern sales manager. He worked tirelessly for many years, particularly with the gypsum board industry. Dave attended several Global Gypsum Conferences and retired just a couple of years ago.

Many others could and probably should be mentioned. But these individuals joined in the early stages of the company, and all contributed largely to the success of Sensortech.

