

The VIC-3D™ Measurement System

The **VIC-3D™ Measurement System** is a turn-key **non-contact** measurement solution for measuring **full-field** displacements and strains utilizing **Digital Image Correlation (DIC)** with a pair of stereo-mounted digital cameras. The VIC-3D™ system offers researchers and engineers unmatched speed and accuracy for a wide range of quasi-static and dynamic applications. This datasheet explains some of the features and specifications of the system with proven accuracy, and often the system achieves measurement resolutions far better than what is listed. Please contact sales@correlatedsolutions.com for more details.

The VIC-3D Digital Image Correlation Measurement System



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Above: The VIC-3D™ 5.0MP System

The VIC-3D™ Measurement System Specifications:

VIC-3D is offered as either a turnkey deformation measurement system for 2D and 3D speckle correlation measurements, or as a software-only solution compatible with almost any industrial digital camera. The system includes the following features:

- Full-field measurement of
 - 3D coordinates
 - 3D displacements
 - 3D velocities
 - Strain tensor, major and minor strains
- High strain resolution: 0.005% (50 microstrain) or better
- Strain measurement range from 0.005% (global) to 2,000% or higher possible
- In-plane resolution up to 1/100,000 * FOV or better.
- Out-of-plane resolution up to 1/50,000 * FOV or better.
- Image formats: Most standard image formats that do not employ lossy compression are supported directly (tiff, pgm, bmp, pnm, etc.)
- Software licenses: The system will come with image acquisition and analysis software preinstalled on a desktop or laptop computer. An additional license will be provided on a USB dongle. This dongle permits execution of the analysis software on any computer the user chooses.
- Data Export: Data can be exported in Tecplot, ASCII as well as spreadsheet-compatible (e.g., Microsoft Excel) files. Other formats can be supported on request as part of technical support.
- Software Interoperability: On Microsoft Windows systems, Correlated Solutions software is fully integrated with Cut&Paste functionality. All graphs and plots can be copied directly into any office suite software or saved in compatible image or video formats.
- Analog Data recording: The system is capable of acquiring external analog voltages simultaneously with the image acquisition. Several acquisition systems are available, depending on the number of analog channels required. All analog voltage measurements can be added to the VIC-3D project for use and manipulation as a measurement variable
- The data density is freely selectable by the user by varying the spacing between analysis points.
- The analysis software includes graphical display of deformations and strain distributions over a 3D depiction of the geometry of the test article.
- The analysis software includes graphical display of all data as an overlay over the image taken of the test article with user-selectable transparency.
- The analysis software includes post-processing features such as minimum/maximum, mean and standard deviation, time-slice extraction, stress-strain curve generation, data extraction along lines, etc.
- The analysis software includes the capability to generate compressed AVI animations of strain distributions both from 3D and image-overlay contour plots.
- A video player with adjustable frame rate, single step functionality and zooming is included for data display.
- The analysis software is capable of automatic start point generation and sequence analysis. The software includes advanced predictive algorithms for both spatial as well as temporal start point generation.
- The analysis software provides a variety of methods to select coordinate systems and transform coordinate systems. The coordinate system can be selected from markers on the test article.

- The analysis software includes a method to integrate data from multiple systems viewing adjacent parts of a test article into a common coordinate system.
- The acquisition and analysis software both include an automated calibration method based on photogrammetry and calibration targets. The calibration can be performed in real-time with the acquisition software or in post-processing using the analysis software.
- Turnkey systems include a desktop computer* with the following minimum specifications:
 - Intel Core i7 3.2GHz Quad-core Processor
 - 16 GB RAM
 - 2 TB hard drive & 250GB SSD
 - 24" LCD
 - DVD-R/W
 - OpenGL® Graphics card with 3D acceleration
 - Windows 7 Professional
 - Microsoft Office 2010

*Laptop or workstation configurations are available (see below)



Portable Laptop



Compact Desktop



Rack-mount PC Workstation

Above: Computer options available

- Turnkey systems for quasi-static testing include two high-resolution monochrome cameras with resolutions available at 2, 5, 11, 16, & 29 Megapixels
- Turnkey systems for high-speed / dynamic testing include two high-speed monochrome digital cameras with frame rates up to 1,000,000 fps.



5.0 MP



5.0 MP



29.0 MP



1.0 MP @ 12,500 fps



312x260 @ 1MHz

Above: List of some cameras available

- The system includes one year of technical support via telephone/email and software upgrades. Technical support is available Mo-Fr 9am-5pm EST. On-site support and consulting is available. Multiple years can be purchased at a discounted rate.

- The system includes a one-year replacement warranty for defects in materials and/or workmanship on all parts. See “Commercial Warranty” document for more details.

- **Recent Vic-3D system Enhancements:**

- Data Export:

- Data extraction from 3D plots based on user-defined lines and circles
 - Node data extraction at points defined by spreadsheet input or manual input (for FEA/CAD comparison)

- Coordinate System:

- Define coordinate system by markers
 - Manual coordinate system rotation/translation

- VIC-Snap Acquisition:

- FlexCapture for variable frame rates that can be programmed before a test
 - Burst mode allowing images to be saved to RAM for short periods of time for faster acquisition rates
 - Support for Photron and Phantom High-Speed Cameras.

- - Support for Cameralink Cameras such as Basler & Point Grey Research Gazelle Cameras.

- Vic-Snap Stage control for Questar Motorized Stages (Typically for the Vic-3D Micro™ System).

- Marker Tracking:

- added tools to VIC-3D that allow "bow-tie" and circular markers to be tracked in three dimensions

Vic-3D Standard Features:

- Analysis speed has been greatly improved with new DIC algorithms.
- Analysis is fully multi-threaded, taking advantage of new multi-core computer system architectures.
- Improved accuracy: The accuracy of the DIC algorithms has been improved through highly optimized interpolation filters.
- Improved accuracy: A new optimized 8-tap filter is available for higher accuracy, particularly in images with very fine speckle and small amounts of aliasing.
- Plotting system has been enhanced with properly labeled Z-axes, customizable contour label spacing, customizable number formats etc.
- Auto and user-scaling has been improved and is more intuitive to use.
- Line extractions can now be animated along with the contour plots.
- Confidence estimates on matching performance. The software now reports the matching confidence (sigma) in pixels instead of the correlation value. This gives direct feedback on the data quality.
- Robustness. The analysis algorithms have been made more robust and produce fewer outliers.

- Improved initial guess algorithm. A much more robust automatic initial guess algorithm has been incorporated, virtually eliminating the need to manually initialize the analysis.
- The calibration point extraction has been greatly improved to be more robust, fully automatic and much faster, particularly for large images.
- Confidence margins on calibration parameters. The software now reports confidence margins on all calibration parameters to provide better feedback on calibration quality.
- Improved real-time module: The real-time module has been greatly enhanced for live data display during tests. The new real-time module takes full advantage of the performance improvements in the analysis code.
- Improved strain calculation algorithm with greatly reduced boundary effects.
- Additional strain tensors are now available (Euler tensor and logarithmic strain for both Lagrangian and Eulerian representations)
- Computation of comparison strain according to von-Mises and Tresca criterion for quick evaluation of "hot spots"
- Integration of infrared cameras. IR cameras can be calibrated and temperature data can be extracted with sub-pixel accuracy.
- Improved calibration procedures for flexible coordinate system transformations.
- This enables calibrating a third camera, or calibrating several stereo systems together without time-consuming data stitching.
- Improved auto-scaling mechanism for scaling plot ranges to an entire sequence.
- Interface for marker editor
- Project file format for improved performance (the old format is still supported for backwards compatibility).
- Improved data export and support for new file formats (Matlab).
- Improved support for stereo-microscope systems (add-on module). Calibration is now automated and distortion removal has been fully integrated (no more separate image pre-processing).
- Improved help system with integrated full-text search.
- Completely new tools for drawing AOI's and setting up initial guesses.
- Uncertainty measures available for position and displacement data.
- Improved parallelization for taking even better advantage of multi-core processors.
- New equation editor with user-selectable constants.
- User interface redesigned for increased ease of use.
- Regenerate your original data at any time with the "Retriangulate" function.
- Calibration process has been streamlined and simplified.
- Strain calculation is now quicker and more accurate.
- Automatic subset size suggestion.
- Multiple start points for increased flexibility and robustness.

Vic-3D New Features:

- **New** calibration dialogue with automatic spacing detection (requires new coded targets)
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- **New** displacement units now user selectable (mm, inches, etc)
- **New** “Paste Mask” feature for saving multiple AOIs with images
- **New** FFT software module for vibration analysis
- **New** Forming Limit software module for material characterization
- **New** Import images via common file naming (no need to select files individually)
- **New** strain algorithm for increased accuracy
- **Improved** project saving - analysis settings are now saved with project
- **Improved** integration - complete calibration within Vic-Snap
- **Improved** integration - save images and analog data directly to projects
- **Improved** initial guess window
- **Improved** stereo system calibration window

Recent Hardware Improvements:

- **New** re-designed calibration targets with coded spacing: less reflective and more durable
- **New** support for Camera Link cameras – 4.0 Megapixel @ 140fps, and 2.0 Megapixel @ 280fps
- **New** USB 3.0 camera support (up to 9MP)
- **New** Dual GigE Camera support (up to 29 Megapixels!)
- **New** support for FLIR IR cameras
- **New** and improved LED lighting systems
- **New** mechanical shutters included in select high-speed camera models for easy black referencing
- Updated PC: Fastest, most powerful Shuttle PC available to date
- **New** custom high-speed camera acquisition software for easy file saving and processing.
- **New** high resolution high-speed camera systems available.
- **New** cool LED lighting system.
- **Improved** mounting systems for all camera models.
- **Redesigned** stereo-microscope system with precise individual camera image adjustment, and a fully motorized computer-controlled 3-axis precision stage.
- **Redesigned** stereo-microscope calibration fixture.
- **Redesigned** CSI aluminum channel analysis cart with rack-mount PC and dual monitors.

Training / Installation Services:

A 2-day training seminar will be held at the customer’s facilities. The seminar will consist of an introductory course explaining the historical development and the theoretical foundation of the speckle correlation measurement technology. An overview of the state-of-the-art technology with application examples will be provided to give attendees an understanding of the scope of measurement problems to which the technology can be applied. The seminar will continue with a course focused on proper experimental procedures for successful speckle correlation measurements. The course will discuss methods of error assessment and will be accompanied by hands-on training.