



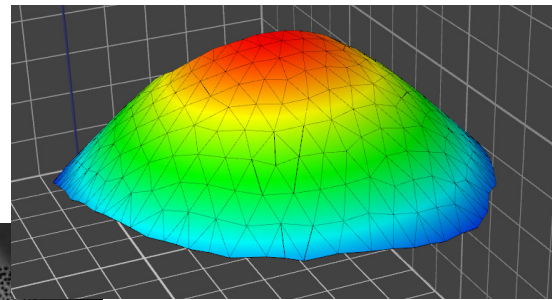
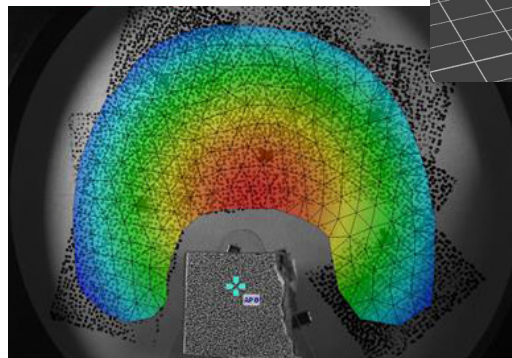
## DEFLEX®

### DEFLEX®-3D

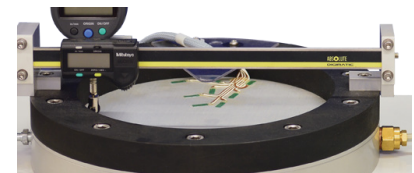
An integrated digital image correlation system for measuring full-field displacements and strains over a material's surface in three dimensions. DefleX® -3D is ideal for material science, structural engineering and general mechanical engineering courses.



## DEFLEX®-3D



DEFLEX®-3D VISUALISATION OF THE EFFECT OF PRESSURE ON THE SURFACE PROFILE OF THE SM1008 DIAPHRAGM



### KEY FEATURES

- Full-field 3D visualisation and analysis of displacements and strains
- 3D data visualisation and surface reconstruction
- 3D visual representation of complex motion and vibration
- Digital or analogue (via A/D, D/A converter) input and output data export for advanced analysis in Python, MATLAB or any spreadsheet program
- Data export for advanced visualisation in ParaView or direct transfer of mesh data and results into FEM software such as Ansys
- All-in-one solution with two integrated 5 MPx CMOS cameras allowing interchangeable lenses and integrated LED light
- DefleX® software package, advanced and easy-to-use digital image correlation (DIC) engine, including interface for creating custom scripts

### KEY BENEFITS

- 3D visualisation of strain measurement and surface deformations
- Non-contact method - no contact between the camera and the object/surface
- Enhances student learning experience
- Fast and easy to set up
- Teaches students principles of digital image correlation
- A non-destructive method to assess the quality of materials and objects by identifying hidden material defects
- Enables precision-driven product development allowing for innovative product design validation and reduced prototype testing
- Great potential in vibration and other structural dynamic tests



### DESCRIPTION

Deflex®-3D is a three-dimensional digital image correlation (DIC) system designed to teach students how to accurately measure full-field 3D surface deformations, strains and displacements in materials and objects. This cutting-edge technology is a powerful tool for gaining insights that are difficult or even impossible to achieve with traditional measurement techniques.

The system uses two digital cameras to capture, record and measure small changes to a surface pattern on a specimen. These deformations are analysed to determine the strains the specimen is experiencing. This can be done in a point- or line-based manner, or across the entire surface area at once, providing full-field strain measurements. The software clearly visualises the data for better perspective and understanding of the physical processes at play. Additionally, data can be easily exported to the user's analysis software of choice for further, more detailed analysis.

As a teaching tool, Deflex®-3D is simple to set up and easy to use. The user only needs to calibrate the cameras based on the testing scenario to begin collecting data immediately.

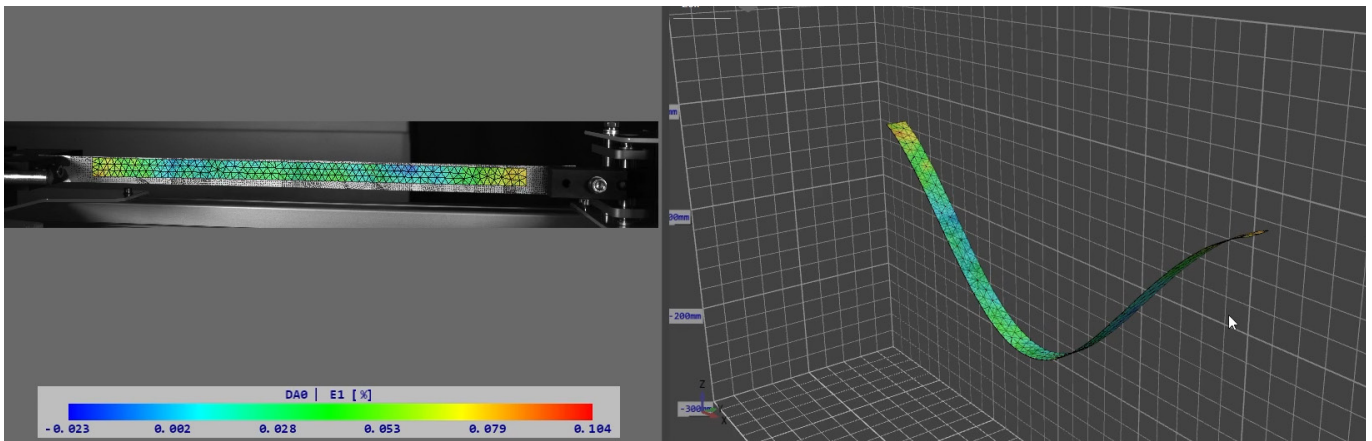
The system provides detailed deformation maps in real-time or during post-processing, making abstract concepts more tangible and easier to understand. It enhances student engagement with the subject matter by enabling interactive learning and providing immediate feedback.

Deflex®-3D emphasises the importance of experimentation and testing in relation to design, simulation and theoretical concepts. It improves retention of acquired principles compared to traditional lecture-based teaching methods.

By encouraging analytical reasoning, the system helps students hypothesize and draw conclusions based on experimental results, while fostering problem-solving and communication skills. Finally, Deflex®-3D introduces students to advanced, industry-standard technology, better preparing them for careers in engineering and research.

### LEARNING OUTCOMES

- **High-precision analysis for learning and demonstration:** as a teaching tool, Deflex®-3D enhances learning by providing high-precision data and visual representations of strain and deformation, such as bending moments in beams under load. It can be also leveraged to expand and develop on learning outcomes for select TecQuipment products and existing and third-party products.
- **FEA validation and verification:** Deflex®-3D provides real-world data to validate, verify and calibrate finite element analysis (FEA) simulation models, bridging theory and practice in engineering.
- **Understanding material behaviour and specimen quality:** the system helps understand material behaviour, facilitates identification of hidden defects and supports precision-oriented product development, ensuring more reliable and effective designs.
- **Enhanced understanding through 3D visualisation:** Deflex®-3D's visualisation capabilities improve comprehension of complex designs and dynamic motion, making intricate structures and processes more accessible.
- **Highlighting testing apparatus limitations:** the system demonstrates the limitations of physical testing apparatuses, such as phantom strains caused by DTI meters or extensometers, emphasising the advantages of non-contact measurement.



3D REPRESENTATION OF DISPLACEMENT AND STRAIN OF A BUCKLED STRUT

### WHAT'S INCLUDED

DefleX®-3D includes:

- All-in-one DIC unit with integrated LED lights and two cameras (supplied with 12 mm lenses)
- 2 x additional 25 mm lens
- Power/USB connection cable
- 3 x calibration grids
- USB licence dongle
- USB device with installation files and comprehensive user guide
- DefleX® software
- Tripod
- 2 x light mounting arm
- 2 x additional LED lights
- 2 x light tripods
- Backdrop screen
- Sturdy storage box
- 5 x each: black permanent fine tip marker pen, black non-permanent fine tip marker pen, white fine tip paint pen
- 5 x cable tie hook and loop
- One year of technical enhancements and customer support

### STANDARD FEATURES

- Five-year warranty
- User guide
- Made in accordance with the current European Union directives
- ISO9001 certified manufacturer
- Compliance to ISO9513 and ASTM E83

### RECOMMENDED ANCILLARIES

- DefleX® Speckling Kit (SPK1)
- DefleX® Starter Kit (DSK1)
- DIC Educational Network Licence (DefleX®-3DNet)
- Additional lenses (see table on page 6 for details)
- Either: an annual or multi-year technical enhancement package up to five years (DefleX®-3D-TE1-TE5)



TRIPOD



DIC UNIT



12 MM LENS



25 MM LENS



POWER/USB CONNECTION CABLE



USB  
INSTALLATION  
FILES AND  
USER GUIDE

USB  
DONGLE



CALIBRATION GRIDS



BACKDROP SCREEN (EXAMPLE IMAGE)



LIGHT MOUNTING ARM  
(EXAMPLE IMAGE)



LED LIGHTS  
(EXAMPLE IMAGE)



STORAGE BOX

### RECOMMENDED EXPERIMENTS/PRODUCTS

#### NEXT GENERATION STRUCTURES:

- Deflection of Beams and Cantilevers (STS4)\*
- Unsymmetrical Bending and Shear Centre (STS7)\*
- Two-Pinned Arch (STS10)
- Fixed Arch (STS11)
- Euler Buckling of Struts (STS12)\*
- Curved Bars and Davits (STS14)
- Plastic Bending of Beams (STS15)
- Plastic Bending of Portals (STS16)
- Frame Deflections and Reactions (STS18)
- Simple Suspension Bridge (STS19)

#### MATERIALS TESTING AND PROPERTIES:

- Materials Laboratory with Data Capture (MF40 MK II)
- Hooke's Law and Spring Rate (SM110)
- Universal Testing Machine (SM1000)
- Torsion Testing Machine (SM1001)\*
- Benchtop Tensile Testing Machine (SM1002)
- Unsymmetrical Cantilever (SM1003)\*
- Beam Apparatus (SM1004)
- Euler Buckling Apparatus (SM1005)\*
- Creep Testing Machine (SM1006)
- Diaphragm (SM1008)

#### THEORY OF MACHINES:

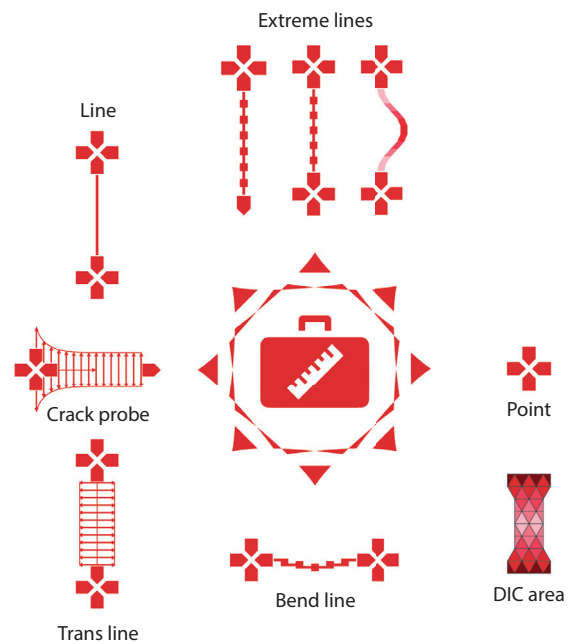
- Free Vibrations (TM161 and TM163-167)
- Free and Forced Vibrations (TM1016V)

\*Sample results available for these experiments/products

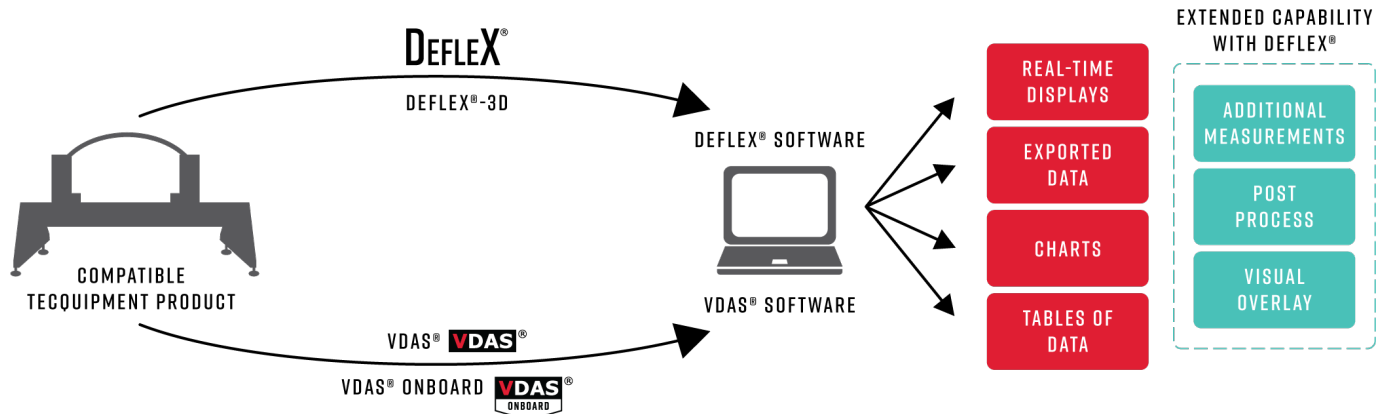
### SOFTWARE

DefleX®-3D edition runs on the DefleX® software to deliver high-quality measurement results while providing an engaging user experience.

- Quick set-up and simple measurement
- Wide range of measurement tools
- Advanced DIC features and I/O
- Postprocess functionalities
- Several measurement probes allow measurements to be tailored to the experiment being conducted



SELECTION OF AVAILABLE PROBES (CAN BE USED INDIVIDUALLY OR IN COMBINATION)



### LICENSING

Deflex®-3D comes with a single-user perpetual software licence linked to a USB dongle key. The software can be installed on unlimited PCs and operated via the USB licence key.

The Deflex® software can be optionally extended by purchasing an annual network licence (Deflex®-3DNet) allowing up to 20 users access to the software on the same network. This enables students to concurrently and independently analyse footage captured by the camera and data recorded in the software. (NOTE: both the network licence and the single-use licence are restricted to educational purposes.)

Deflex® is aimed at education for use in universities, colleges and other specialist training centres, and shall only be installed on equipment owned or used by such institutions. Please contact TecQuipment in the event that you wish to use Deflex® for published research or commercial purposes.

### SUPPORTED OPERATING SYSTEM

- Windows 11 64 bit / Windows 10 64 bit
- Windows Server 2019 / Windows Server 2022

Latest release on date of purchase

### PRODUCT SPECIFICATION

- 2 x 6 Mpx CMOS cameras integrated into one container box unit with built-in LED lights
- Alpha DIC software licence USB dongle
- 3 x calibration grids (full, half and quarter size)
- 2 x LED light panels
- 2 x 12 mm lenses
- 2 x 25 mm lenses
- Adjustable film tripod, motion along three planes
- Various focal length lenses available

### ESSENTIAL SERVICES

#### ELECTRICAL SUPPLY:

- 100-240 VAC, 50/60 Hz, 0.5 A

#### MINIMUM COMPUTER HARDWARE:

- 1 x USB 3.0
- 2 x USB 2.0
- Memory 8 GB
- Hard disk 8 GB HDD
- CPU: Intel/AMD 2 GHz 2-core

#### RECOMMENDED COMPUTER HARDWARE:

- 1 x USB 3.0
- 2 x USB 2.0
- Memory: 16 GB DDR4
- Storage: 1 TB SSD
- CPU: Intel / AMD: 4 GHz 8-core

#### MINIMUM PC OPERATING SYSTEM TO RUN DEFLEX® SOFTWARE:

- Windows 11 64 bit / Windows 10 64 bit
- Windows Server 2019 / Windows Server 2022

### OPERATING CONDITIONS

#### OPERATING ENVIRONMENT:

Laboratory environment

#### STORAGE TEMPERATURE RANGE:

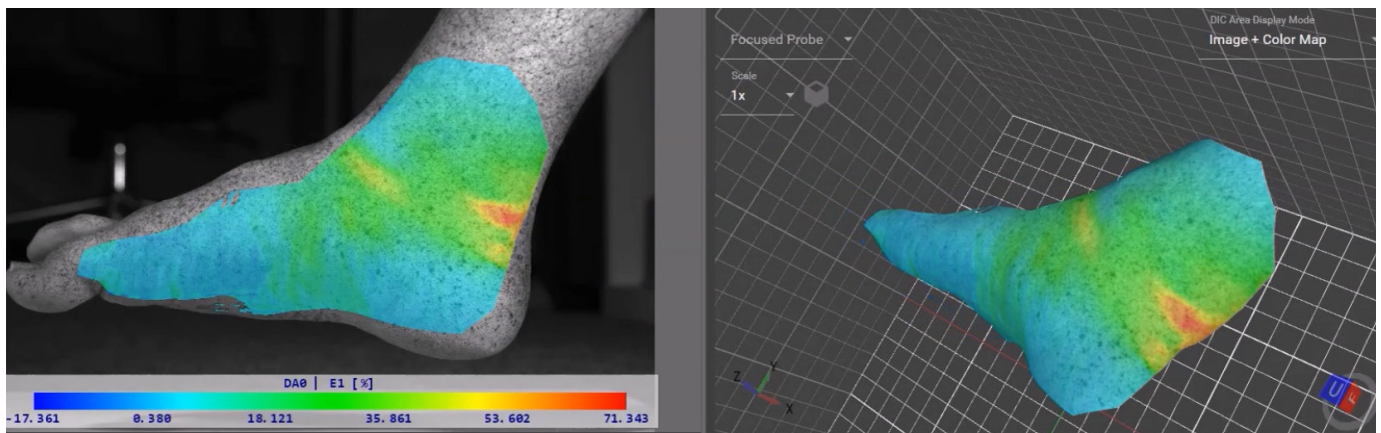
-25°C to +55°C (when packed for transport)

#### OPERATING TEMPERATURE RANGE:

+5°C to +40°C

#### OPERATING RELATIVE HUMIDITY RANGE:

80% at temperature <31°C decreasing linearly to 50% at 40°C



3D REPRESENTATION OF STRAIN ON SOFT MATERIALS SUCH AS SKIN

### LENSES

Selecting the right lens can optimise accuracy by maximising the number of available pixels for the measured area.

Two lenses per 3D system are required.



DEFLEX® LENS08



(SUPPLIED) LENS12



DEFLEX® LENS16



(SUPPLIED) LENS25



DEFLEX® LENS35



DEFLEX® LENS50



DEFLEX® LENS75

PRODUCT REFERENCE	FOCAL LENGTH [MM]	SENSOR FORMAT	MINIMAL FOCUSING DISTANCE [MM]	F-STOP	DIMENSIONS [MM]	WEIGHT [G]	FILTER SIZE	MOUNT
DefleX® LENS08	8	2/3"	100	2.8	Ø32 x 35.5	60	M30.5x0.5	C
-	12*		100		Ø29 x 43.5	60	M27x0.5	
DefleX® LENS16	16		250		Ø29 x 29	40	M27x0.5	
-	25*		200		Ø29 x 31.5	40	M27x0.5	
DefleX® LENS35	35		250		Ø29 x 38.5	50	M27x0.5	
DefleX® LENS50	50		300		Ø29 x 56	65	M27x0.5	
DefleX® LENS75	75		400		Ø36 x 75	100	M34x0.5	

\*Supplied as standard



INTRODUCTORY VIDEO