

# It's a sensor game

Sierra Instruments continues to challenge the industry status quo and realise the vision of its forefather with innovation in sensors, software, and flow control.

An interview with Sierra Instruments President and CEO **Matthew J. Olin**.

**F**rom Sierra's beginning over 40 years ago, founder Dr. John G. Olin was driven by the vision of supplying industrial customers with the world's most accurate mass flow meter. And, he knew it was a 'sensor' game.

With a background – and Ph.D. – in mechanical engineering and specialised in fluid mechanics and heat transfer, Olin was a driven innovator and founded Sierra Instruments Inc. in 1973 with the purpose of offering industrial grade thermal mass flow meters to solve industry's need for rugged, reliable flow meters based on the thermal principle.

The development of an industrialised metal-sheathed sensor in the early 1980s was Sierra's first big step, but was only the beginning for Dr. Olin, who saw 'thermal mass flow' as his life's work. Many successful innovations followed, including a major breakthrough in 1999 with the introduction of Sierra's patented no-drift DrySense™ mass velocity sensor. With this development, Sierra engineers recognised they were on the cusp of realising Dr. Olin's vision.

Now a second-generation business, today Sierra has nearly 200 employees, facilities in five countries, and agents in no less than 53 countries. The company has grown substantially under the leadership of Dr. Olin's son, Matthew J. Olin. President and CEO since 2003, he imbues the company's focus on building a great company, not stock price, and creating innovative products that continually change the way people think about industrial companies.

Sierra has pioneered with a number of firsts throughout its history, starting in the early 1980s with the first mass flow meter (MFM) and mass flow controller (MFC) with a cleanable sensor – the SideTrak® – and more recently the first digital MFC with multi-gas capability (Dial-A-Gas®) with unique local pilot module display interface – SmartTrak® – and the first four-sensor thermal mass air/gas flow meter design in the shape of the QuadraTherm 640i/780i.

Recent product releases include the SmartTrak® 140 Ultra-Low ΔP for semiconductor applications, the SmartTrak® 100 High Pressure for pilot plants, a cryogenic version of the InnovaMass® 240 multi-variable mass vortex flow meter, and the SmartVO™ Control Valves range. With this in mind, we asked Sierra's CEO about markets and innovation.

"Sierra is responding to market/industry demands by continually creating effective and innovative products that meet the needs in those markets," Olin says. "Specifically over the past few years we have brought to the market the world's first QuadraTherm® 640i/780i thermal dispersion mass flow meter. The first of its kind with patented four-sensor technology, it offers unparalleled +/-0.5% accuracy plus our latest release, new gas mixing software that allows

customers in oil and gas and other industries to do in-the-field-gas-composition changes/creation without loss of accuracy."

Olin refers to Sierra's new qMix gas mixing software which, for the first time, allows oil and gas engineers to field adjust their gas composition on thermal mass flow meters in the field for flare, Vapour Recovery Units (VRU's), and storage vessels without sending the meter back to the factory for recalibration. The new software package is included with every QuadraTherm 640i/780i thermal mass flow meter on a beta trial basis and is a unique feature of Sierra's Smart Interface Program (SIP) software, unlike anything available on the market for industrial mass flow meters.

The ability to create custom gases or gas mixtures to compensate for gas compositional changes in the field without accuracy loss means oil or gas engineers can easily meet US EPA Directive 40 CFR Part 98 for shale gas upstream production operations since they can use qMix when the gas composition changes in the pipe, or when moving the meter to another location with a different gas composition.

This is potentially a game-changing solution in flow control; traditionally, thermal mass flow meters are calibrated using the exact gas mixture they are intended to measure, or a surrogate mixture with very similar properties. With the qMix-enabled

QuadraTherm, end-users are able to field adjust and maintain flow meter accuracy if the gas composition changes – avoiding costly recalibration. Sierra is,



therefore, hailing the QuadraTherm 640i/780i with qMix as the 'perfect solution' for challenging shale gas upstream production applications.

With the energy sector under continual – and rapid – evolution today, and of increasing significance to the industrial gas and equipment community, the launch of Sierra's qMix software exemplifies its founder's quest to develop flow control solutions for industry's ever-changing needs.

## Realising the vision in flow control

This mission was, and is, no mean feat. Thermal technology, by its very nature, uses the physics of heat transfer and conservation of energy in an open system to measure mass flow rate.

This means that for a thermal mass flow meter to achieve the greatest accuracy, it must first solve the First Law of Thermodynamics (Heat Energy In = Heat Energy Out) for each data point.

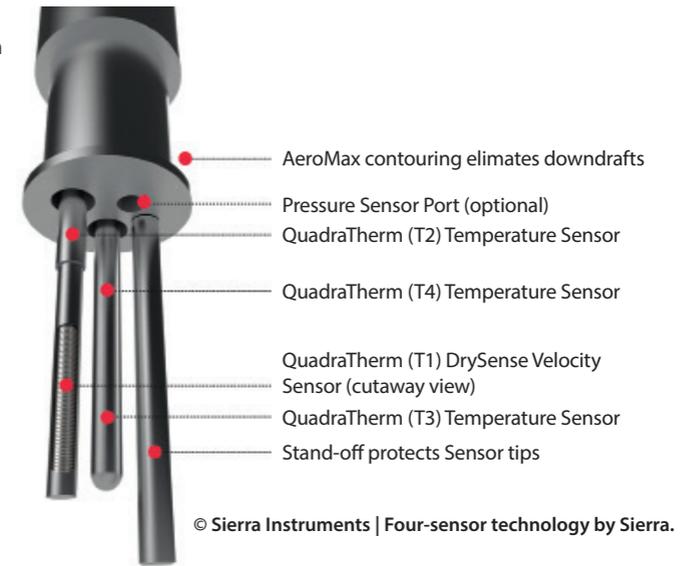
"As you can imagine, solving the First Law in a flow instrument was no easy task," Olin explains. "By Dr. Olin's own accounting, decades of 'hard-nosed dedication to excellence' by himself and Sierra's engineering team, years of testing, and his stack of yellow note pads over five feet high, jammed with his handwritten equations and designs, finally yielded the secret in the form of two revolutionary technologies – the QuadraTherm® and Raptor™ II – now both patented worldwide."

Traditional thermal sensors have two sensors – one temperature sensor and one velocity sensor, each in a separate probe sheath. QuadraTherm (the term 'Quad' meaning 'four') introduces four sensors – three precision platinum temperature sensors and one patented DrySense mass velocity sensor. "Sensor performance improvements never thought possible are gained with QuadraTherm as forced convection is completely isolated (the critical variable for measuring gas mass flow rate) by calculating and then eliminating unwanted heat-transfer components, like sensor stem conduction, one of the major causes of false flow readings," Olin adds.

The 'true' brains behind this is Sierra's Raptor II operating system (formerly known as qTherm), a revolutionary, living, learning algorithm set made possible by today's hyper-fast microprocessors and QuadraTherm sensor inputs. Olin explains, "At Sierra, we refer to Raptor II as our ball-of-math. It manages changes in gas flow, gas temperature and gas pressure, as well as outside temperature, via a comprehensive heat-transfer model. The result is a proprietary, fundamentally different gas mass flow rate calculation using all pertinent variables for the most precise, stable and accurate mass flow measurement possible."

## High flows, high pressure and ever-higher accuracy

Sierra's products can affect an industrial gas company's bottom line by helping to improve the quality of their product, reduce utilities costs, reduce operations and maintenance cost, reduce capital and engineering, provide accurate data for any environmental and



regulatory requirements, optimise throughput, reduce waste, and improve availability.

Indeed, Olin affirms that ever-higher accuracy and turndown, high flows, field calibration and validation, and changing gases and gas composition 'on the fly' are hot topics right now in the world of flow control. But flow control at the industrial gas plant is one of a number of applications driving growth for Sierra in 2015. Flow 'energy' measurement and management, ultra high purity gases in the semiconductor sector, high pressure pilot plants, and very high flows and changing gas compositions in the oil and gas business are all significant opportunities for the Sierra of both today and tomorrow.

The common challenges across all applications are:

- Increasing accuracy to improve quality and throughput
- Lowering measurement costs – total cost of ownership
- Flexibility with changing application conditions in the field.

This, Olin says, will create opportunities in flow control for multi-variable meters. "Accuracy is dollars, and if one flow meter can perform in many different applications, customers like to buy all the same meter types to reduce cost and maintenance."

It's a market that Sierra, thanks to the vision of its founder and its ongoing innovation throughout the decades, is ready to serve – and enable. Olin concludes, "Sierra has a bright future focused heavily on the energy, environment and natural resource markets. We believe in thinking ahead and always working with an uncompromising focus on QDPICS™ (Quality, Delivery, People, Innovation, and Customer Service)."

"We believe by focusing on our customer needs and continually challenging the status quo in our industry, we will always be able to respond and anticipate customer's needs." 