

Advanced Ultrasonic Flaw Detectors with Phased Array Imaging



Conventional UT

Conventional UT with PA



EPOCH 1000 Series — Advanced Ultrasonic Flow Detectors with Phased Array Imaging



The EPOCH® 1000 series digital ultrasonic flow detectors combine the highest level of performance for conventional portable flaw detection with the power of phased array imaging. The EPOCH 1000, 1000*i*R, and 1000*i* feature a horizontal case design with full VGA display, knob and navigation arrows for parameter adjustment, and full EN12668-1 compliance. The advanced conventional ultrasonic functionality of the EPOCH 1000 series has been enhanced with phased array imaging capabilities in the EPOCH 1000*i*.



Key Features

- Available with Phased Array Imaging package
- EN12668-1 compliant
- 37 digital receiver filter selections
- 6 kHz pulse repetition rate for high-speed scanning
- Encoded or time-based C-scan option
- Automatic phased array probe recognition
- Intuitive wedge delay and sensitivity calibration for all focal laws
- Programmable analog/alarm outputs
- Designed for IP66 environmental rating
- Horizontal design with a navigation panel and knob parameter adjustment
- Digital high dynamic range receiver
- Full VGA sunlight readable display
- ClearWave® visual enhancement package for conventional A-scan interpretation
- SureView® visualization feature
- Reference and measurement cursors
- Standard dynamic DAC/TVG
- Standard onboard DGS/AVG

Three Instrument Configuration Levels to Suit Many Inspection Needs

EPOCH 1000

Advanced UT

The EPOCH® 1000 is an advanced conventional ultrasonic flaw detector that can be upgraded with phased array imaging at an authorized Olympus service center.

EPOCH 1000iR

Advanced UT + Phased Array Ready

The EPOCH 1000iR provides the same ultrasonic flaw detection capabilities as the EPOCH 1000, with the benefit of upgrading to phased array with simple field-remote activation.

EPOCH 1000i

Advanced UT + Phased Array Built-in

The EPOCH 1000i comes standard with the same advanced ultrasonic flaw detection capabilities as the EPOCH 1000, with the addition of a built-in phased array imaging package.



*Field-Remote Upgradable,
Software*

Factory Upgradable, Software and Hardware



Key Industries and Applications

- General weld inspection
- Crack detection and sizing
- Power generation inspections
- AWS D1.1/D1.5 weld inspection
- Casting and forging defect inspections
- DGS/AVG defect sizing
- In-line inspections
- Composite delamination and defect inspections
- Aerospace and maintenance
- Automotive and transportation

Advanced Conventional Ultrasound Upgradeable to Phased Array

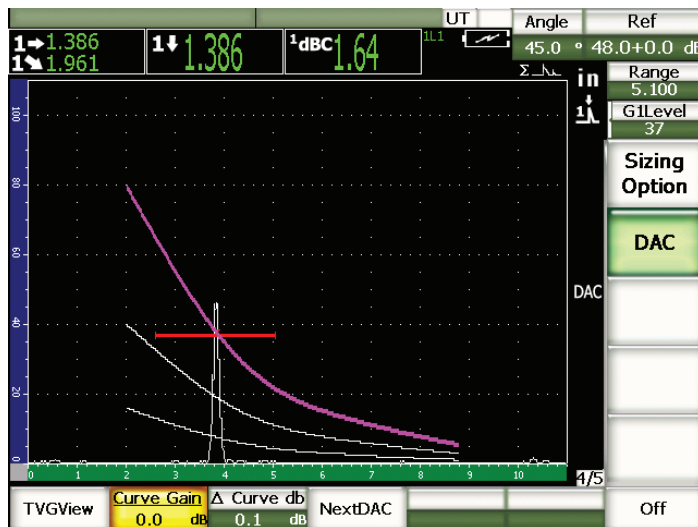
The EPOCH® 1000, EPOCH 1000iR, and EPOCH 1000i provide advanced conventional ultrasound capabilities for both basic and advanced level users. These portable instruments can also be integrated into small systems for high-speed scanning and single-channel imaging and come standard with a host of high-performance features, including a 6 kHz maximum Pulse Repetition Frequency (PRF) with single-shot measurements for accurate high-speed scanning applications, tunable square wave pulser with PerfectSquare™ technology, and comprehensive digital filter sets for exceptional signal-to-noise clarity.



Pulser/Receiver Features

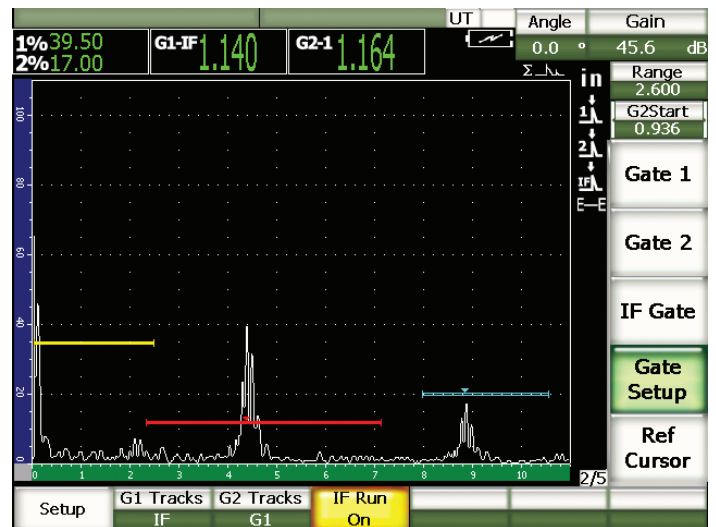
- Adjustable pulse repetition frequency (PRF): 5 Hz to 6 kHz
- Single-shot measurements in all standard modes
- Tunable square wave pulser with PerfectSquare™ technology
- Programmable analog and alarm outputs
- Over 30 digital filter sets
- Digital high dynamic range receiver

Standard Software Features



Dynamic DAC/TVG Mode

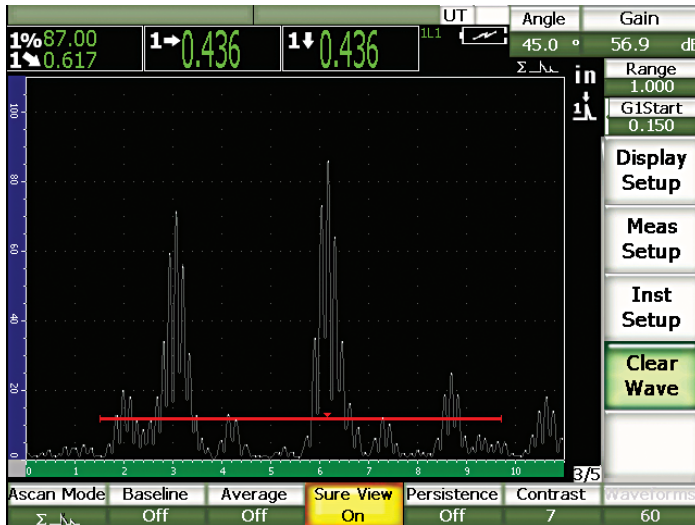
- **Dynamic DAC/TVG** – This standard feature enables fast and dynamic creation of DAC curves using reference reflectors, in addition to single-button switching from DAC to TVG mode. Includes ASME, ASME-III, JIS, 20% to 80% DAC, Custom, and TVG Table.
- **Onboard DGS/AVG** – The DGS/AVG flaw sizing technique uses calculated attenuation curves to aid you in sizing potential defects. A vast onboard library of characterized probes enables you to quickly and easily setup a DGS/AVG curve and perform precise flaw sizing.



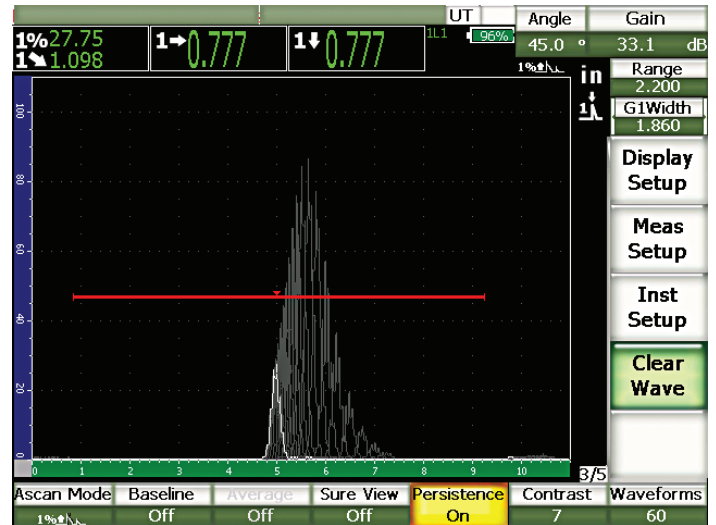
Interface Gate with Gate 1 and Gate 2 Tracking

- **Interface Gate** – This optional third measurement gate enables real-time tracking of a variable interface echo in order to maintain consistent digital measurements.
- **AWS Welding Rating** – This weld rating calculator provides a live AWS D1.1/D1.5 code-compliant “D” value weld rating for gated flaw indications.
- **Floating Gate** – This option enables you to “float” Gate 1 and/or Gate 2 at a selected height compared to a gated echo (–1 dB to –14 dB). This feature provides more consistent, precise readings, especially in Edge Detection mode.

ClearWave® Conventional Ultrasound Visual Enhancements



SureView Screen



Persistence Mode Screen

The EPOCH® 1000 series features a new and exciting set of visual enhancement capabilities to improve the quality and ease of detection in advanced applications.

- **SureView®** – This feature emulates the functionality of analog CRT displays, allowing you to visualize peak indications from reflectors by adding a point of light along the A-scan trace where every peak occurs.
- **Composite A-scan** – This feature uses every A-scan acquired in between screen update rates (multiple A-scans when PRF > 60 Hz) to draw a composite A-scan based on the maximum envelope of all the acquired A-scans. This feature increases confidence of visual detection when scanning quickly.
- **Max Amplitude** – This feature displays only the acquired A-scan with the highest gated amplitude reading between screen updates.

- **Persistence Mode** – This feature retains previously acquired A-scans on the instrument display for a user-selectable duration. This feature provides visual “memory” of an inspection for enhanced visual detection over a short period of time.
- **Baseline Break** – This feature displays “zero-cross” points as lines connecting individual A-scan lobes to the baseline in full-wave rectified mode.
- **Min Thickness** – This feature displays only the A-scan representing the minimum thickness reading between screen updates.
- **Averaged A-scan** – This feature enables you to view the average of the acquired A-scans. Averaging is applied in multipliers of 2x, 4x, 8x, 16x, 32x, and 64x.



Phased Array Imaging Package with Advanced Conventional Ultrasound

The EPOCH® 1000i provides powerful conventional ultrasonic and phased array flaw detection in a portable, rugged instrument. This instrument offers increased probability of detection of flaws, better visualization of areas of interest, and improves inspection efficiency by enabling a single setup to view A-scans at multiple angles (focal laws), thus eliminating the need for multiple probes and wedges. This instrument provides the same reliable and exceptional performance for conventional detection as the EPOCH 1000, with the added benefit of phased array capabilities. The EPOCH 1000i allows you to perform code-compliant inspections in accordance with conventional standards, with the advantage of phased array for increased accuracy and efficiency.

Available with a standard 16:16 configuration and upgradable to 16:64 configuration via software, the EPOCH 1000i also includes many sizing features to facilitate in-flaw inspections. The instrument comes standard with A-scan and S-scan reference and sizing cursors for flaw-size evaluation.



EPOCH 1000i Phased Array Specifications

Focal Laws	61
Maximum Elements	64 elements
Maximum Active Aperture	16 elements
Video Filtering	Off, Low, High
Display Modes	A-scan, S-scan, Linear scan, C-scan, A-scan plus image
Image Update Rate	60 Hz update for all A-scans; 20 Hz update for all images



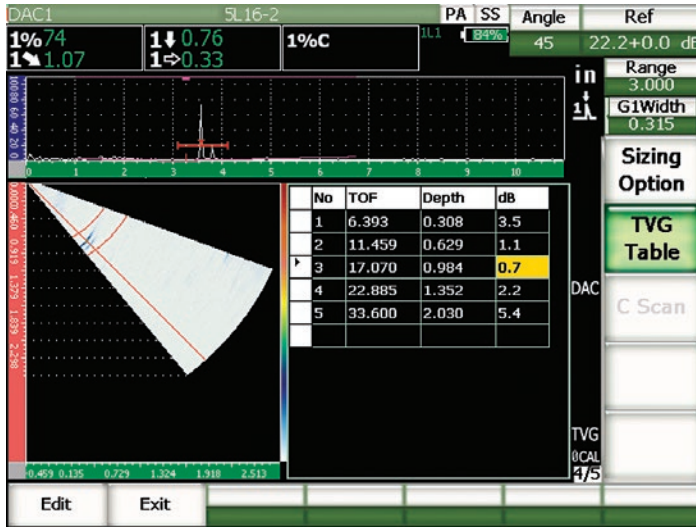
Combined A-scan and S-scan Views

The EPOCH 1000i features a standard combined A-scan and S-scan view that displays A-scan data from every angle between two user-defined start and end values. Each individual angle, collectively referred to as focal laws, can be selected to display a live A-scan enabling you to detect and characterize potential defects at multiple angles simultaneously using phased array imaging.

Calibration Across All Focal Laws

When calibrating for gain and zero offset in phased array mode, the EPOCH 1000i utilizes single-step procedures to calibrate across all focal laws. These automated calibration procedures allow you to capture peak amplitude or TOF/distance measurements from a single reflector across all the imaging angles (focal laws). The instrument then uses the captured amplitude or TOF/distance data to adjust the gain and zero offset at each focal law so that calibrated measurements are provided for every A-scan.

Phased Array Features for Manual Imaging Inspections



Phased Array DAC Edit Mode

Standard DAC/TVG for All Focal Laws

The EPOCH 1000i comes standard with DAC/TVG for all focal laws. This allows you to acquire a DAC curve or create a TVG setup from known reflectors for all defined angles/focal laws at once. The instrument then allows you to edit individual points acquired during setup for precise DAC or TVG presentation. After completing the setup, you can use the S-scan image to detect potential defects at various focal laws.



Phased Array DGS/AVG Mode

Standard Phased Array DGS/AVG

The DGS/AVG flaw sizing technique is included as a standard option in phased array mode. This feature uses the probe ID and wedge information to establish the DGS/AVG curve characteristics and applies the curve at 0°, 45°, 60°, and 70° focal laws. The standard EPOCH onboard DGS/AVG menu and modified GAIN calibration tool allow for quick and easy setup. The option also provides an interpolated image TVG for easy detection across a given soundpath range.



Weld Inspection Solutions with Phased Array

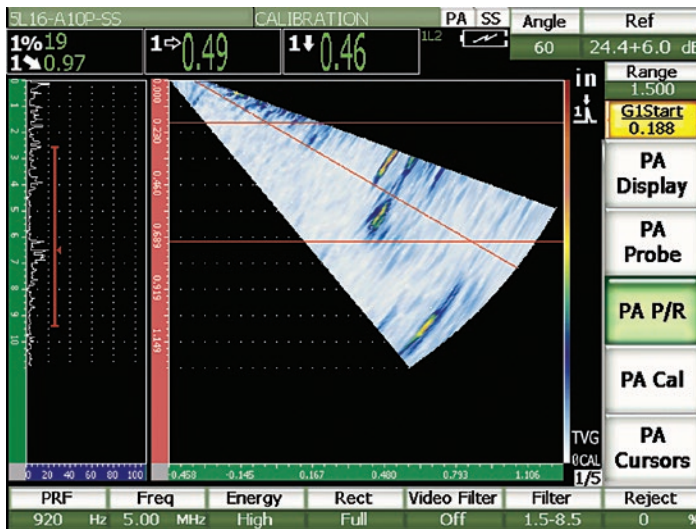


Phased Array S-scan with Weld Overlay

Weld Overlay

Weld Overlay is a standard inclusion on the EPOCH 1000i, providing a visual reference of a weld profile on the S-scan display. This profile enables you to visualize the relative position of indications in relation to the weld geometry.

A weld centerline cursor allows manual positioning of the overlay on the S-scan. The Weld Overlay enhances your ability to locate, characterize, and size flaws within the component during inspection, and improves reporting.

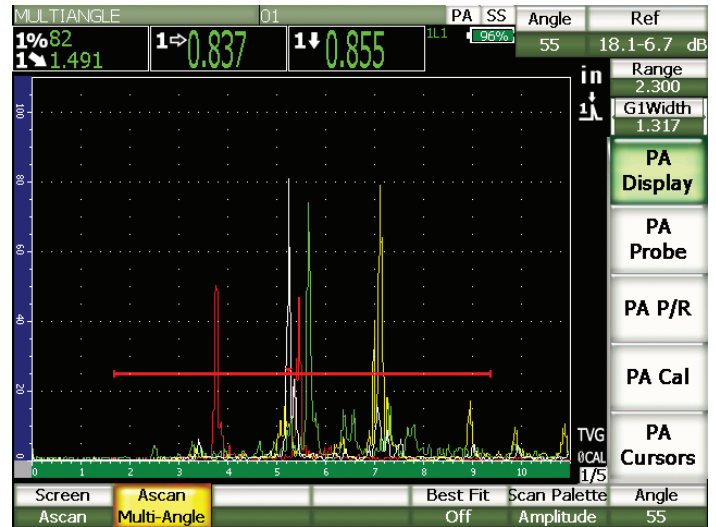


A-scan and S-scan view with True Depth Gates

True Depth Gates

Measurements gates can be displayed in True Depth mode on the Sector Scan, thus enabling you to acquire measurements from a constant depth area throughout the part, regardless of the focal law selected. This is particularly helpful when using the encoded C-scan option, as it enables you to collect information for one entire skip distance with a single gate position.

The True Depth gates display as horizontal lines on the S-scan only; the A-scan view remains in Soundpath mode.



Multi-Angle Phased Array Mode

EPOCH 1000i Multi-Angle

The EPOCH 1000i phased array mode includes a standard feature called Multi-Angle. This feature enables you to designate any three angles, or focal laws, available in the sector scan as “visible” focal laws. The A-scans from each of the three designated angles are overlaid, one on top of the other, in the A-scan window, enabling you to view all three A-scans at the same time. Each individual angle is color coded for ease of use. This feature is perfect for inspectors using conventional sizing methods requiring evaluation at 45°, 60°, and 70°.



AWS “D” Weld Rating displayed for 45° focal law

AWS Weld Rating

The EPOCH 1000i comes with an AWS D1.1/D1.5 weld rating calculator. In conjunction with Olympus’ AWS-rated phased array transducer, this enables you to use imaging capabilities for flaw detection while sizing flaws at 45°, 60°, and 70° using the conventional A-scan technique, and also view the D value for onscreen weld rating of any selected A-scan (focal law).

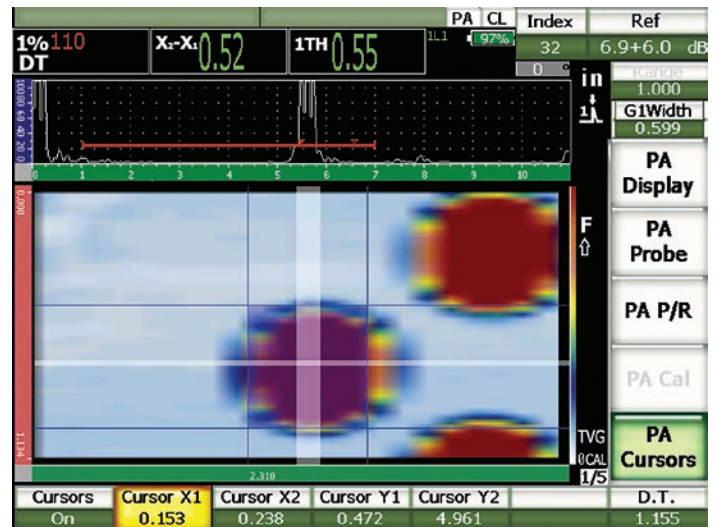
Linear Scans and Encoded C-scans

This optional software feature expands the EPOCH 1000i to a 16:64 element configuration and enables linear scans in addition to encoded or timed C-scans. Linear scans are collected using a probe with up to 64 elements and a maximum active aperture of 16 elements.

C-scan imaging is created by accumulating image data from the programmed linear scan or S-scan across a single-line scan axis. An encoder is required to track the position as the probe is moved along the scan axis. This encoded C-scan image collects both time of flight (TOF) and amplitude data from two independent measurement gates. The live A-scan is viewable during C-scan acquisition. Compressed A-scan images can be stored for all points on the C-scan, and can be reviewed along with the S-scan or linear scan from a particular C-scan location for basic visual analysis. Data source and type can be adjusted dynamically after the scan is acquired, and cursors are available for basic scan sizing. Additional color palettes are available for phased array image scans. These color palettes provide different color scales for use with varied applications and can be modified to meet your specific needs.

Features

- Encoded or time-based C-scan
- Uni- or bi-directional encoding
- Supports probes with up to 64 elements
- Minimum scan resolution of 1 mm (0.040 in.)
- Compressed A-scan storage for all C-scan points
- C-scan can be created from S-scan or linear scan
- Encoding up to 3 m (118.11 in.) per scan (61 focal laws at 1 mm scan resolution)
- Image and A-scan review for visual analysis using cursors



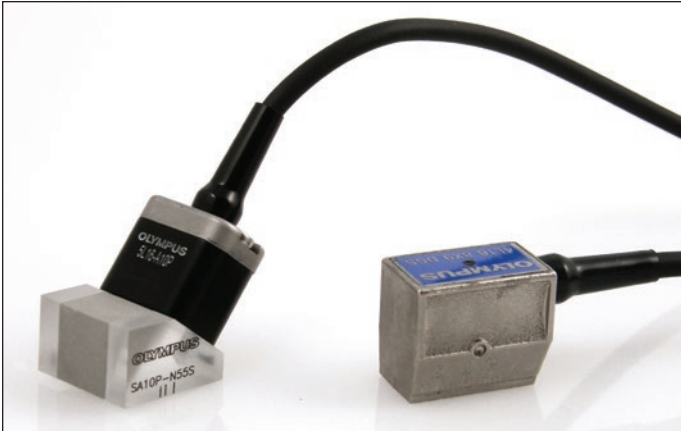
Zero-degree C-scan

Encoded C-scan Specifications

Maximum File Size	70 Mb
Minimum Scan Resolution	1 mm (0.040 in.)
C-scan Acquisition Rate	20 Hz
Saved A-scan size	500 points



EPOCH 1000i Phased Array Probes and Accessories



The EPOCH® 1000i supports a new series of phased array probes to meet the demands of critical inspections. These probes include specialized probes for specific code compliance and standard weld inspection probes, including removable or integral wedge phased array probes. Most common phased array probes with up to 64 elements are supported.

Fast Switch from Conventional to Phased Array

The EPOCH 1000i is compatible with all standard single element transducers in conventional mode. Switching between conventional UT and phased array inspection is as easy as pressing a button. The EPOCH 1000i features a high-speed transition from UT to PA mode, enabling you to easily combine conventional UT and phased array inspections.

Ordering Information

Numbering systems used to order standard phased array probes.

5L16-9.6x10-A10P-P-2.5-OM



Frequency

2.25 = 2.25 MHz
5 = 5.0 MHz
10 = 10.0 MHz

Array Type

L = Linear

Number of Elements

16 = 16 Elements

Active Aperture

Active aperture in mm

Elevation

Elevation in mm
Example 10 = 10.0 mm

Probe Type

A = angle beam with external wedge
DGS1 = DGS inspection/Atlas (AVG probe)
AWS1 = AWS Inspection

Casing Type

Casing type for a given probe type

Cable Type

P = PVC outer
M = Metal armor outer

Cable Length

Cable length in m
2.5 = 2.5 m
5 = 5.0 m
10 = 10.0 m

Connector Type

OM = OmniScan® connector

Probes*

Probe Description	Item Number	Usage/Code Compliance	Frequency (MHz)	Number of Elements	Pitch	Active Aperture (mm)	Elevation (mm)	Dimensions in mm L x W x H (in.)		
2.25L8-A10P	U8330663	General Purpose	2.25	8	1.2	9.6 x 10	10	22.5 (0.89)	15.6 (0.61)	20 (0.79)
5L16-A10P	U8330661		5.0	16	0.6	9.6 x 10	10	22.5 (0.89)	15.6 (0.61)	20 (0.79)
10L16-A10P	U8330662		10	16	0.6	9.6 x 10	10	22.5 (0.89)	15.6 (0.61)	20 (0.79)
2.25L16-AWS1	U8330660	AWS D1.1/D1.5	2.25	16	1.0	16 x 16	16	37.6 (1.48)	25.4 (1.0)	17.8 (0.70)
2L8-DGS1	U8330598	Integral Wedge/ DGS-AVG	2.0	8	1.0	8 x 9	9	27.3 (1.07)	16.8 (0.66)	22.3 (0.88)
4L16-DGS1	U8330597		4.0	16	0.5	8 x 9	9	27.3 (1.07)	16.8 (0.66)	22.3 (0.88)
5L64-A12	U8330593	General Purpose	5.0	64	0.6	38.4 x 10**	10	22.5 (0.89)	44.6 (1.76)	20 (0.79)

*All probes are supplied with 2.5-meter cable and OmniScan-style connector. For other variations contact Olympus NDT.

** Represents all 64 elements. Only 16 or fewer elements can be active at one time.

Mini-Wheel™ Encoder

The Mini-Wheel encoder can be used with the encoded C-scan option for the positioning and dimensioning of defects in the scan axis and can synchronize data acquisition with probe movement.

The Mini-Wheel encoder is waterproof and can be mounted onto the Olympus PA wedges using the included bracket kit. This miniature encoder is made entirely of stainless steel and features sealed bearings for long-lasting smooth operation. The custom electronic circuit was designed for minimal noise induction.

Features

- Waterproof (designed for IP68 rating).
- Small footprint dimensions.
- Double O-ring tire for better adherence.
- Sealed bearing for long-lasting smooth wheel rotation.
- Strain relief for cable protection.
- Two M3 threaded holes on top of the casing for rigid attachment.

Ordering Information

The Mini-Wheel encoder has been designed specifically for use with a variety of instruments. EPOCH 1000i users will require an adaptor cable to use this encoder.

Cable Number	Item Number	Description	Cable Length (m)
CABL-10016-0008	U8801209	EPOCH 1000i Mini-Wheel encoder adaptor cable	0.15
ENC1-2.5-DE	U8780197	Mini encoder, 2.5 m cable, DE15 connector for OmniScan MX	2.5
ENC1-5-DE	U8780198	Mini encoder, 5.0 m cable, DE15 connector for OmniScan MX	5.0

Wedges for Manual Inspection

Wedge Number	Item Number	Matching Probe(s)	Nominal Refracted Beam Angle (in steel)	Sweep (°)	Probe Orientation	Dimensions in mm (in.)		
						L	W	H
SA10P-0L	U8720704	2.25L8-A10P, 5L16-A10P, 10L16-A10P	0° LW	-30 to 30	Normal	25.4 (1.0)	23.1 (0.91)	20 (0.79)
SA10P-N55S	U8720705	2.25L8-A10P, 5L16-A10P, 10L16-A10P	55° SW	30 to 70	Normal	23 (0.91)	23.2 (0.91)	14.2 (0.56)
SAWS1-0L	U8700264	2.25L16-AWS1	0° LW	-30 to 30	Normal	38 (1.49)	37.6 (1.48)	40 (1.57)
SAWS1-N60S	U8720552	2.25L16-AWS1	55° SW	30 to 70	Normal	45.3 (1.78)	38 (1.49)	30.3 (1.19)

Wedges for Encoded Inspection

The wedges listed below have threaded inserts for connection to encoders. These wedges must be used for encoded inspection setups.

Wedge Number	Item Number	Matching Probe(s)	Nominal Refracted Beam Angle	Sweep (°)	Probe Orientation	Dimensions in mm (in.)			Removable IHC Ring
						L	W	H	
SA10-0L	U8720544	2.25L8-A10P, 5L16-A10P, 10L16-A10P	0° LW	-30 to 30	Normal	25.4 (1.0)	23 (0.91)	20 (0.79)	SA10-IHC
SA10-N55S	U8720545	2.25L8-A10P, 5L16-A10P, 10L16-A10P	55° SW	30 to 70	Normal	23 (0.91)	23 (0.91)	14.2 (0.56)	SA10-IHC
SA12-0L	U8720549	5L64-A12	0° LW	-30 to 30	Normal	61.8 (2.43)	23 (0.91)	53.4 (2.1)	SA12-IHC
SA12-N55S	U8720550	5L64-A12	55° SW	30 to 70	Normal	58 (2.28)	23 (0.91)	23 (0.91)	SA12-IHC



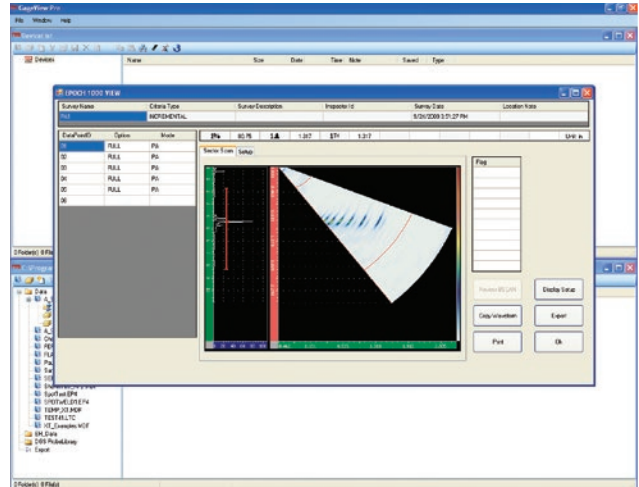
Standard Inclusions

- 1 Encoder with standard wheel
- 1 Bracket kit
- 1 Allen key screwdriver for bracket attachment
- 1 Carrying case

PC Data Management and Reporting

GageView® Pro Data Software

The EPOCH 1000 series is fully compatible with GageView Pro Olympus' standard portable instrument PC interface program. The GageView Pro interface program can be used to download saved data for review, export, and backup, and to generate reports containing setup parameters, measurement data, and waveforms. Database backup files can be viewed directly in GageView Pro using a USB memory stick without having to connect the EPOCH 1000 series instrument to the PC. This feature allows for backup, data review, and report generation of instrument files without having to remove the instrument from in-field work. Other tools, including an instrument firmware upgrade utility, are also available as part of this program.



Features

- Download saved inspection data and setup files.
- Review setup information and measurements on a PC.
- Export measurements and calibration data to common spreadsheet programs.
- Back up calibration and inspection data from the instrument.
- Upgrade instrument firmware.
- Generate reports with setup parameters, measurements, and waveforms.
- Access saved data through unit database backup files.

Accessories

The EPOCH 1000 series offers various optional accessories to allow full functionality of available features.

- EPXT-C-VGA-6 (U8779019):** VGA output cable
- EP4P/C-USB-6 (U8840084):** USB client cable
- EP1000-C-RS232-6 (U8779197):** RS-232 communications cable
- EP1000-C-26OUT-6 (U8779018):** Hardware I/O cable (alarm outputs triggering)
- EP1000-C-9OUT-6 (U8779017):** Hardware I/O cable (analog output)
- EP4/CH (U8140055):** Chest harness
- EPXT-EC-X:** External battery charger
- EPXT-BAT-L (U8760021):** Extra battery (lithium-ion)
- EP1000-TC-S (U8764078):** Small Transport Case
- EP1000-TC-L (U864079):** Large Transport Case



Small Transport Case (P/N: EP1000-TC-S)



Large Transport Case (P/N: EP1000-TC-L)

Rugged. Portable. Meets the Demands of the Toughest Inspection Environments.

The EPOCH® 1000 series is designed to meet the IP66 environmental rating. Tested for shock, vibration, explosive atmosphere, and wide temperature range, these instruments can withstand operation in harsh inspection conditions. Some of the EPOCH 1000 series' other key physical features include:

- Large, full VGA (640x480) resolution color transfective display for optimum viewing in low or bright lighting conditions.
- Rugged rubber handle for easy transport.
- Durable instrument-mounted D-rings for chest harness use.
- Front and rear stands for table-top or steep inclined viewing.
- USB Client and Host ports for PC communication, direct printing and communication with peripheral devices.
- VGA output for presentations, training, and remote instrument monitoring.
- Programmable analog outputs, alarm outputs, and RS-232 communication.
- Standard internal, rechargeable lithium-ion battery.



General Specifications	
Overall dimensions (W x H x D)	252 mm x 177 mm x 107 mm (9.92 in. x 6.97 in. x 4.2 in.)
Weight	3.67 kg (8.1 lb), including lithium-ion battery
Keypad	English, International, Japanese, Chinese
Languages	English, Spanish, French, German, Japanese, Chinese, Russian, Italian, Polish
Transducer connections	BNC or Number 1 LEMO
Data storage	Onboard up to 10,000 IDs with waveform, standard 4 GB compact flash card (removable)
Battery type	Single lithium-ion rechargeable standard
Battery life	8 hours (conventional UT mode); 7 hours (phased array mode)
Power requirements	AC Mains: 100 VAC to 120 VAC, 200 VAC to 240 VAC, 50 Hz to 60 Hz
Standby mode	Adjustable from 15 minutes to 120 minutes with 50% less battery consumption.
Display type	Full VGA (640 x 480 pixels) Transfective Color LCD, 60 Hz update rate
Display dimensions (W x H, Diag.)	132.5 mm x 99.4 mm, 165.1 mm (5.2 in. x 3.9 in., 6.5 in.)
Inputs/Outputs	
USB ports	1 USB Client, 3 USB Host ports
RS-232	Yes
Video output	VGA output standard
Analog output	4 analog outputs, Selectable 1V/10V Full Scale, 4 mA max
Alarm output	6 alarm outputs, 5V TTL, 10 mA
Trigger I/O	Trigger input 5V TTL; trigger output, 5 V TTL, 10 mA
Encoder inputs	2-axis encoder line (quadrature)
Environmental Ratings	
IP rating	Designed to meet requirements of IP66
Explosive atmosphere	Tested to MIL-STD-810F, Method 511.4, Procedure 1. Atmosphere defined per NFPA 70, Article 500 as Class I, Division 2, Group D.
Shock tested	IEC 600689-2-27, 60 g's, 6 µsec Half-Sine, 18 Axes total
Vibration tested	Sine vibration, IEC 60068-2-6, 5 Hz to 150 Hz @ 0.03 in. or 2 g's Displacement Amplitude, 20 sweep cycles
Operating temperature	-10 °C to 50 °C (14 °F to 122 °F)
Battery Storage temperature	-20 °C to 60 °C (-4 °F to 140 °F)
Battery Recharge temperature	0 °C to 40 °C (32 °F to 104 °F)

EPOCH 1000 Series Conventional/Phased Array Specifications*

EPOCH 1000, EPOCH 1000iR, EPOCH 1000i (conventional UT mode)		EPOCH 1000i (PA mode)
Pulser		
Pulser type	Tunable Square Wave	
PRF	5 Hz to 6,000 Hz in 5 Hz increments	Manually adjustable. Maximum 1,520 Hz
Energy settings	50 V to 475 V in 25 V increments	40 V or 80 V
Pulse width	Adjustable from 45 ns to 5,000 ns (0.1 MHz) with PerfectSquare Technology	Adjustable from 45 ns to 1,000 ns (0.5 MHz) with PerfectSquare Technology
Damping	50 Ω, 100 Ω, 200 Ω, 400 Ω	Not applicable
Pulser delay	Not applicable	0 to 10 μs, 2.5 ns resolution
Receiver		
Gain	0 to 110 dB	0 to 80 dB
Maximum input signal	20 Vp-p	250 mVp-p per channel
Receiver input impedance	400 Ω ± 5%	50 Ω ± 10%
Receiver bandwidth	0.2 MHz to 26.5 MHz @ -3 dB	0.5 MHz to 12.5 MHz @ -3 dB
Receiver delay	NA	0 μs to 10 μs, 2.5 ns resolution
Digital filter settings	Standard filter set (EN12668-1 Test & Compliant): 7 filters Advanced filter set (not tested to EN12668-1): 30 filters	6 filters
Rectification	Full wave, positive half wave, negative half wave, RF	
Reject	0 to 80% FSH with visual warning	
Amplitude measurement	0% to 110% full-screen height with 0.25% resolution	
Measurement rate	Equivalent to PRF in all modes	
Calibration		
Automated calibration	<ul style="list-style-type: none"> • Velocity, Zero Offset • Straight Beam (first back wall or echo-to-echo) • Angle Beam (Soundpath or Depth) 	<ul style="list-style-type: none"> • Velocity, Zero Offset, Sensitivity • Soundpath or Depth (Zero Offset)
Test modes	Pulse Echo, Dual, or Through Transmission	Pulse Echo
Units	Millimeters, inches, or microseconds	
Range	3.33 mm to 26,808 mm (0.131 in. to 1054.1 in.) at 5900 m/s (0.2320 in./μs)	61 focal laws, 3.33 mm to 390.95 mm (0.131 in. to 15.373 in.) at 5900 m/s (0.2320 in./μs)
Velocity	635 to 15, 240 m/s (0.0250 to 0.6000 in./μs)	
Zero offset	0 μs to 750 μs	Automatic for all focal laws through calibration, or Manually adjustable from 0 to 100.00 μs (Global Delay Offset mode)
Display delay	-59 mm to 25,400 mm (-2.323 in. to 1000 in.)	0 to max range
Refracted angle	0° to 85° in 0.1° increments	61 angular focal laws, 0.5°, 1.0, 1.5°, or 2.0° increments Adjustable from -80° to +80°
Gates		
Measurement gates	Two fully independent gates for amplitude and time-of-flight measurements	
Measurement mode	Soundpath	Soundpath, Depth
Interface gate	Optional, with Gate 1 and Gate 2 tracking	Not applicable
Gate start	Variable over entire displayed range	
Gate width	Variable from gate start to end of displayed range	
Gate height	Variable from 2% to 95% full-screen height	
Alarms	<ul style="list-style-type: none"> • Positive and negative threshold • Minimum depth 	<ul style="list-style-type: none"> • Positive and negative threshold (for selected focal law) • Minimum depth (for selected focal law)
Reference cursors	Two reference cursors for A-scans	Two reference cursors for A-scans; four reference cursors for images
Measurements		
Displayed measurement	Six locations available (manual or auto selection)	
Gate 1	Thickness, soundpath, projection, depth, amplitude, time-of-flight, min./max. depth, min./max. amplitude	
Gate 2	Same as Gate 1	
IF Gate (optional)	Thickness	Not applicable
Echo-to-Echo	Standard. Choose between Gate2-1, Gate2-IF, and Gate1-IF	Standard
Other measurements	Overshoot (dB) value for DGS/AVG, ERS (equivalent reflector size) for DGS/AVG, AWS D1.1/D1.5 rating (D), reject value	
DAC/TVG	Standard	
DAC points	Up to 50 points, 110 dB dynamic range	Up to 20 points, 40 dB dynamic
Special DAC modes	20% to 80% DAC, Custom DAC (up to 6 curves)	Not applicable
TVG table	Up to 50 points, 110 dB dynamic range, compatible with IF Gate at all PRF settings	Up to 20 points, 40 dB dynamic
Curved surface correction	Standard. Tube or bar OD correction for angle beam measurements	



The EPOCH® Flaw Detector Family: The EPOCH flaw detector line features vertical and horizontal layout instruments that span the range of inspection capabilities from basic to advanced. The EPOCH 600 and EPOCH 1000 series flaw detectors feature horizontal layout instruments for enlarged A-scan and image representation in a portable format, and provide an exceptionally high quality of digital flaw detection technology.

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For enquiries - contact
www.olympus-ims.com/contact-us

OLYMPUS CORPORATION OF THE AMERICAS
48 Woerd Avenue, Waltham, MA 02453, USA, Tel.: (1) 781-419-3900
110 Magellan Circle, Webster TX, 77598, USA, Tel.: (1) 281-922-9300
OLYMPUS NDT CANADA INC.
505, boul. du Parc-Technologique, Québec (Québec) G1P 4S9, Tel.: (1) 418-872-1155
1109 78 Ave, Edmonton (Alberta) T6P 1L8

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