EPOCH® 650

Versatile and Rugged Flaw Detector

- Compact and Rugged
- Powerful Data Reporting
- Intuitive Interface
- ISO 22232-1 Compliant

EPOCH® 650 Ultrasonic Flaw Detector

Economical Size, Quality Performance

The large, full VGA transflective display combined with our patented digital high dynamic range receiver provides a stable, striking A-scan representation in any lighting condition. The EPOCH 650 flaw detector is designed to meet the requirements of ISO 22232-1 and allows a full range of standard and optional flaw detection features. Multiple onboard reporting tools and a comprehensive data filing system enable you to easily collect and report high-quality inspection data. The rugged, ergonomic design enables use in nearly any inspection environment, while the flexible PerfectSquare™ pulser and highest number of digital filters in its class can tackle nearly any application.

The EPOCH 650 digital ultrasonic flaw detector combines Evident' industry-leading conventional flaw detection capabilities with the efficiency of a highly portable, intuitive instrument. The EPOCH 650 flaw detector's blend of efficient menus and direct access keys enables you to take advantage of the highest quality flaw detection platform with exceptional ease of use.

Designed for All Inspection Environments

The EPOCH 650 flaw detector is designed for use in nearly any inspection environment, from benchtop testing in a laboratory to extreme outdoor and hazardous conditions. Designed for IP rating in either knob (IP66) or navigation pad (IP67) configurations and tested to very high environmental and reliability standards, the EPOCH 650 flaw detector enables users in any inspection environment to feel confident in both the performance and durability of the instrument.

Key Features

- Designed to meet the requirements of ISO 22232-1
- PerfectSquare™ tunable square wave pulser
- Full screen A-scan mode
- Digital high dynamic range receiver
- Thirty digital filters for enhanced signal-to-noise ratio
- 2 kHz PRF for rapid scanning
- Knob or navigation pad adjustment configurations
- Large, full VGA sunlight readable display
- 15+ hours of battery life
- Standard dynamic DAC/TCG and onboard DGS/AVG
- Multiple onboard report formats
- microSD™ memory card for data transfers
- Optional Corrosion Module software with encoded B-scan
- USB on-the-go (OTG) for PC communication
- Alarm and VGA outputs
- Optional analog output

Simple and Comfortable Operation

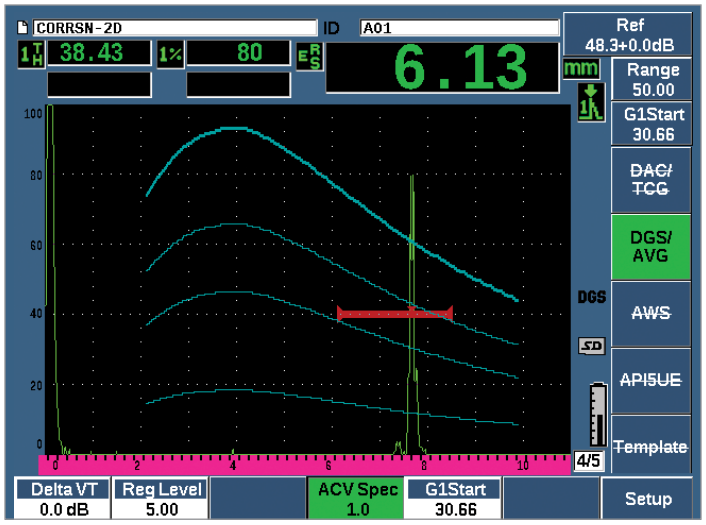
The EPOCH 650® flaw detector's design is focused on providing a very high level of flaw detection with the simplicity of a basic instrument. The instrument is designed to be ergonomic, intuitive, and practical for both experienced and novice ultrasonic inspectors.

Intuitive User Interface

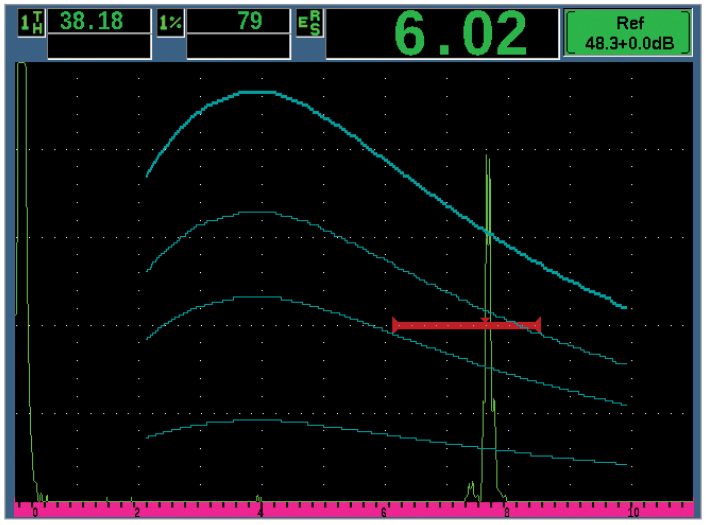
The user interface combines a simple menu structure for instrument settings, calibration, and software feature adjustment, with the EPOCH brand's hallmark direct-access key approach for critical inspection functions such as gain and gate adjustment, screen freeze, and file save. Supported in multiple languages, the user interface is intuitive for any level of operator.

Vibrant VGA Display with Full Screen Mode

The EPOCH 650 flaw detector features a full VGA (640 x 480 pixels) resolution display. The horizontal design optimizes the A-scan size and readability on this high-quality display. Built with transflective technology, this VGA display provides excellent clarity in indoor, low-lighting conditions using its powerful backlight, as well as in direct sunlight by using the ambient light as a pseudo-backlight. The full screen mode feature enhances this vibrant display to provide a large A-scan.



EPOCH 650 DGS/AVG feature—standard screen mode



EPOCH 650 DGS/AVG feature—full screen mode

Options for Comfortable Navigation

To accommodate different user needs and preferences, the EPOCH 650 flaw detector is available in two hardware configurations:

Knob

The adjustment knob is used along with the CHECK and ESC keys to adjust parameter values in either coarse or fine increments. You have the ability to lock the knob to prevent accidental parameter value changes during an inspection. This configuration provides smooth value slewing for customers who prefer adjusting parameters using a knob. The knob configuration is designed to meet the requirements of IP66.

Navigation Pad

The navigation pad is a hallmark feature of the EPOCH flaw detectors. The up and down arrows on the navigation pad are used for coarse parameter adjustment and the left and right arrows for fine adjustment. The navigation pad also contains additional functions and frequently used parameters such as gain, save, and the CHECK and ESC keys. The navigation pad configuration is designed to meet the requirements of IP67.

Optimized Access to Powerful Features

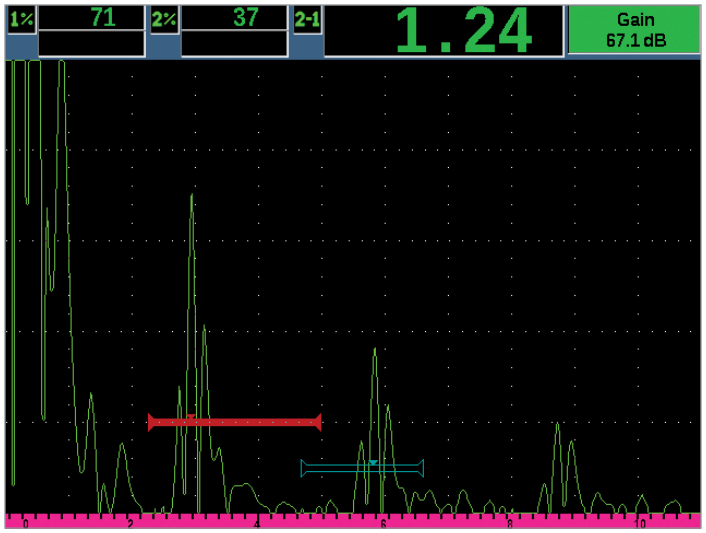
The EPOCH® 650 flaw detector provides excellent quality ultrasonic performance. The instrument provides flexible, powerful pulsing and receiving features to accommodate the needs of most flaw detection inspections.

Pulser/Receiver

The EPOCH 650 flaw detector comes standards with powerful flaw detection capabilities, such as:

- PerfectSquare™ tunable square wave pulser
- Digital high dynamic range receiver
- Thirty (30) 100% digital filter sets
- Auto or manually adjustable PRF from 10 Hz to 2000 Hz
- Pulser voltage from 100 V to 400 V
- Amplitude resolution to ± 0.25%
- Five customizable digital measurements

EPOCH 650 dynamic DAC/TCG feature



EPOCH 650 echo-to-echo with gate tracking

Standard Software Features

Dynamic DAC/TCG: Calculates signal amplitude as a percentage or decibel level compared to a DAC curve or a reference echo amplitude fixed at a time-varied gain. DAC versions include Standard, ASME 3, JIS, and Custom. Also includes several key features: dynamically adjustable DAC curves, switchable DAC and TCG views, custom DAC warning curves, and 20–80% DAC views, and an editable TCG table.

DGS/AVG: This flaw sizing technique allows echo signals to be evaluated with a DGS/AVG diagram associated to a particular type of probe and material. The DGS/AVG diagram illustrates the relationships between echo height, flaw size, and distance from the transducer.

AWS D1.1 and D1.5: Provides a dynamic reflector indication rating for various AWS weld inspection applications. This allows more efficient inspections by eliminating manual calculations.

Versatility Through Optional Performance

Optional Software Features

Interface Gate: This optional third measurement gate enables real-time tracking of a variable interface echo in order to maintain consistent digital measurements.

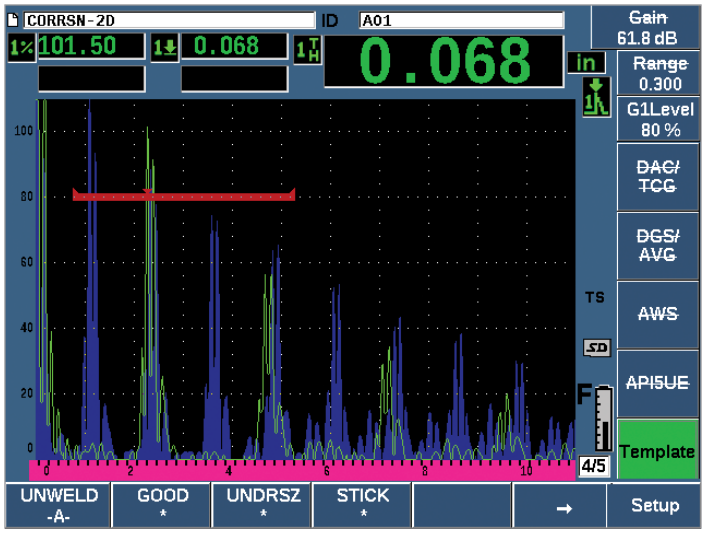
Corrosion Module: Simplified corrosion mode enabling automatic ultrasonic setups based on transducer selection, Automatic Gain Control (AGC), thickness gage measurement algorithm, V-path correction, and transducer wear compensation using an automatic zero function ("Do Zero"). Also features color-coded grid view and encoded B-scan.

Template Storage: Enables on-screen comparison of a live waveform with a saved reference waveform. Saved templates can be dynamically toggled on and off with a single key press for fast waveform comparison. Excellent for spot-weld analysis and other applications.

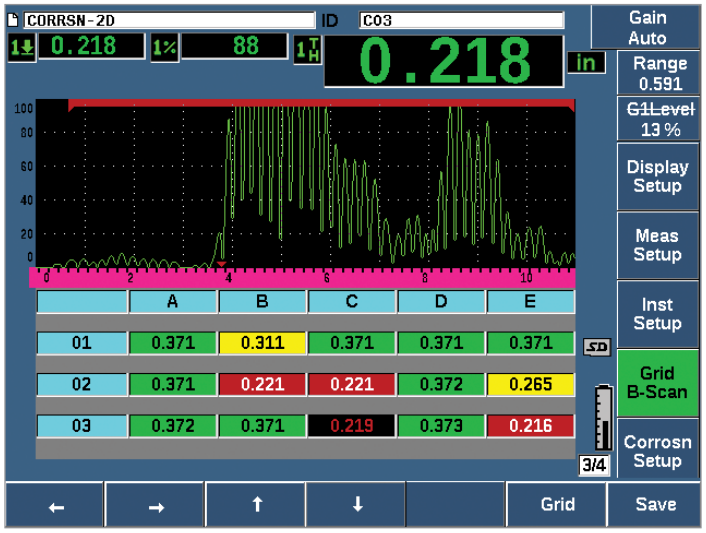
Backwall Echo Attenuator (BEA): Attenuates the backwall of an inspected part using the screen region defined by Gate 2.

API 5UE: Allows defect sizing according to API Recommended Practice 5UE. Uses the Amplitude Distance Differential Technique (ADDT) to measure the size of potential defects during the prove-up process of OCTG pipe.

Waveform Averaging: This feature allows live A-scan averaging 2X, 4X, 8X, 16X, and 32X.



EPOCH 650 template storage feature



EPOCH 650 Corrosion Module feature

Data Logging and PC Interfacing

Data Management

The EPOCH® 650 flaw detector offers several methods of storing, archiving, and reporting inspection and calibration data. The instrument features up to 100,000 points of onboard memory, as well as video recording and review. It is also fully compatible with the GageView® Pro PC Interface program. With quick file setup functions and flexible data management, logging and reporting inspection data is simple and efficient.

Data Logger

The EPOCH 650 flaw detector features an onboard data logger for calibration and inspection file storage. The instrument comes with two primary file types: calibration (CAL) and incremental (INC) files. CAL files enable you to save a virtually unlimited number of parameter setups for fast and easy recall to live settings. INC files store multiple pieces of inspection data under a single file name for downloading and reporting by inspection.

The onboard data logger is enhanced by full featured corrosion-style data logger file types standard on the instrument. This feature includes the following data file types: sequential, sequential with custom point, 2D grid, 2D grid with custom point, 3D grid, boiler, 2D EPRI.

GageView® Pro

Used with GageView Pro software, you can download inspection data, review measurements on a PC, export measurements and calibration data to common spreadsheet programs, back up calibration and inspection data from the instrument, and perform basic operations such as instrument firmware upgrades and screen captures.

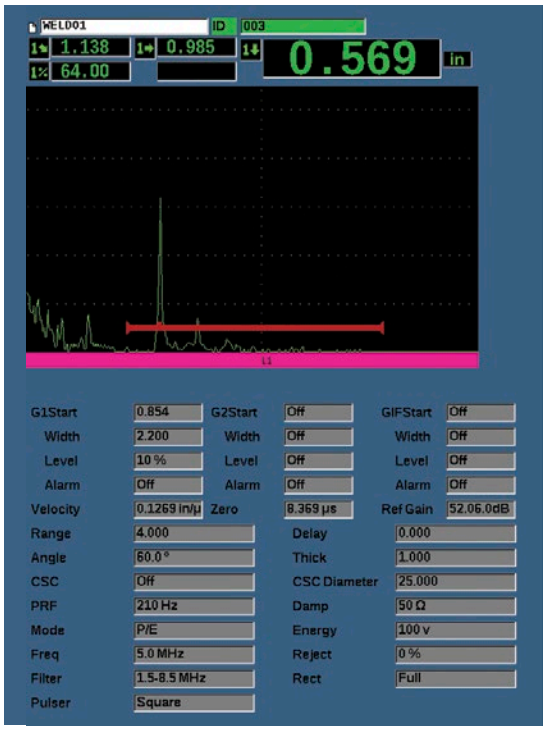
Memory

The EPOCH 650 flaw detector uses an external microSD™ memory card (2 GB included, up to 64 GB supported) for both onboard and removable memory. Through removable memory, you are able to share files between instruments, as well as output reports in various formats. A second 2 GB microSD card is mounted to the PC board inside the instrument and is responsible for all onboard data storage. In the event the instrument is damaged beyond repair, this microSD card can be removed at an authorized service center, enabling the operator to recover critical data from the damaged instrument.

Onboard Reporting

Reports can be generated on the instrument in a variety of formats. You can easily capture screen shots to the removable microSD card, as well as export saved data in .csv or .xml files. The instrument also features bitmap report generation for single data points or entire files.

The EPOCH 650 flaw detector comes standard with a video recording feature. You can capture up to 8 minutes of the live A-scan inspection data at 60 frames per second. This data can be reviewed on the instrument or exported for review on a PC.



EPOCH 650 onboard file report output (bitmap format)

Portable, Rugged, and Ergonomic

Standard Package

- EPOCH® 650 digital ultrasonic flaw detector, AC or battery operation
- Charger/AC adaptor (100 VAC, 115 VAC, 230 VAC, 50 Hz or 60 Hz)
- Rechargeable lithium-ion battery
- Transport case
- USB cable
- Quick reference card
- Comprehensive operation manual (CD)

Physical Features – Rear

A – USB On-The-Go port
B – microSD™ card
C – DC power connector
D – VGA port
E – Digital I/O port
F – Transducer connectors (2)
G – Battery door
H – Pipe stand

Physical Features

The portable, lightweight EPOCH 650 flaw detector is built to be rugged and flexible for nearly any inspection. Some key features include:

- Large, full VGA resolution transflective display for vivid clarity in any indoor lighting and direct sunlight conditions
- Rubber overmolded bumpers on all four corners for shock absorption and anti-marring considerations
- Four-point harness connection for chest straps
- "No tools" access to battery compartment and side I/O door
- Continuous position stand with right angle crook for improved stability from 0 to 180 degrees
- Gasketed side door for USB OTG connection and removable memory
- Standard internal, rechargeable lithium-ion battery
- Lightweight, ergonomic design for increased portability and ease of use

Instrument Inputs/Outputs

USB ports	USB On-The-Go (OTG)
RS-232 port	Yes
Video output	VGA output standard
Analog output	1 analog output (optional), selectable 1 V/10 V full scale, 4 mA max
Alarm output	3 alarm outputs, 5 V TTL, 10 mA
Trigger I/O	Trigger input, 5V TTL; Trigger output, 5V TTL, 10 mA max
Encoder inputs	1-axis encoder line (quadrature—Corrosion Module mode only)

Environmental Ratings

IP rating	Designed to meet the standards of the Ingress Protection (IP) rating number IP67 (navigation pad version) or IP66 (knob version) per IEC 60529-2004 (Degrees of Protection provided by enclosures – IP Code). The product design was confirmed to meet the IP rating by means of the Evident internal design verification test process that occurs prior to the release of the product to production.
Explosive atmosphere	Safe operation as defined by Class I, Division 2, Group D, as defined in the National Fire Protection Association Code (NFPA 70), Article 500, and tested using MIL-STD-810F, Method 511.4, Procedure I. A version that conforms to the requirements of the ATEX directive is available.* For more information, visit us online at www.evidentscientific.com.
Shock tested	MIL-STD-810F, Method 516.5 Procedure I, 6 cycles each axis, 15 *g*, 11 ms half sine.
Vibration tested	MIL-STD-810F, Method 514.5, Procedure I, Annex C, Figure 6, general exposure: 1 hour each axis
Operating temperature	–10 °C to 50 °C (14 °F to 122 °F)
Battery storage temperature	0 °C to 50 °C (32 °F to 122 °F)

EPOCH® 650 Specifications*

General

Overall dimensions (W x H x D)	236 mm x 167 mm x 70 mm (9.3 in. x 6.57 in. x 2.76 in.)
Weight	1.6 kg (3.5 lb), including lithium-ion battery
Keypad	English, International, Japanese, Chinese
Languages	English, Spanish, French, German, Japanese, Chinese, Portuguese, Russian
Transducer connections	BNC or Number 1 LEMO®
Data storage	100,000 IDs onboard, removable 2 GB microSD™ card (standard)
Battery type	Single lithium-ion rechargeable standard
Battery life	15 h to 16 h (lithium-ion)
Power requirements	AC mains: 100 VAC to 120 VAC, 200 VAC to 240 VAC, 50 Hz to 60 Hz
Display type	Full VGA (640 x 480 pixels) transflective color LCD, 60 Hz update rate
Display dimensions (W x H, Diag.)	117 mm x 89 mm, 146 mm (4.62 in. x 3.49 in., 5.76 in.)

Pulser

Pulser	Tunable Square Wave
PRF	10 Hz to 2000 Hz in 10 Hz increments
Energy settings	100 V, 200 V, 300 V or 400 V
Pulse width	Adjustable from 25 ns to 5,000 ns (0.1 MHz) with PerfectSquare™ technology
Damping	50, 100, 200, 400 Ω

Receiver

Gain	0 to 110 dB
Maximum input signal	20 V p-p
Receiver input impedance	400 Ω ± 5%
Receiver bandwidth	0.2 MHz to 26.5 MHz at –3 dB
Digital filter settings	Thirty digital filter sets standard Seven ISO 22232-1:2020 compliant filters (0.2-10 MHz, 2.0-21.5 MHz, 8.0-26.5 MHz, 0.5-4 MHz, 0.2-1.2 MHz, 1.5-8.5 MHz, 5-15 MHz)
Rectification	Full-wave, Positive half-wave, negative half-wave, RF
System linearity	Horizontal: ± 0.5% FSW
Resolution	0.25% FSH, amplifier accuracy ± 1dB
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	Velocity, Zero Offset Straight Beam (First Backwall or Echo-to-Echo) Angle Beam (Soundpath or Depth)
Test modes	Pulse Echo, Dual, or Through Transmission
Units	Millimeters, inches, or microseconds
Range	3.36 mm to 13,388 mm (0.132 in. to 527.10 in.) at 5,900 m/s (0.2320 in./µs)
Velocity	635 m/s to 15240 m/s (0.0250 in./µs to 0.6000 in./µs)
Zero offset	0 to 750 µs
Display delay	-59 mm to 13,401 mm (-2.320 in. to 526.97 in.) @ longitudinal velocity in steel
Refracted angle	0° to 90° in 0.1° increments

Gates

Measurement gates	2 fully independent gates for amplitude and TOF measurements
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	Positive and Negative Threshold, Minimum Depth (Gate 1 and Gate 2)

Measurements

Measurement display locations	5 locations available (manual or auto selection)
Gate (1, 2)	Thickness, Soundpath, Projection, Depth, Amplitude, Time-of-Flight, Min./Max. Depth, Min./Max. Amplitude
Echo-to-Echo	Standard Gate 2-Gate 1, Optional IF Gate Tracking
Other measurements	Overshoot (dB) value for DGS/AVG, ERS (equivalent reflector size) for DGS/AVG, AWS D1.1/D1.5 A, B, C and D values, Reject Value, Echo to RefdB values
DAC/TCG	Standard
DAC points	Up to 50 points, 110 dB dynamic range
Special DAC modes	Custom DAC (up to 6 curves), 20–80% view
Curved surface correction	Standard OD or bar correction for angle beam measurements
Corrosion (optional)	Zero-cross measurement algorithm, V-path correction, Single or Echo-to-Echo, Encoded B-scan

Software Options

- **EP650-TEMPLATE (Q1400002):** Template Storage
- **EP650-API5UE (Q1400003):** API 5UE Flaw Sizing
- **EP650-AVERAGE (Q1400004):** Waveform Averaging
- **EP650-IG (Q1400005):** Interface Gate
- **EP650-BEA (Q1400006):** Backwall Echo Attenuator (BEA)
- **EP650-CORRSN (Q1400001):** Corrosion Module (includes encoded B-scan)

Optional Accessories

- **600-BAT-L-2 (U8760058):** Rechargeable lithium-ion battery
- **EP4/CH (U8140055):** Chest harness
- **600-TC (U8780294):** Transport case
- **CBAS-10668-0060 (Q7790012):** RS232 communication cable
- **DSUB-HD15-6 (U8780333):** Digital output cable
- **600-C-VGA-5 (U8780298):** VGA output cable
- **MICROSD-ADP-2GB (U8779307):** 2 GB microSD memory card
- **600-SC-K (U8780334):** Soft carrying case with pouch (knob version)
- **600-SC-N (U8779879):** Soft carrying case with pouch (navigation pad version)
- **N600-EXTALM (U8780332):** External alarm beeper
- **CBAS-10669-0010 (Q7790008):** Encoder cable for B-scan buggy (10 feet, other lengths available)

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