Ultrasonic flaw detection is widely used to detect and characterize hidden internal defects in engineering materials such as metals, plastics and composites. High frequency sound waves reflect from cracks, voids and other material discontinuities, producing distinctive echo patterns.

**Specifications**

**NEW Outstanding ultrasonic performance**

The combination of the rugged USN durability, 11 hours of battery operation, fast rotary knob operation, outstanding ultrasonic performance, and the “square wave pulser” form powerful portable ultrasonic inspection tool.

**NEW Optimized outdoor use design**

The USN 60 / USN60L flaw detectors are especially designed to be used outdoors:

- Extreme temperature use (-20°C to +55°C / -4°F to 130°F)
- Easy to view in direct sunlight
- 11 hours battery operation

**NEW Vibrant colors**

- Hi-resolution color LCD display produces “Analog Look and Performance” echo dynamics.
- 4 selectable vibrant display color schemes to match lighting conditions.
- Gates and gate functions are color coded for easy identification and fast adjustment.
User preferred features:

- Simple operation with fast rotary knob adjustments; gain is always directly accessible with the left-hand rotary knob and lockable.
- Auto CAL makes calibration fast & easy.
- 15 Hz to 6 kHz (spike mode) PRF and 15 Hz to 2 kHz (square mode) PRF (pulse repetition frequency).
- 2 independent gates monitor amplitude and sound path distance for both flaw detection and thickness measurement applications.
- 250 KHz to 25 MHz frequency range.
- RF display mode enhances signal evaluation and bond inspection of dissimilar materials.
- 4 selectable damping settings (50, 75, 150, 500 ohms) for optimum probe performance.
- 1 mm to 28 m (0.040" to 1100") range (in steel) covers thin to lengthy acoustically clean materials.
- dB REF key evaluates subsequent echoes gain value and amplitude against the highest echo in Gate A (reference echo) when activated.
- IF (Interface) Gate Option for automatic start of the display, Gate A, Gate B, and / or DAC / TCG for immersion testing applications.
- VGA Output Option provides an easy way to connect to a PC monitor or PC projector for viewing by large audiences or training purposes.
- RF Output Option outputs the raw RF waveform via a standard Lemo connector for further analysis.
- BEA (Backwall Echo Attenuator) Option allows independent gain control of the region under Gate B for backwall echo monitoring.
- 19" Rack Mount Model.

Applications:

Of all the applications of industrial ultrasonic testing, flaw detection is the oldest and the most common. Since the 1940s, the laws of physics that govern the propagation of sound waves through solid materials have been used to detect hidden cracks, voids, porosity, and other internal discontinuities in metals, composites, plastics, and ceramics. High frequency sound waves reflect from flaws in predictable ways, producing distinctive echo patterns that can be displayed and recorded by portable instruments. Ultrasonic testing is completely nondestructive and safe, and it is a well established test method in many basic manufacturing, process, and service industries, especially in applications involving welds and structural metals.

1. Basic Theory: Sound waves are simply organized mechanical vibrations traveling through a medium, which may be a solid, a liquid, or a gas. These waves will travel through a given medium at a specific speed or velocity, in a predictable direction, and when they encounter a boundary with a different medium they will be reflected or transmitted according to simple rules. This is the principle of physics that underlies ultrasonic flaw detection.

   **Frequency:** All sound waves oscillate at a specific frequency, or number of vibrations or cycles per second, which we experience as pitch in the familiar range of audible sound. Human hearing extends to a maximum frequency of about 20,000 cycles per second (20 KHz), while the majority of ultrasonic flaw detection applications utilize frequencies between 500,000 and 10,000,000 cycles per second (500 KHz to 10 MHz). At frequencies in the megahertz range, sound energy does not travel efficiently through air or other gasses, but it travels freely through most liquids and common engineering materials.

   **Velocity:** The speed of a sound wave varies depending on the medium through which it is traveling, affected by the medium's density and elastic properties. Different types of sound waves (see Modes of Propagation, below) will travel at different velocities.

Basics of Ultrasonic Test

Ultrasonic wavelengths are on the same order of magnitude as visible light, giving them many of the same properties of light. For example, ultrasonic wavelengths can be focused, reflected, and refracted. Ultrasonic waves are transmitted through air, water, and solids such as steel by high frequency particle vibrations. These waves are transmitted in homogenous solid objects much like pointing a flashlight around a room with various objects that reflect light. The directed energy in an ultrasonic wave is reflected by boundaries between materials regardless of whether the material is gas, liquid, or solid. Ultrasonic waves are also reflected by any cracks or voids in solid materials. These reflected waves, which are caused by internal defects, can be compared to the reflected waves from the external surfaces, enabling the size and severity of internal defects to be identified.
Generating and detecting ultrasonic waves requires an ultrasonic transducer. Piezoelectric ceramics within ultrasonic transducers are "struck"—similar to the way tuning forks are struck to generate an audible note—with electricity, typically between 50 and 1000 V—to produce the ultrasonic wave. The ultrasonic wave is carried from the transducer to the unit under test (UUT) by a couplant—typically water, oil, or gel—and is reflected back to the transducer by both external surfaces and internal defects.

When operating in pulse-echo mode, ultrasonic transducers act as both emitters and receivers. The reflected ultrasonic waves vibrate the piezoelectric crystal within the ultrasonic transducer and generate voltages that are measurable by data acquisition hardware. When operating in through-transmission mode, two ultrasonic transducers are used; one transducer generates the wave and the other receives the wave.