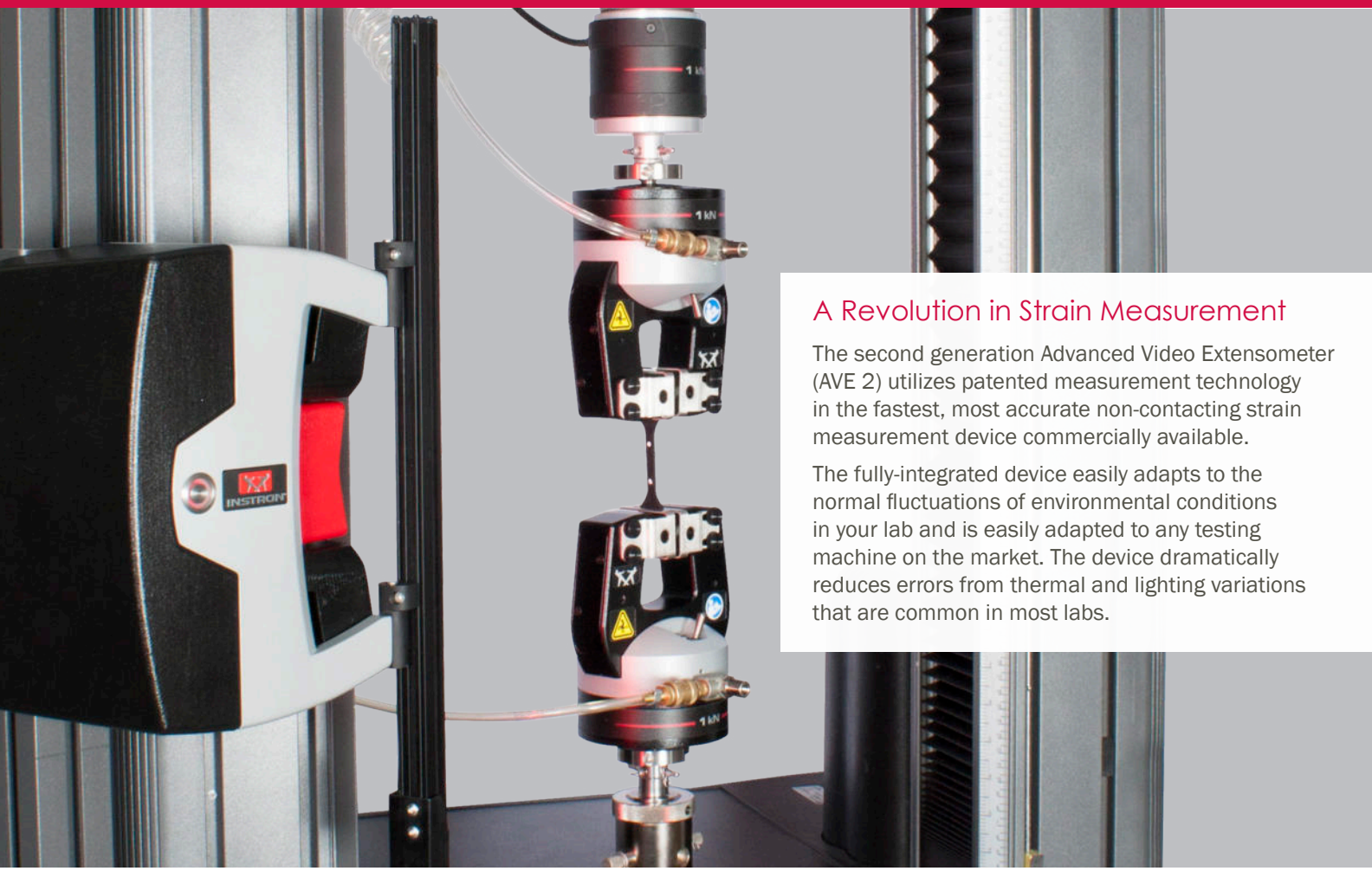
INSTRON®

The difference is measurable®

AVE 2 | Non-Contacting Video Extensometer



A Revolution in Strain Measurement

The second generation Advanced Video Extensometer (AVE 2) utilizes patented measurement technology in the fastest, most accurate non-contacting strain measurement device commercially available.

The fully-integrated device easily adapts to the normal fluctuations of environmental conditions in your lab and is easily adapted to any testing machine on the market. The device dramatically reduces errors from thermal and lighting variations that are common in most labs.

One Device, Any Machine

Don't have an Instron® in your lab? The AVE 2 will still work for you. Regardless of the machine currently installed in your lab, the AVE 2 can be integrated with any non-Instron or past-generation Instron system that uses a ±10v analog input.*

One Device, Endless Applications

Do you wish you had one device for use at ambient, high/low temperatures, or for use with specimens and components submersed in a bath? Do you need a device that can meet the needs of your lab over the next five years? The versatility of the new AVE 2 allows for testing under multiple environmental conditions, and can be used for advanced strain measurement with Digital Image Correlation (DIC). Additionally, the AVE 2 conforms to the most rigorous testing standards, such as ISO 527 and ASTM D638.

Designed by Customers, Engineered by Instron

How often do you find that your testing equipment isn't quite what you need or expected? Learning what is critical for our customers allows us to develop technology that is intuitive and eliminates unnecessary steps and complicated set up procedures. Every interaction that our global sales and service teams have with customers allows us to gain valuable insight into customer problems, providing the input for us to engineer customized solutions that address these important customer concerns.

* Performance depends on system, analog output has 18 bit resolution

Meeting Your Endless Applications

- Meets a broad range of international testing standards, including ISO 527, ASTM D638, and ASTM D3039
- Utilize the real-time 490 Hz data rate to capture quickly changing measurement events
- Measure both modulus and strain to failure of almost any material including plastics, metals, composites, textiles, films, elastomers, paper, components, and bio-materials
- Record images of the test for synchronized playback or for post-analysis with Digital Image Correlation
- A single device in your lab now accommodates test specimens with multiple gauge lengths or varied elongations

Conveniently Installs on any Machine within Your Lab

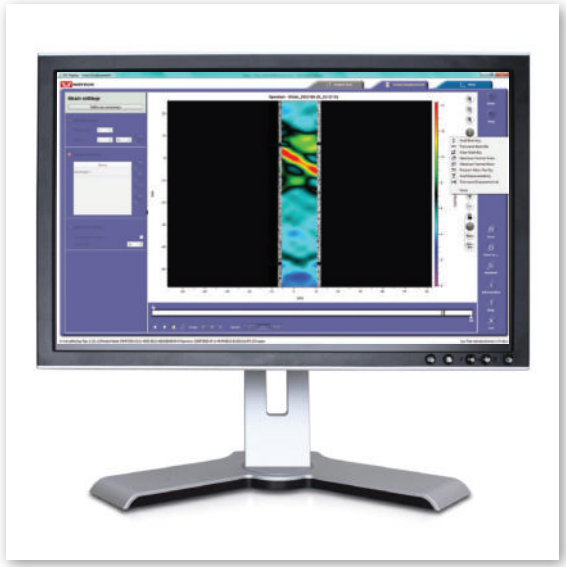
- Its versatility allows for testing specimens and components at ambient and high/low temperatures, or while submersed in a bath
- Can be used on ANY system in your lab that accepts a ±10V analog input, regardless of age or manufacturer
- Mounts easily to testing frame and can quickly be moved from machine to machine within the lab

Delivering a Robust Solution with Potential for Future Expansion

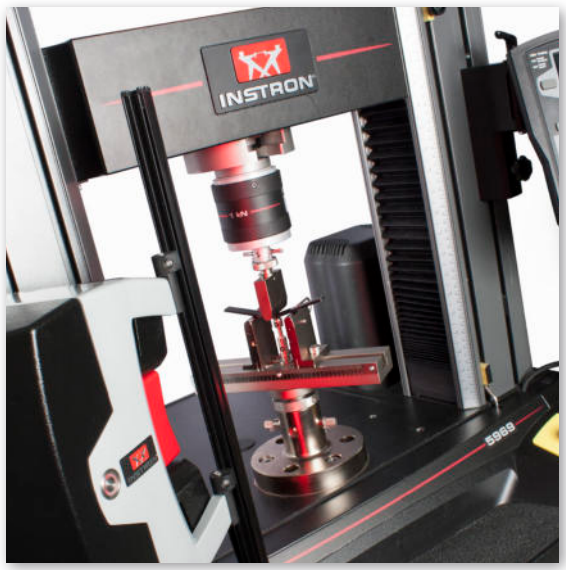
- Depending on your application, you can now take measurements using a variety of marking methods — dots, lines, speckle, or even natural patterns
- Plug-and-play installation dramatically reduces dependency upon PC requirements
- Streamlined operator controls are integrated directly into Bluehill® 3 Software, removing confusing and unnecessary steps
- Patented* technology reduces errors from thermal and lighting fluctuations that are common in most labs
- On-board measurement technology means that data is processed in real time

* Instron holds US and European patents for the control of air currents between the camera and specimen that eliminates noise caused by refraction of light; and for the low-voltage LED illumination system that ensures optimum lighting under all lighting conditions. US 7,047,819 B2, US 7,610,815 B2, and EP 1,424,547, B1.

AVE 2 Mounted on a Temperature Chamber



Adaptable with Digital Image Correlation



One Device, Endless Applications

Specifications

Axial Measurement

Lens Focal Length	mm	35	16	9	6
Field of View for Tabletop Static and Dynamic Systems[1]	mm	100	240	425	620
	in	3.94	9.45	16.73	24.41
Field of View for Floor Model Static Systems[2]	mm	130	310	560	840
	in	5.11	12.2	22.04	34.46
Resolution	µm	0.5	0.5	1.5	3
Accuracy	µm	±1 or 0.5% of Reading*	±1 or 0.5% of Reading*	±3 or 1% of Reading*	±9 or 1% of Reading*
Data Rate	Hz	490	490	490	490
Minimum Gauge Length	mm	5	6	12	15
	in	0.2	0.23	0.47	0.59
Maximum Following Speed	mm/min	2500	2500	2500	2500
	in/min	98.4	98.4	98.4	98.4
Resolution with Chamber	µm	0.5 + 0.5/25°C	0.5 + 0.5/25°C	1.5 + 1/25°C	3 + 1/25°C
Accuracy with Chamber	µm	±2 or twice resolution or (0.5% + 0.015%/50°C)*	±3 or twice resolution or (0.5% + 0.015%/50°C)*	±10 or twice resolution or (1% + 0.03%/50°C)*	±27 or twice resolution or (1% + 0.03%/50°C)*

Transverse Measurement Option

Field of View for Tabletop Static and Dynamic Systems[1]	mm	13	33	57	85
	in	0.51	1.29	2.24	3.34
Field of View for Floor Model Static Systems[2]	mm	16	40	70	110
	in	0.62	1.57	2.75	4.33
Resolution	µm	0.5	0.5	1.5	3
Accuracy	µm	±2.5 or 0.5% of Reading*	±2.5 or 0.5% of Reading*	±7.5 or 1% of Reading*	±22.5 or 1% of Reading*
Minimum Gauge Width	mm	5	6	12	15
	in	0.2	0.23	0.47	0.59

Classification to Standards

Classification to ISO 9513:2012	mm	Class 0.5	Class 0.5	Class 1 (Travel > 0.3)	Class 1 (Travel > 1)
Classification to ASTM E83-10	mm	Class B-1 (G.L. > 10)	Class B-1 (G.L. > 10)	Class C (G.L. > 15)	Class C (G.L. > 25)

*Whichever is greater

Notes:

1. 334X, 336X, 594X , standard width 596X, ElectroPuls™, and 8800 Systems
2. Standard width 3382, 5982, 5984, 5985

Hardware and Software Requirements

The AVE 2 runs on the same PC as the testing machine software. The minimum specification for the PC is: 3.06 GHz Pentium 4 with 4 GB memory and Microsoft® Windows® 10 Professional (64 bit) or Microsoft® Windows® 7 Professional (32 and 64 bit)"

www.instron.com

INSTRON®

Worldwide Headquarters
825 University Ave, Norwood, MA 02062-2643, USA
Tel: +1 800 564 8378 or +1 781 575 5000

European Headquarters
Coronation Road, High Wycombe, Bucks HP12 3SY, UK
Tel: +44 1494 464646

Instron Industrial Products
900 Liberty Street, Grove City, PA 16127, USA
Tel: +1 724 458 9610

INSTRON®

The difference is measurable®

AVE 2 | Dynamic Strain Measurement and Control

Discover More with Non-Contacting Dynamic Strain Measurement

In addition to its excellent performance for static testing, the Instron AVE 2 is now available with an option for cyclic testing and high speed monotonic test measurement. Capable of tracking displacement at up to 500mm/s with cyclic test frequencies up to 20Hz, it offers the speed and flexibility scientists and engineers have been waiting for to study the dynamic behaviour of materials without contacting the specimen.

A Breakthrough in Strain Measurement for Sensitive Specimens

Many materials are sensitive to the contact force from traditional clip-on devices and there has been no practical solution until now. Whether the application is delicate films or soft tissue samples, wire or polymer matrix composites, AVE 2 Dynamic offers a unique range of functionality for dynamic measurement & control of specimen strain.

Versatility that Solves Your Research Challenges

In all research environments the biggest challenge can often be coping with the changing demand of both internal and external customers. This can be problematic when you need to specify the laboratory equipment which needs to accommodate both short-term and long-term application challenges. The AVE 2 offers you the chance to invest in a system which can adapt to your changing demands and bring new capability to your lab today with the confidence that the same technology will be delivering the results you need for many years to come.

Specimen Variety

Measure and control cyclic strain on a wide range of materials and specimen geometries. A single device in your lab now covers test specimens with multiple gauge lengths and varied elongations. If you aren't currently able to use a clip-on extensometer or you are looking for increased flexibility and usability from your strain measurement device, the AVE 2 Dynamic option offers many benefits.

Synchronous Axial & Transverse Dynamic Measurements

Both axial and transverse measurements are delivered synchronously with other transducer data. This data can be used in live test calculations and included in mixed-mode control tests; Axial displacement can be used for direct test control, with safety features to protect system and operator should the camera view be obscured.

Compliant Specimens & High Strain Rates

The dynamic measurement option is well suited to testing high elongation materials or for studying strain rate behaviour where clip-on devices influence specimen behaviour, have limited travel and require removing before failure.

Specifications

DYNAMIC AXIAL MEASUREMENTS

Lens Focal Length	mm	16
Field of View for Dynamic Systems	mm in	240 9.45
Resolution	µm	2.0
Accuracy	µm	2.0
Measurement Increment	µm	0.25
Maximum Following Speed	mm/s in/s	500 20
Minimum Displacement	mm in	± 0.1 ± 0.004
Minimum Gauge Length	mm	6
Data Rate	Hz	490

Note: Only AVE 2 specifications that differ during dynamic operation are provided above. Refer to the AVE 2 literature for all other specifications.

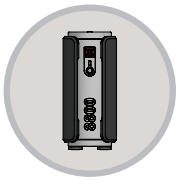
DYNAMIC TRANSVERSE MEASUREMENTS

Field of View for Dynamic Systems	mm in	33 1.29
Resolution	µm	2.0
Accuracy	µm	2.0
Measurement Increment	µm	0.25
Minimum Gauge Width	mm in	6 0.23

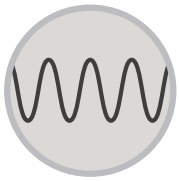
CLASSIFICATION TO STANDARDS

ISO 9513:2012	Displacement Range ≤ 0.5 mm	Class 2
	Displacement Range ≥ 0.5 mm	Class 1
	Displacement Range ≥ 1 mm	Class 0.5
ASTM E83-10	Gauge Length ≥ 6 mm	Class C
	Gauge Length ≥ 25 mm	Class B-2
	Gauge Length ≥ 50 mm	Class B-1

Features & Benefits



8800 MT



CYCLIC UP TO 20Hz

SEAMLESS WAVEMATRIX™ INTEGRATION

TRACKING UP TO 500 MM/S

DYNAMIC STRAIN CONTROL

Hardware & Software Requirements

AVE 2 Dynamic functions are available exclusively on the latest Instron® 8800 Minitower dynamic control system with WaveMatrix test software (requires Firmware V12.15, Console V8.11, WaveMatrix V1.9 or later). AVE 2 will switch seamlessly from dynamic measurement with WaveMatrix to static measurement when in use by BlueHill® software and other non-Instron systems. Compatible with AVE 2 16mm focal length lens and WaveMatrix Calculations and Advanced Control Modules (if required).

www.instron.com

INSTRON

Worldwide Headquarters
825 University Ave, Norwood, MA 02062-2643, USA
Tel: +1 800 564 8378 or +1 781 575 5000

European Headquarters
Coronation Road, High Wycombe, Bucks HP12 3SY, UK
Tel: +44 1494 464646

INSTRON®

The difference is measurable®

DIC Replay | 2D Digital Image Correlation Software

Digital Image Correlation (DIC) is an optical technique that compares images of a tested specimen's surface to generate full-field strain and displacement maps. In other words, you can see an FEA-style picture to visualize strain and displacement over the full two-dimensional surface of the test specimen. This powerful capability unlocks the true story of the material behavior and allows materials testing professionals to analyze a number of advanced strain characteristics after the test.

The technique of DIC has been around for more than a decade. However until now, many users have struggled with a complex user interface and synchronization problems. In response, the Instron® DIC Replay package is streamlined for the materials testing community with an interface that is refreshingly simple and familiar. Additionally, Instron's DIC package features built-in synchronization of DIC images with test data collected, including load, position, and more. It is a DIC package that a capable materials testing professional can use easily.

Features

Full Field Strain and Displacement

Visualize strain and displacement over the full surface of a two dimensional object*. Displays include Axial strain (ε_{yy}), Axial Displacement (d_y), Transverse Strain (ε_{xx}), Transverse Displacement (d_x), Shear Strain (ε_{xy}), Maximum Normal Strain, and Minimum Normal Strain.

Simple Display Options

Adjust display options using intuitive graphical icons. Options include:

- A variety of color palettes for contour maps
- Automatic or fixed scaling options
- Display gridlines to show data point locations
- A toggle to show or hide the raw sample images

* 2D analysis is appropriate where surface height deformation is negligible

Virtual Gauges

Snap on and resize strain gauges or extensometers to analyze strain behavior over a specific area of the test specimen or the average strain between two points.

Method Saving

Save strain/displacement and plot methods to recall and apply to other specimens.

Integration with Materials Testing Software

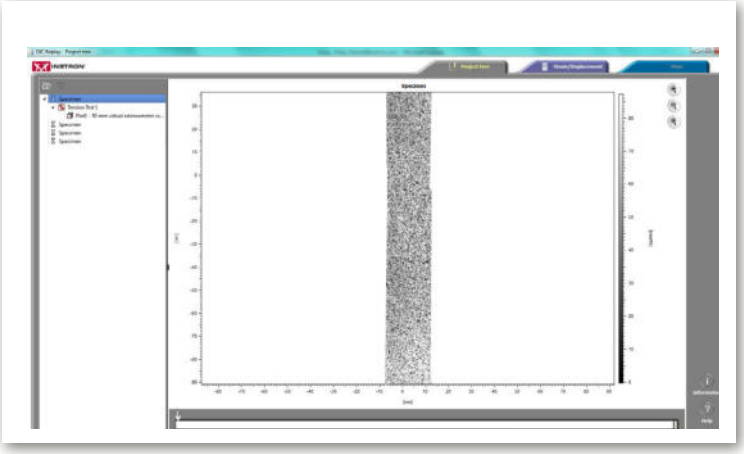
View and plot results against the test data collected with Bluehill 3 Software — no additional synchronization hardware or cabling required.

Flexible User License

Users can install the DIC Replay software on many PCs while ensuring secure access through a portable USB dongle. This dongle acts like a key to open the software and allows users to process data away from the testing machine (e.g. on an office laptop.) or without a network connection.

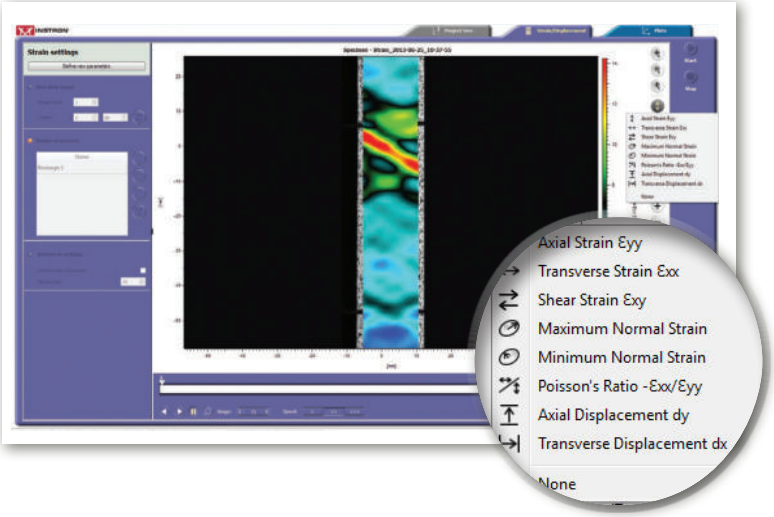
Software Overview

Instron® DIC Replay Software is a self-contained 2D DIC package. The software consumes images and calibration data saved by Instron's Advanced Video Extensometer (AVE) and works in a post-processing mode. The user interface leverages the same tabbed style and graphical design of Bluehill® Software. In fact, there are only three screens to sort, analyze, and plot DIC results.



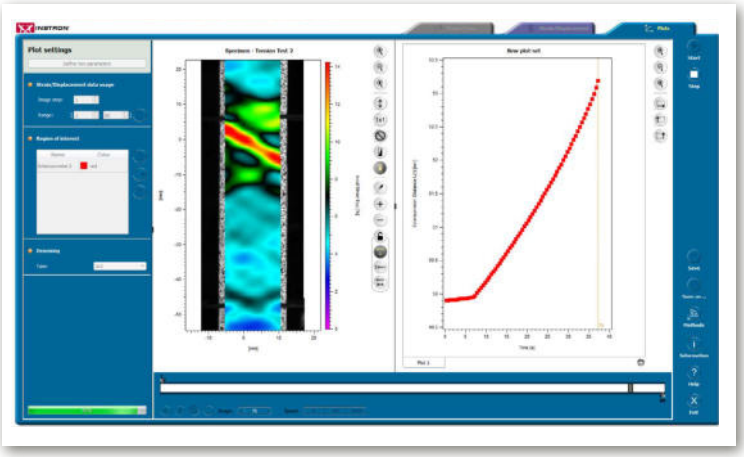
Sort Data with a Logical Project Tree

- Browse and play raw image sequences from tested specimens
- Explore calculated full-field displacement and strain maps
- Find saved line plots showing virtual extensometer and virtual strain gauge data



Analyze Strain and Displacement Maps

- Define a region of interest with simple 'click-and-drag' shape tools
- Calculate strain and displacement maps over the entire sequence or from a region of interest
- Choose the type of strain or displacement values to display using intuitive visual icons
- Save screen shots and video files of the analysis for presentation and distribution.
- Save screen shots and video files of the analysis for presentation and distribution.

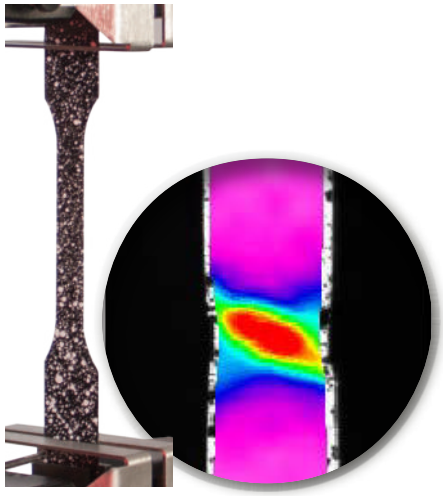


Create Simple Line Plots

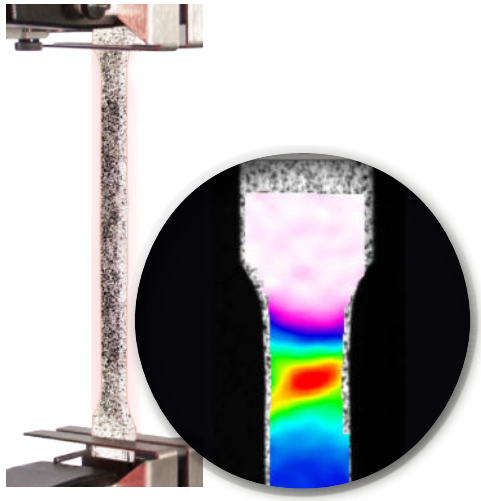
- Click, place, and size virtual extensometers or virtual strain gauges anywhere on the processed region
- Display average strain (strain gauge) or strain between two points (extensometer) using simple line plots
- Plot virtual gauges against synchronized measurement data collected during the test
- Configure a range of plots using X/Y axis settings and the simple worksheet tabs

Applications

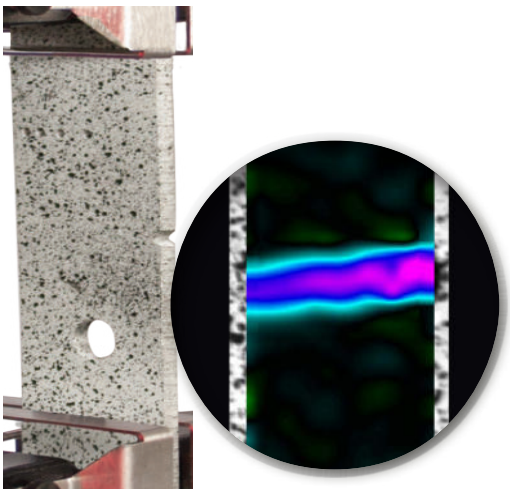
2D full-field strain and displacement maps are useful for a number of diverse applications, including: visualizing material behavior on coupons or components, checking specimen alignment, and going beyond the capabilities of conventional extensometers in the identification and measurement of localized strains.



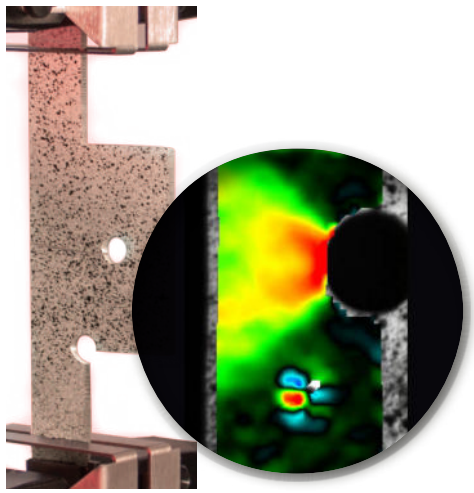
Check specimen preparation techniques by comparing one specimen to the next and looking for localized strain concentrations.



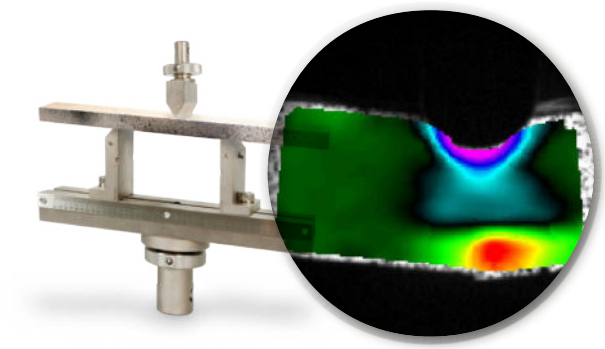
Check for standards compliance by identifying localized strain that falls outside of the standard gauge length or clip-on extensometer.



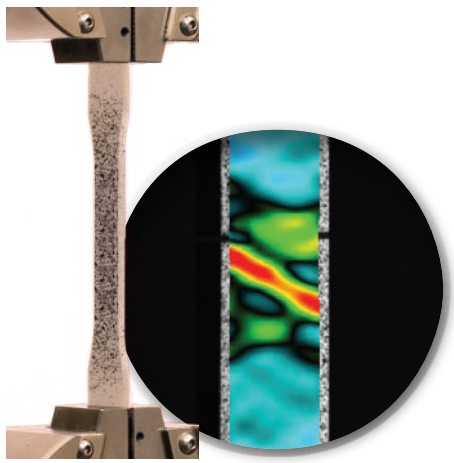
Visualize and detect cracks that are not visible by eye or in the raw images under tension or compression loading.



Analyze strain and displacement on the flat surface of a part or component where traditional extensometers are impractical.



Visualize the side profile of a flexure or compression specimen to observe tension and compression strain behavior.



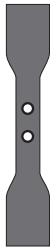
View materials testing phenomenon, such as discontinuous yielding, localized necking, and more.

DIC Replay Specifications

Modes of Operation

Speckle Only
Analyze specimens after the test using the DIC Replay Software

Mixed Mode
Capture average strain in real-time (large dots) and use background speckle for DIC post-test processing



Real-time Strain
Turn off DIC mode to run traditional tests (capturing average axial or transverse strain in real time)

Specifications

Compatibility	Instron® AVE, AVE 2,and Bluehill® Software [1]
PC Specifications[2]	• Microsoft® Windows 7 - 10 or 64 bit • Minimum of 2 GB RAM • Minimum of 2.67 GHz • Minimum of 250 GB HDD space required • Minimum of display resolution: 1280 × 720 pixel • Mouse Required[3]
Image Collection Rate	User defined up to 50 Hz (down sampling possible for DIC processing)

1. Version 3.42 onwards for AVE, Version 3.62 onwards for AVE 2
2. Instron's premium PC offering meets these requirements (Cat. No. 2490-647 and 2490-686), as does Blue Hill Operatror Dashboard (Cat. No 2490-695)
3. DIC software is not optimised for touch operation Instron strongly recommends using either: a PC mouse when used with Bluehill Operator Dashboard or a separate PC for DIC data analysis

Expected Accuracy for DIC Computations

Field of View (FOV)	mm	100-130	240-310	425-560	620-840
DIC Error from Virtual Extensometer (Accuracy)	µm	± 1	± 2	± 4	± 9
DIC Error from 5 × 5 mm Virtual Strain Gauge (Uncertainty)	µε	100	200	500	1000

Notes:

Refer to AVE literature for accuracy of real-time strain.

These accuracy values represent typical values under ambient conditions - the nature of the DIC measurement technique means that there is an accuracy trade off between strain resolution and spacial resolution and there are many variables that can contribute to measurement errors.

DIC REPLAY

DIC Replay is available with new or existing AVE's as a software upgrade

www.instron.com

INSTRON®

Worldwide Headquarters
825 University Ave, Norwood, MA 02062-2643, USA
Tel: +1 800 564 8378 or +1 781 575 5000

European Headquarters
Coronation Road, High Wycombe, Bucks HP12 3SY, UK
Tel: +44 1494 464646

POD_DICReplay_Rev3_0217