Sonatest

RapidScan2™

RapidScan2™

Fast, portable, user-friendly...
...the complete C-scan solution.

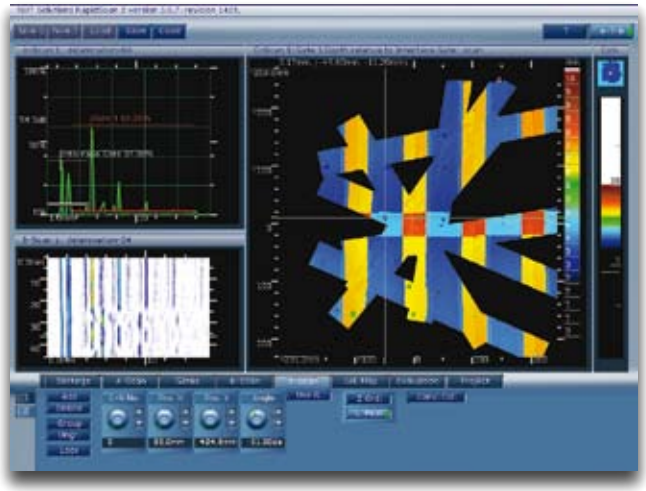
Designed for speed, portability, and performance, RapidScan2 has been developed as a versatile and user-friendly A, B and C-scan inspection instrument. Using novel, proprietary, rubber-coupled array sensors, immersion quality A-scan data is recorded very quickly. Powerful gating and evaluation tools ensure that the ultrasonic signals can be analysed and interpreted to the fullest extent.

RapidScan2 operates in pulse-echo mode suitable for inspecting medium to large areas. The high resolution C-scans show time of flight and amplitude data, simultaneously displaying both A and B-scans live. The system includes a 128-channel multiplexing pulser/receiver module; state-of-the-art data capture electronics and a standard PC laptop, housed in a low-profile rugged plastic enclosure. The instrument operates through a user-friendly Windows based interface.

RapidScan2 has been successfully employed for inspecting a range of materials and structures. A simple parallel may be drawn to conventional A-scan inspections; if a part can be inspected with a ¼", single element transducer then it can often be inspected using RapidScan2. Exceptions to this rule are compound curves, complex geometry and parts with restricted access.

Common application areas are: the inspection of metal and carbon fibre composite structures, detecting defects such as delaminations, cracks, flaws, corrosion, porosity, foreign material and bond integrity.

Delamination Detection



A common application for RapidScan2 is the inspection of carbon fibre composite components to detect delaminations and large voids. BVID (barely visible impact damage) is easily visualised, showing the full extent of the sub-surface defects. Detection and interpretation is simplest with time of flight C-scan data, recording the depth of the largest echo beneath the front face, measured relative to the interface gate.

The inspection of composite material usually requires implementation of TCG (time corrected gain). TCG sets variable receiver gain over the time base of the A-scan, compensating for signal attenuation. When a TCG curve is correctly implemented, the amplitudes of echoes from reflectors of the same size at different depths in the same material are equal. The use of TCG optimises the near surface resolution of the inspection such that defects as near as 0.5mm from the top surface can be detected.

Once several C-scans have been recorded they may be assembled into a single compound scan, referred to as a T-scan (tiled scan). Within a T-scan, individual C-scans can be easily added, moved and rotated in order to assemble a single, complete scan. Overlapping areas can be blended using the highest amplitude data for each point or set to overlay one another. C-scans are imported either with or without A-scan data. Importing with the full A-scan data, the T-scan may be re-gated to optimise the set up. Similar to the C-scan, the T-scan data (such as absolute amplitude, time of flight data, etc.) may be toggled to obtain multiple scan types as well as adjustment of the colour maps. The origin for all the coordinates may be reset to anywhere on the scan, which is useful for measuring the location of defects relative to a known features on the scan.

Multiple tools are available for complete analysis, evaluation and reporting. Defects are marked on the scans as circles, rectangles, ellipses or even arbitrary shaped polygons. Size, shape and statistical data for marked defects are available. Individual defects are automatically named for reference. Scans may be saved, exported or printed either as a scaled image or at actual size over multiple pages to lay the print over the part and accurately locate defects.

Bond Inspection

There are a vast range of bonded structures that require inspection, and as such it is not possible to produce a generic method suitable for all.

Thin metallic parts can mask the A-scan data with multiple reflections whereas, at the opposite end of the spectrum, composite materials and adhesives may exhibit very high attenuation making the back wall echo difficult to identify. In several cases though, bond inspection is both feasible and simple, when the echoes from the bond-line and the back wall are easily identified and distinguished. For bonded material (good bond), there is a strong echo from the back wall of the material and only a small echo from the bond-line. As the percentage area that is bonded beneath the transducer reduces (partial bond) so the amplitude of the echo from the bond-line increases and the amplitude of the back wall echo reduces. If there is no bond beneath the transducer (disbond) then only an echo from the bond-line is received.

Observing C-Scans simultaneously helps to simplify and validate the bond assessment, e.g. absolute amplitude of the bond-line echo, absolute amplitude of the back wall echo, and amplitude of bond-line echo relative to amplitude of back wall echo; all three may be displayed together whilst scanning to aid interpretation ensuring that all disbonds are correctly identified and sized. Defect markings are shown on all the visible C-scans to assist with sizing procedures. The comprehensive capabilities and analysis toolbox of RapidScan2 provides a complete inspection and evaluation solution.

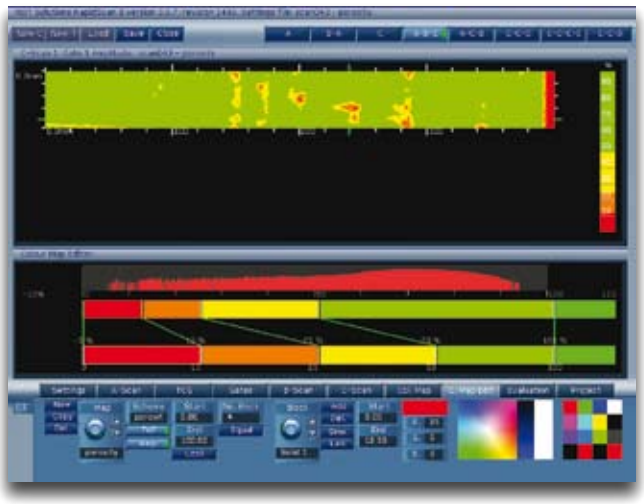
Flaw Detection

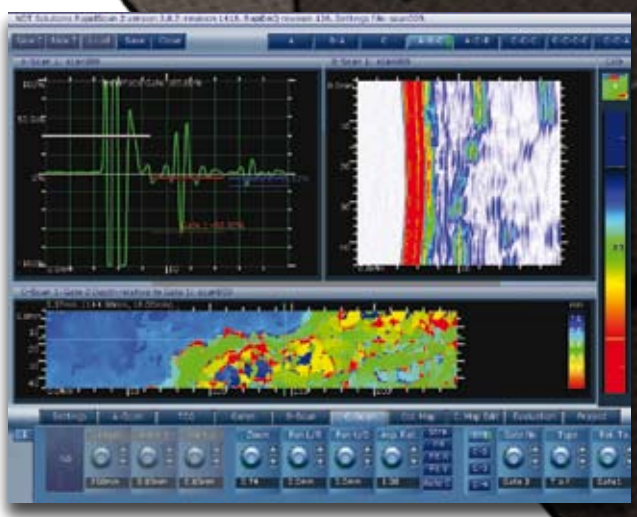
Small internal flaws typically occur in both composite materials and metals. Examples include foreign bodies (release film), small voids and porosity. Inspection methods monitor the amplitude of the back wall echo and/or the amplitude of internal echoes. For parts of non-constant thickness, conventional gates are difficult to set up and interpret, to guarantee the full internal thickness range is inspected. It is often only possible to inspect the thinnest region. Within RapidScan2 it is possible to reference the width of a gate to another (such as the back wall echo). This feature enables a gate to maintain its position from just below the front face to just above the back wall ensuring the full internal thickness is always monitored. Variable width gates are ideal for detecting low amplitude, internal defects.

Acceptance criteria for amplitude based inspections are commonly specified in decibels. Such methods can be implemented through the use of a logarithmic colour map, easily generated using the colour map editor. For the example shown, colour blocks are set to 0dB to -6dB = light green, -6dB to -12dB = yellow, -12dB to -18dB = orange, < -18dB = red. With this colour map, the upper limit can be easily scaled by adjusting the high value whilst preserving the relative decibel measurements.

Thickness Mapping

A number of applications simply require the thickness of a part to be measured. Such applications include the detection and measurement of corrosion, erosion and the verification of manufacturing dimensions. Often performed on metal components, the gating options available provide the necessary tools for the inspection. Several RapidScan2 features are useful to optimise and simplify the inspection, including interface synchronisation, echo-to-echo time of flight (depth) measurement, B-scan display and multiple C-scan representations that may be viewed simultaneously. All of these and more enable comprehensive evaluation of a part for the accurate assessment and measurement of loss of material.





RapidScan2™

Technical Specifications

General

Power supply Voltage: Universal power supply (110-240V)
Dimensions: 520 x 375 x 210mm (W x D x H)
Weight: 15 Kg

Application Software

Simultaneous live A, B, C-scan
Simultaneous capture of multiple C-scans
Large area mapping capability
Powerful post processing capability using full waveform capture
Rectification: RF, Full Wave, Half Wave Positive, Half Wave Negative
High frame rate B-scan display (>200 Hz typical)
Up to 6 gates with multiple peak detection, triggering and measurement
Evaluation tools for data analysis: Line, Rectangle, Circle, Ellipse, Polygon tools
Histogram analysis: Min, Max, Mean, Std. Dev.
Fully user definable colour palette interface
Scan speed: 200 mm/s (64 elements, 2 gates, 1000 A-scan points, 0.8 mm resolution)
Up to 2Gb data file size

User Interface

Laptop processor: Pentium M
Operating system: Windows XP/2000
User input: Standard laptop keyboard with regional variations
Display: 14" TFT 1024x768 LCD
Hard Drive: 60 - 80Gb
Interfaces: 10/100 baseT Ethernet, USB, Wi-Fi, Bluetooth
DVD+/-RW
Memory: 2Gb
Optional user inputs: Head up display, Wireless optical mouse

Processing Electronics

Pulser

Pulser type: Negative square wave
Pulser amplitude: -70 V
Pulse width: 25 ns to 250 ns, adjustable in 0.5 ns steps
Max prf: 100 kHz
Active Channels: 32
Max no. of Channels: 128

Receiver

System bandwidth: 1 MHz to 22 MHz
Receiver gain: 80 dB
TCG: No. of points: 16
Amplitude resolution:0.3 dB
Time resolution: 10 ns
Total correction: 80 dB
Slope range: 0 - 40 dB/µs

Digitiser

Data Capture: FPGA based DSP engine
Rate: 100 MHz
Dynamic range: 12 bits
Memory: 4 Msamples

Wheel Probe Sensor

Ultrasonic Array

Centre freq.: 2, 5, 10 MHz
Bandwidth: > 60% (-6 dB)
Element pitch: 0.8mm*
Active array width: 50mm*
No. of elements: 64*
Aperture: 8, 16, 24 and 32 channel beam formation supported
Max. cable length: 10 m @ 5 MHz
Connector: Cannon ZIF 260 pins

Wheel probe

Water filled low attenuation rubber tyre
Rotary quadrature encoder for positional information
Spring loaded buggy for fast scanning

* Custom Wheel probe options available

Array Sensors

Wheel Probe

Wheel probes are available with array or single element transducers. Single element wheel probes provide A and B-scan capability when used with ultrasonic flaw detector instruments and are available as dry coupled and semi-dry coupled sensors.

To enable the fast scanning speeds available with the RapidScan2, Sonatest NDTS have developed a range of inspection sensors incorporating array transducers. The sensors enable the ultrasonic array to be quickly and easily moved over the surface of parts providing A, B and C-scan data from the structure. The light-weight ergonomic designs are easily deployed by hand, featuring a 64-element array and position encoding for recording accurate and repeatable C-scans. The sensors are coupled to the structure using a proprietary rubber formulation that has been developed to match closely the acoustic properties of water providing a cheap and reliable coupling medium.

The wheel probe tyre is conformable and therefore can accommodate small surface irregularities such as those around rivets and boltholes without compromising data capture. Whereas traditional ultrasonic sensors require large amounts of couplant, Sonatest NDTS' wheel probe requires only a minimal spray of water to provide excellent coupling for consistent scanning. The conformability and resilience of the tyre material contribute to the robust nature of the wheel probe, capable of withstanding temperatures >100°C and extremely durable. For the rare case where the tyre is damaged, the simple design allows it to be easily replaced. The wheel probe features a spring loading mechanism to regulate the tyre coupling force making it suitable to scan narrow structures or along the edge of components. A button is incorporated into the handle to start and stop scans which are then saved automatically, remote from the main RapidScan2 unit.

Sliding Probe

A sliding probe has been developed using the same rubber formulation as the wheel tyre, moulded into a delay line sleeve. Used with RapidScan2, it is suitable for scanning areas that are difficult to inspect with the wheel probe such as varying curvature, or very close up to a vertical edge.

RapidScan2™

RapidScan2 is the complete C-scan inspection instrument from Sonatest NDTS. This comprehensive system bridges the gap between hand-held and gantry equipment offering the convenience and versatility of a portable unit combined with the speed and in-depth data analysis capability of an automated C-scan inspection system. Utilising ultrasonic array transducers, RapidScan2 provides real-time A, B and C-scan information with high resolution full data recording.

Compared to standard portable instruments, RapidScan2 is able to scan much faster, and further with an expansive set of evaluation and analysis tools. Multiple level user access allows configuration of the instrument to be as simple or as flexible as the operator desires.

The evolution of the RapidScan2 has been strengthened by the development of innovative inspection sensors. This has culminated in the design of Sonatest NDTS' wheel probe, utilising a rubber formulation of exceptional properties that is ideally suited for use with ultrasound. The water-filled rubber tyre requires only minimal water misting for excellent consistent coupling between sensor and part. In addition to the wheel probe, several other inspection sensors are available incorporating our proprietary rubber including contact array delay lines, single element wheel probes and dry-coupled transducers.

Sonatest Ltd
Dickens Road
Old Wolverton
Milton Keynes, UK
MK12 5QQ

Tel +44 (0) 1908 316345
Fax +44 (0) 1908 321323
E-mail sales@sonatest.com
Web www.sonatest.com

Part No: 147359 (iss 2)

Sonatest