Ultrasonic Phased Array Flaw Detector Series
**Sonatest veo series**

Power & performance perfectly packaged.

The veo range of Phased Array ultrasonic flaw detectors reinforces Sonatest's reputation for innovative technician focussed product development. Simple controls, superior performance, advanced features and rugged enclosure deliver simplicity, capability and reliability to the technician's finger tips.

Ultrasonic Phased Array technology has become the established method for advanced NDT testing applications. Phased Array techniques allow the user to control parameters such as beam angle and focal distance to create an image of the test part; enhancing defect detection and speed of testing. In addition, using the latest computer technology, data can be permanently recorded for processing and report generation. The veo's robust design, intuitive user interface and extensive online help brings the power of Phased Array to the field-based technician. Typical applications include Weld Inspection, Corrosion Mapping, Aerospace and Composite Testing.

**Simplicity**

The intuitive menu system is application and workflow driven, with set up and operation swiftly becoming second nature. Integrated Help and Wizards guide the user through scan set up whilst Optimisation Tips ensure the veo always performs at the highest level. The unique 3D ScanPlan view gives immediate visual confirmation of correct set up and ultrasound coverage, even in complex multi-probe applications.

Fast and efficient wizards for Sound Velocity, Wedge Delay, TCG, DAC, Sensitivity and Encoder calibration are all provided as standard. Clear indication of the calibration status is provided on screen via a simple traffic light system, so that operators can check at a glance that the veo is calibrated for the inspection task.

Menu navigation uses Sonatest's second generation scroll wheel technology for fast parameter selection, with shortcut keys for the most used functions and alphanumeric entry. The familiar Start, Stop and Record keys switch quickly between set up, acquisition and recording modes.

**Capability**

The powerful veo platform unlocks a new level of performance in a portable instrument, helping you to maximize your efficiency on-site. The Inspection Plan shows the operator in 2D and 3D where probes are positioned on the test part, simplifying the inspection setup and providing an inspection reference for reporting. All adjustments to focal laws are instantaneous, with angle resolution to 0.1° and up to 1024 focal laws without loss of performance. Multiple scans from.
different probes may be displayed and evaluated at the same time. Multiple sectorial scans, true top, side and end view extractions plus C-Scans are all supported by the veo. TOFD and Phased array inspections can be carried out in tandem at full scanning speed and with up to 3GB data files large areas can be inspected more efficiently. Full resolution waveform data can be stored directly to a removable USB data key for ease of back up and transfer to PC.

The veo has two dedicated mono element flaw detection channels for conventional UT and TOFD inspection. Based on Sonatest’s Masterscan flaw detector the channels have 400V pulser, Time Corrected Gain and low noise amplifiers for the most demanding applications. An impressive hardware specification provides high quality ultrasonic data, via a full 16 bit high speed architecture and 12 bit ADC technology. Digital signal processing enables smoothing and averaging, enhances image interpretation. Measurement and sizing of indications are quickly achieved using advanced measuring tools such as Hyperbolic Cursors for TOFD.

UT Studio

UT Studio is a PC based software, which comes as part of the veo package, for Phased Array configuration development, data analysis and report generation. Recorded veo data files are easily transferred via a network or USB data key and used to generate new views and projections. Using a familiar windows drag and drop interface, the user can create multiple views such as Top, End and B-Scan by simply dragging veo data files onto templates for display.

Reliability

Robust design and proven reliability are essential attributes in demanding NDT environments. Down time is expensive and should be minimized to ensure maximum productivity. Sonatest’s reputation for rugged construction and high quality products has been earned over 50 years serving the industry. The veo is constructed to exacting standards using a rigid, shock mounted, internal chassis surrounded by an impact absorbing enclosure and designed to meet IP66. Designed to incorporate many features to make site work easier, the veo is fitted with standard camera mount fittings underneath and four attachment points on the back for tripods and other equipment accessories. Additionally the four corner D-rings allow the veo to be attached to carry straps or 4 point body harnesses, for easy movement, freeing hands for scanning. The veo has a two battery design which are “hot swappable”, therefore minimising down time and heightening the reliability of performance in the field.

For any flaw detector the display is a crucial element. The Sonatest veo range has a colour transflective TFT LCD, providing high visibility in all conditions, with the highest display to size ratio of any field instrument.
Superior Imaging
Full Data Recording
Fast Encoded Scans
Multi Scan
Simultaneous UT & PA
Instant Focal Law Calculations
Easy Report Generation
IP66 Enclosure
Calibration Wizards
3D ScanPlan
Probe & Wedge Databases
TCG and DAC
Unlimited Scan Lengths

veo 16:64

3D Scanplan
The veo Scanplan supports multiple probes and scans, enabling the set up of inspection plans from a number of sources quickly and efficiently. Choose from a range of weld geometries and visualise the probes on the part in the locations you choose. Multiple skip paths are shown on the 3D Scanplan allowing the user to ensure coverage for weld inspections. Simple reference points are indicated for easy interpretation and locations of probes on the part can be quickly defined. Mixtures of probe types are supported in pulse echo and pitch and catch; phased array; TOFD or conventional UT. The Scanplan is an invaluable reference for your inspection report, communicating the results of your inspection more clearly, and saved as part of your inspection for future use.

TOFD
The veo has a dedicated analogue architecture for TOFD inspection, using analogue filters developed from the Sonatest range of flaw detectors. Coupled with the lowest noise amplifiers, high speed data acquisition and a high definition display, superior quality TOFD scans can be viewed live at the same time as Phased Array. Phased Array and TOFD inspections can be evaluated together for added confidence during weld inspection. Built in evaluation tools, such as straightening and lateral wave removal, allow quick and accurate evaluation of the TOFD inspection, which can be included in a test report.

Multi Scans
The veo can be quickly configured to display a large range of multi scan views. This allows the user to select the views important for the inspection and to get best use from the display. Sector scan, top, side and end views can all be combined with multiple A-Scan views and TOFD. Cursors and rulers are used to identify indications in the views, whilst measurement tools give size and annotation.

www.sonatestveo.com
Huge File Size (3GB)
USB key Data Storage
WheelProbe Compatible
Hot Swap Battery Packs
Merged C-Scan
Simultaneous TOFD & PA
Ray Tracing with Reflection
Interface Triggering (TCG/DAC)

16:128 (additional features)
Up to 128 probe elements
High Power -130 volts
Enhanced Multigroup up to 6 concurrent scans

A-Scan
The veo supports traditional ultrasonic testing with mono transducers. The high definition LCD and fast graphics rendering ensure high levels of accuracy and a fast interactive waveform display. Thanks to the high resolution of the LCD display, measurements are clear and easy to read, and the wide screen format provides a huge viewing area for the scan. The A-Scan display ensures the peak signal is always displayed so that you never miss a defect.

Stop Mode
In stop mode the veo system is able to display four screens of information simultaneously. For example a Configurations Summary, Help Page, Plan view of Inspection (showing expected probe movement), 3D Scanplan (showing the probes, parts, inspection beams and planes of focus - as above. Any one of these can be maximised to a full screen view.

C-Scan
The veo offers full merged C-Scan capabilities allowing the inspector to see the complete area of inspection. TOP views (from angled or normal beam inspections) or C-Scans (from normal beam inspection) can be produced based on either amplitude or time of flight data. C-Scans from multiple passes can be merged together. This is particularly valuable for corrosion mapping and assessment of large composite structures.

Veo & Corrosion WheelProbe Scanning Systems

The Corrosion WheelProbe is a tried and tested solution for corrosion mapping and can be combined with the veo and scanning system to provide simple and effective scanning solutions in this field. The scan width is close to 50mm in one pass and can be used on diameters from 12 -120cm (4 - 48 in). Importantly the tyre allows excellent coupling to rough surfaces, and the design allows for consistent reliable inspection in both depth and amplitude. Advantages of this system include the portability, relative simplicity and complete autonomy from the need for additional power sources on the inspection site. Additionally the veo CWP system gives the flexibility of utilising the CWP on a manual basis for small area scans, e.g. screening of pipe work of vessels (where LRUT has been used) or scanning along the length (Axial) of the pipe.
### PHASED ARRAY Specifications

**Pulsers**
- **Configuration**: 16/64 (16/pulse RECEIVING, driving up to 64 elements)
- **Test Mode**: Pulse-Echo, Transmit/Receive
- **Transducer Socket**: IPEX
- **Voltage**: -50 V to 100 V (in steps of 10 V)
- **Shape**: Negative square wave (with ActiveEdge)
- **Width**: adjustable 25ns to 1000ns (2.5ns resolution)
- **Time**: <15 ns in 50 ohms load @1000V
- **Output Impedance**: <16 ohms
- **Delay Range**: 0 to 10 µs (2.5 ns resolution)

**Data Acquisition**
- **Architecture**: Full digital delay and sum architecture
- **Digitizing Frequency**: 50/100 MHz
- **Digitizer Resolution**: 12 bits
- **Data Processing**: 16 bits/sample
- **Data Recording**: Full raw data recorded

**Max A-Scan Length**: 811 samples (32 meters in steel LW, 50 MHz, 1:128)

**Maximum PRF**: 20 kHz

**Focal Law**: Up to 1024

**Focusing Type**: Constant Depth, Constant Sound Path, Constant Offset

**Processing**
- **Digital Filters**: Smoothing, Contouring, Rejection
- **Filters**: 7 narrow bands and 3 broadband, automatic
- **Sub-sampling**: 1:1 to 1:128

**Rectifier**: RF, Full, Positive, Negative

**Trigger Synchronization**: On encoder resolution or internal PRF (not encoded)

**Reference**: Initial pulse or gate, IFT supported

**Scan & Views**
- **Supported Scans**: S-Scan & L-Scan
- **Real Time Views**: S, L, B, C-Scan, Merged Top and End view
- **Colour Maps**: 10 Standard & User customisable palettes

**Multi-Group**: 4 scans and 1 TOFD Scan

**Cursors**
- **Types**: Cartesian, Extraction Box, Angular
- **Measurements**: Path Length, Depth, Surface Distance, DAC, AWS

### CONVENTIONAL UT/TOFD (MONO ELEMENT CHANNELS)

**Pulsers**
- **No. of Channels**: 2 TX/RX (2 multiplexed channels)
- **Test Mode**: Pulse Echo, transmitt/receive, TOFD

**Transducer Socket**: BNC or LEMO (factory option)

**Voltage**: -400 V (adjustable from -110 to -400 V in steps of 10 V)

**Shape**: Negative Square Pulse (with ActiveEdge)

**Width**: Adjustable from 25 ns to 2000 ns, resolution 2.5 ns

**Edge Time**: <20 ns in 50 ohms load @400V

**Output Impedance**: <10 ohms

**Bandwidth**: 200 kHz - 27 MHz (-3 dB)

**Gain**: 0-84 dB, in steps of 0.14 dB

**Input Impedance**: 50 ohms

**Bandwidth**: 200 kHz - 27 MHz (-3 dB)

**Data Acquisition**
- **Architecture**: Full digital delay and sum architecture
- **Digitizing Frequency**: 50/100 MHz
- **Digitizer Resolution**: 12 bits
- **Data Processing**: 16 bits/sample
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**Max A-Scan Length**: 811 samples (32 meters in steel LW, 50 MHz, 1:128)

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- **Sub-sampling**: 1:1 to 1:128

**Rectifier**: RF, Full, Positive, Negative

**Trigger Synchronization**: On encoder resolution or internal PRF (not encoded)

**Reference**: Initial pulse or gate, IFT supported

**Scan & Views**
- **Supported Scans**: A-Scans & TOFD
- **Views**: A, B, C-Scan, Merged & TOFD

**Cursors**
- **Types**: Cartesian, Hyperbolic
- **Measurements**: Path Length, Depth, Surface Distance, DAC, AWS, DGS

### CONVENTIONAL AND PHASED ARRAY

**DMC**
- **Number of Points**: 16
- **DAC Quantity**: 1 with 3 sub-DAC (per focal law in PA)

**Time Corrected Gain (TCG)**
- **Number of Points**: 16
- **Gain Range**: 0 to 60 dB
- **Max Gain Slope**: >50 dB/µs

**Gates**
- **A-Scan Gates**: 4 gates per A-scan (3 extracted A-scans per S/L-scan)
- **Gate Trigger**: Flank, Peak
- **S/L-Scan**: 2 Extraction Boxes per S/L-scan
- **Alarm LED**: 1 (sync on all gates & DACs)

**Measurements**: Available in A-scan view

**Peak & Flank (FSH, dB, Depth, Beam Path Length, Surface Distance, Echo-to-Echo, Floating Gates (reference from IFT)**

### GENERAL

**Data Storage**
- **Internal**: 6 GB (standard)
- **External**: Hot removable "User" USB GB (standard)

**Transfer Rate**
- **Internal**: Only limited by USB key capacity
- **External**: Up to 27 MB/s Read mode

**Data File size**: 3GB (FAST2 file system)

**Typical Scanning Speed**: 10 to 15 cm/s (3.9 to 5.9 in/s)

**Typical Scan Length**: >10 m (32.8 ft)

**Display**
- **Size**: 25.9 cm (10.2 in) Wide aspect ratio
- **Resolution**: 1024 x 600 pixels
- **Colour**: 260k (65535 colours for scan palettes)
- **Type**: TFT LCD

**I/O Ports**
- **USB Ports**: 3 x USB certified ports (480 Mbps)
- **Ethernet**: Gig Ethernet (1000 Mbps)

**Video Output**: VGA Analog (1024 x 600)

**Encoder**: 1 or 2 axis quadrature encoder (LEMO connectors)

**Power Input**: 5 V, 500 mA, current limited

**Interface and Reporting**
- **Active help & parameter description / Optimization**

**Language (Dynamic)**: Selectable: English, German, French, Spanish, Russian, Chinese, Hungarian, Italian, Portuguese.

**Remote Connection**: Onboard VNC Server and FTP Server (connection through Ethernet protocol)


**Report Generation**: PDF Report (includes customer logo, scan acoustic parameters, measurement results, etc.) PNG screen capture

**PDF Reader**: Allows viewing any uploaded PDF file, scan plan, procedures, old reports etc.

**Batteries & Power Supply**
- **Battery Type**: Intelligent Li-Ion batteries
- **Number of Batteries**: 2
- **Operation**: 1 battery or 2 batteries, DC Power pack
- **Battery Replacement**: Batteries recharge in unit, operating or not
- **Battery Life**: 6+ hours (typical operation).

**Enclosure**
- **Size**: H220 mm x W335 mm x D115 mm (8.66 in x 13.19 in x 4.52 in)
- **Weight**: 5.28 kg(11.6 lb) 1 battery, 7.5 kg (16.6 lb) 2 batteries

**Environmental**
- **Temperature**: Operating -10 C to 40 C (-13 F -104 F).
- **Storage**: -25 C to 70 C (-13 F -187 F).
- **Relative Humidity**: 5 to 95% non-condensing
- **Warranty**: 1 year
- **Calibration Standard**: EN12698.
- **Vibration**: EN60068-2-6 Sinusoidal vibration, 50Hz to 500Hz, 0.5mm, 18g, 5 sweep cycles
- **Shock (drop)**: Tested to MIL-STD-810F, Method 516.5, Procedure IV, 26 g, 1 "meter drops" (each face, edge, corner), while operating, to 2 inch plywood over concrete.

**Vevo 16:128 only**

**PHASED ARRAY**
- **Position**: 16/128 (16 pulses/receivers; driving up to 128 elements)
- **Gain**: -50 V to 120 V (in steps of 10V)
- **Output Impedance**: <32 ohms

**Trigger Synchronization**: External digital input, encoder or internal

**Software Options**
- **TOFD**
  - TOFD module includes all acquisition & measurement software tools.
- **CSV EXPORT**
  - Software function to export view data into a CSV format

**Supported Inspection Codes**
- Other relevant Codes are also met.

### Vseo 16:128 only

- **PHASED ARRAY**
  - **Configuration**: 16/128 (16 pulse RECEIVING, driving up to 128 elements)
  - **Voltage**: -50 V to 120 V (in steps of 10V)
  - **Output Impedance**: <32 ohms
  - **Trigger Synchronization**: External digital input, encoder or internal

- **Software Options**
  - **TOFD**
    - TOFD module includes all acquisition & measurement software tools.
  - **CSV EXPORT**
    - Software function to export view data into a CSV format

**Supported Inspection Codes**
- Other relevant Codes are also met.
Phased Array Transducers

X-Series

Building on the Phased Array instrumentation range from Sonatest Ltd, the X-Series of transducers now offer the operator a broader choice in range and frequencies; together with the assurance of industry standard configurations. These X-Series phased array probes have an integral 2.5 metre cable and an IPEX connector, compatible with the Sonatest veo and other leading phased array testing equipment.

X1 Series - Miniature & Sub-Miniature PA Probes

The X1 models are small probes for aerospace and limited access work. Key applications include “Scribe line” inspection.

X2 Series - General Purpose PA Probes

This is a general purpose compact probe design suitable for sector scanning applications.

X3 Series - Long Array Probes for Electronic Scanning

These probes are ideal for Linear Scanning applications (L-Scan or E-Scan).

X4 Series - Miniature Phased Array Probes with Integral Wedge

An integral wedge design which are dimensionally and ultrasonically equivalent to standard European mono-element shear wave probes. A good choice where a compact angle beam is required.

X5 Series - Medium Phased Array Probes - AWS, High Temperature & Deep Penetration

These are low frequency high energy probes intended for fairly deep penetration applications and general testing. These can also be used with the appropriate SW62XXX range wedges, including the “Snail” and high temperature.

DAAH (Detachable Active Array Head)

Sonatest manufacture a wide range of Array and Mono-Element probes suitable for use on the veo and other phased array flaw detectors.

The DAAH (Detachable Active Array Head) range provides a unique phased array probe solution using standard cables and a range of detachable probe heads. This concept yeilds advantages in cost and gives the end user more flexibility in the field during the inspection process.

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Model Number</th>
<th>No.of Elements</th>
<th>Pitch (mm)</th>
<th>Wedge</th>
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<tbody>
<tr>
<td>2.25</td>
<td>T1-PE-2.25M20E1.2P</td>
<td>20</td>
<td>1.2</td>
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<td>T1-PE-2.25M14E1.2P-35W0D</td>
<td>14</td>
<td>1.2</td>
<td>35° Integral</td>
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<tr>
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<td>T1-PE-2.25M18E1.2P-17W0D</td>
<td>18</td>
<td>1.2</td>
<td>17° Integral</td>
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<td>T1-PE-5.0M32E0.8P</td>
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<td>0.8</td>
<td>External</td>
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<td>0.8</td>
<td>35° Integral</td>
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<tr>
<td>5</td>
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<td>64</td>
<td>0.8</td>
<td>WheelProbe</td>
</tr>
</tbody>
</table>

Further transducer models available. Enquire for full range.
veo Kits & Accessories

Standard veo Kit
- Calibration Certificate
- UT Studio Single user licence
  - Conventional Views (A/B/C/D)
  - Phased Array Views (S/L-Scan)
  - Viewing Reports
- USB Memory Stick (8GB)
- Lithium-Ion Battery packs x 2
- Power Cord & Power Supply adaptor
- Quick Start Guide & User Manual CD
- Screen Protector (Anti-Glare)
- Carry Strap
- 4-point Neck Harness
- Transport Case (Airplane carry on size)

veo Kits
- veo & Magman Scanner
- veo & Corrosion WheelProbe
- veo & Manual TOFD
- veo & Manual Weld

veo Accessories
- Splash Proof USB Keyboard
- Waterproof Mouse
- Battery Charger
- Tripod
- Lithium-Ion Battery pack
- UT Studio - Professional edition
- QuickTrace Encoder
- Rapidscan to veo Encoder Adapter
- DAAH Array probe cable
- Screen Protector
- USB Memory Stick (8GB)
- Phased Array Cable Y-Splitter
- Splitter Box (32/32 or 64/64)
- TOFD 40 dB Pre-amp
- Phased Array Test Block Steel
- Phased Array Test Block Aluminium
- HD15 Encoder Adapter

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