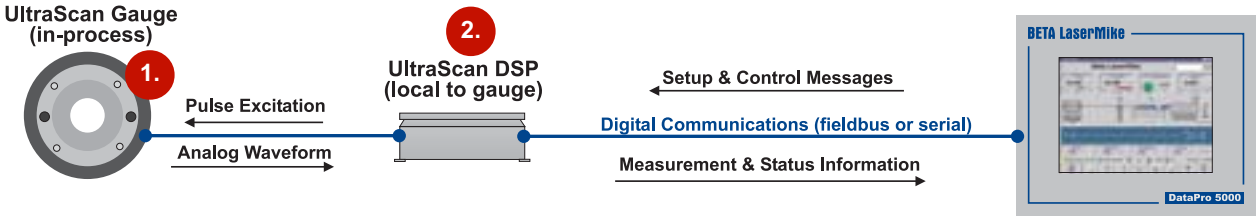
Wall & Concentricity Measurement Systems

UltraScan systems from Beta LaserMike provide on-line precision measurements of tube wall thickness and concentricity. Using ultrasonic technology, UltraScan systems are able to make high-speed, non-contact measurements during production.

Main Components of UltraScan Measurement Systems



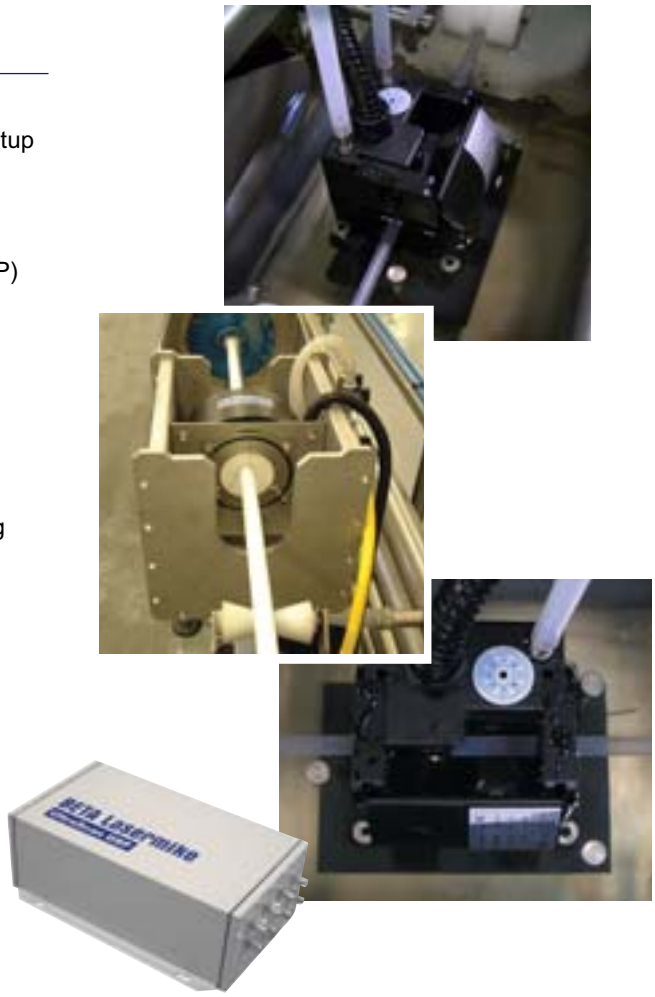
DataPro Controller
(or other host system)

1. The **Ultrasonic Gauge** consists of a fixture holding multiple ultrasonic transducers around the tube. Each transducer generates an ultrasonic signal that is capable of measuring one layer or multiple layers of the tube.

2. The **Ultrasonic Intelligence Module** interfaces to the ultrasonic transducers and analyzes the signals in a Digital Signal Processor (DSP) to perform and communicate the measurements. The Beta LaserMike ultrasonic intelligence module, called **UltraScan DSP**, is the most powerful and advanced system of its kind in the world, and is the key to providing the user with a very robust and easy-to-use ultrasonic system.

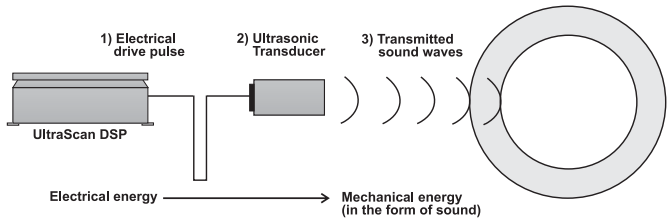
The UltraScan™ Advantage

- Eliminates need for operator intervention with unique patented “Snap Technology” that provides automatic setup
- Achieves highest ultrasonic accuracy and repeatability with unique patented “Snap Technology” that optimizes each measurement in the Digital Signal Processor (DSP)
- Finds short-term wall variations with high-speed tolerance checking option
- Increases measurement repeatability with line speed and temperature compensation
- Offers flexible mounting options including inside cooling troughs, spray tanks, vacuum tanks, or in a separate installation tank provided by Beta LaserMike
- Provides flexible communication integration to UltraScan DSP with RS-232, DeviceNet, CANopen and Profibus protocol support



Ultrasonic Wall & Concentricity Measurement Principle

UltraScan DSP sends an electrical drive pulse and the transducers convert that energy into an ultrasonic sound wave.



The UltraScan DSP calculates the wall thickness as:

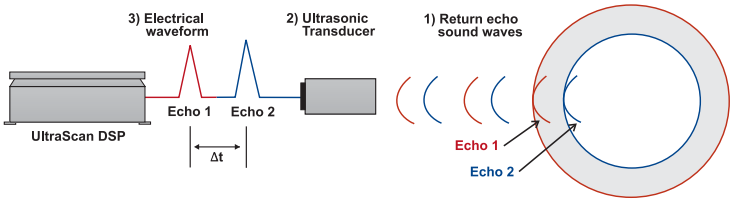
Wall = (Δt * s) / 2

Δ**t** = time between echoes

s = speed of sound through the material[1]

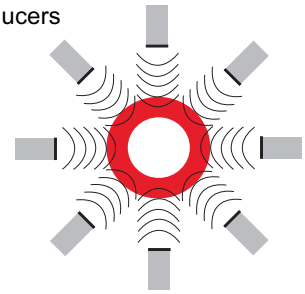
[1]The DataPro 3000 and 5000 controllers provide a feature that allows the UltraScan DSP to determine the speed of sound through the material on line.

Echoes are sent back to the ultrasonic transducers from the walls of the tube and the transducers convert that energy into an electrical waveform.*



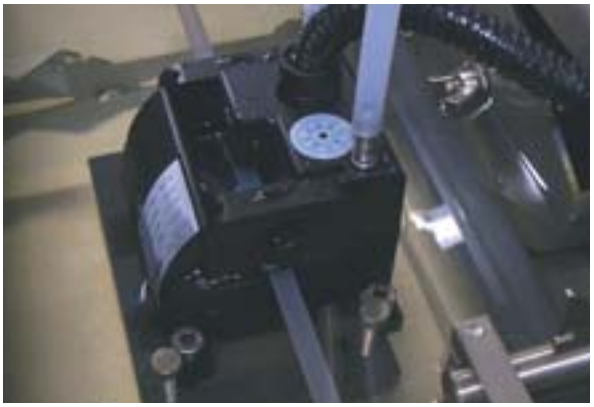
Multi-Point Wall & Concentricity

Using multiple transducers provides full measurement of the product. This allows the calculation of concentricity and the determination of the minimum and maximum wall thickness.



***With multi-layer tubes, an echo occurs at each layer and therefore each layer can be measured individually.**

UltraScan Gauge Models



UltraScan gauges are available to cover various tube diameter and wall thickness sizes. Each supports multiple transducers and is capable of measuring multiple layers.

Beta LaserMike ultrasonic gauges can support multiple transducer types, each covering a different wall thickness range. Beta LaserMike engineers will select the appropriate transducer type for your application.

Specifications (all models)

- Wall measurement accuracy to ±0.001 mm (±0.000040 in.)
- Concentricity accuracy to ±0.1%

Options

- Small trough for mounting outside existing cooling troughs
- Height stand for trough
- Base mount carriage for mounting to base of trough (only needed with models UltraScan 1063 and 1125)
- High-speed tolerance checking software

Model	OD Range	Gauge Throat	Transducers
UltraScan 1012	0.25 – 12 mm (0.01 – 0.5 in.)	20 mm (0.79 in.)	4, 8
UltraScan 1025	2.5 – 25 mm (0.1 – 1.0 in.)	30 mm (1.2 in.)	4, 8
UltraScan 1063	3.75 – 63 mm (0.148 – 2.5 in.)	83 mm (3.3 in.)	4,6,8
UltraScan 1125	10.5 – 125 mm (0.413 – 5.0 in.)	190 mm (7.5 in.)	4,6,8
UltraScan 1175	30 – 175 mm (1.181 – 7.0 in.)	236 mm (9.3 in.)	4,6,8

Unique Ultrasonic Technology

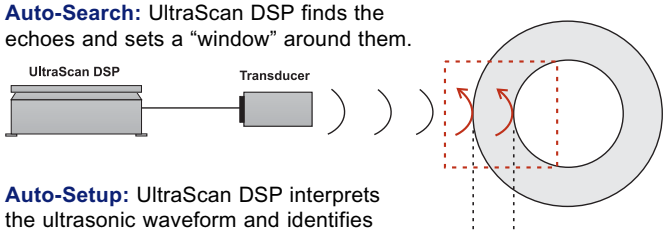
Snap Technology

So Simple, it's always being used.
All ultrasonic measurement systems require some form of setup of the ultrasonic waveform. The measurement system must know the proper echoes and positions in the waveform to trigger on and measure from, and the user must set this up.

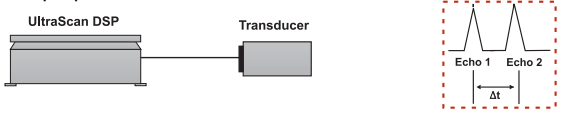
But the UltraScan DSP, with its unique and powerful patented **Snap Technology**, is the world's only ultrasonic system that is capable of completely setting up its own ultrasonic waveforms instantly and automatically. The intelligence of Snap Technology provides fully automatic ultrasonic measurement with:

- Auto-search
- Auto-setup
- Auto-tracking

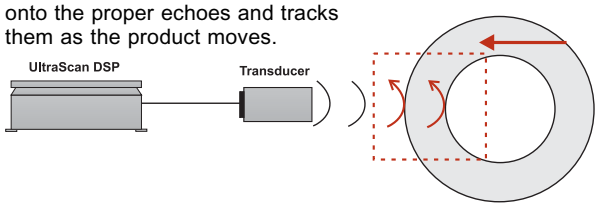
Auto-Search: UltraScan DSP finds the echoes and sets a "window" around them.



Auto-Setup: UltraScan DSP interprets the ultrasonic waveform and identifies the proper echoes.

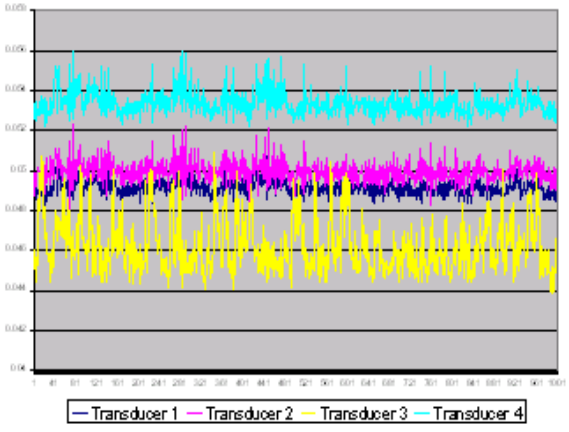


Auto-Tracking: UltraScan DSP locks onto the proper echoes and tracks them as the product moves.



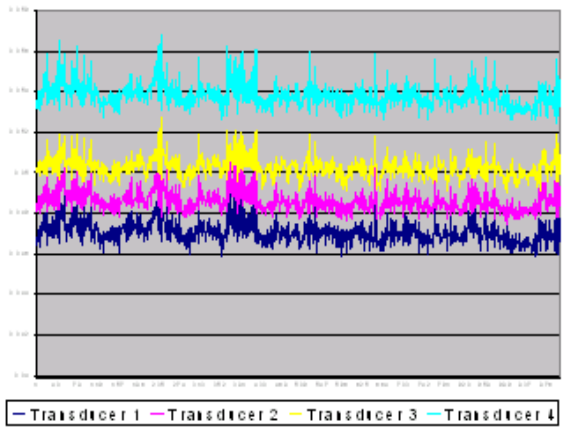
Highest achievable ultrasonic accuracy

Since each ultrasonic transducer is set up individually, other ultrasonic systems have the potential to introduce error in the measurements due to the human error created by manual setup. And when conditions of the product or the process change, the fixed manual setup does not adapt the signal processing with the changes. But when the measurements are set up automatically with Snap Technology, it ensures that the setup is the same across all transducers. And when conditions of the product or the process change, the auto setup **instantly adapts** the signal processing with the changes. This continuous and automatic setup of all transducers ensures **maximum consistency** across each transducer, thus providing **higher accuracy** of average wall and concentricity measurements.



Gauge 1: Manual waveform setup

The 4 on-line wall measurements show some inconsistency (caused by differences in the manual waveform setup of the 4 transducers).



Gauge 2: Automatic waveform setup

The 4 on-line wall measurements all follow the wall changes precisely the same, due to Snap Technology's automatic setup and tracking software.

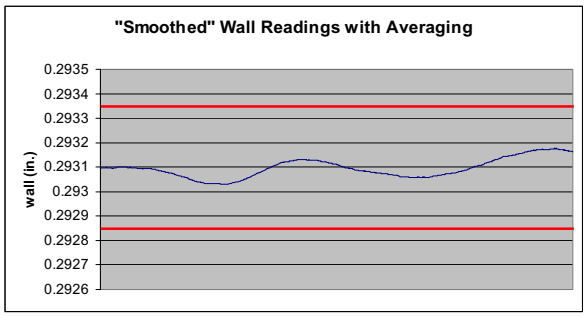
Unique Ultrasonic Technology

High-Speed Tolerance Checking

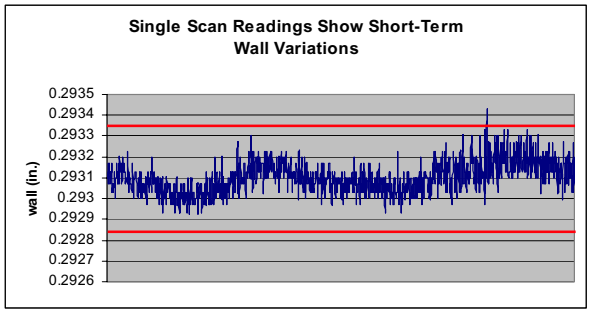
Detection and notification of short-term wall variations

Ultrasonic systems are often implemented in tube extrusion lines to monitor and correct gradual changes in the wall thickness. Short-term variations in wall thickness are often missed when the ultrasonic system is averaging data and monitoring for periodic changes. But UltraScan systems are capable of taking approximately 2,000 wall measurements per second, depending on thickness, and have an advanced feature for **High-Speed Tolerance Checking**. The UltraScan DSP checks each scan of each transducer and compares the measurement against wall tolerances. This high-speed checking of tolerances is designed to catch short-term wall variation on each individual layer of the tube.

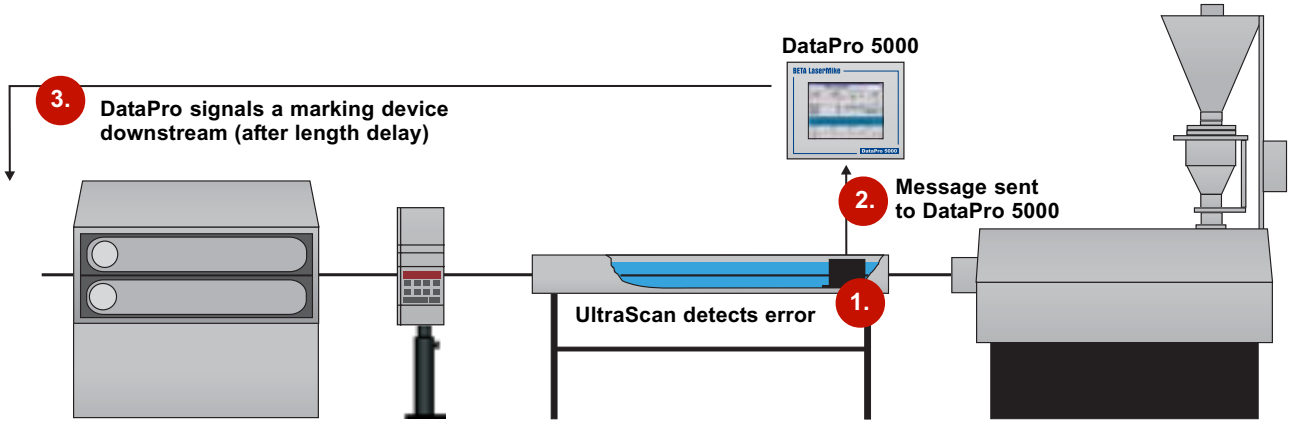
Once a high-speed tolerance error is found, the UltraScan DSP sends a signal to the DataPro 5000 controller to indicate that an error has occurred. The DataPro 5000 can then send a signal to a device downstream that will mark or cut out the area of the product that is out-of-tolerance. A length delay is implemented by the DataPro 5000 after the error message is received, so that the mark or cut matches with the position of the error.



Standard tolerance checking compares averaged wall values against tolerance limits



High speed tolerance checking compares individual scans against tolerance limits



Record keeping of short-term wall variations

The UltraScan DSP sends details of each error to the DataPro 5000, including:

- which transducers detected the error
- max and min wall size during error
- length of error
- which layer or layers contain error

*Each error message sent is logged to a report on the DataPro 5000 screen