



DELTA THERM™ 1000

Stress Measurement System

The **DELTA THERM™ 1000** by Stress Photonics is a unique infrared differential thermography system suited to Thermoelastic Stress Analysis (TSA) and thermal nondestructive evaluation (NDE). By coupling special high-speed image processing electronics with a high-performance infrared array detector, it is now possible to **image stresses** in just seconds.

APPLICATIONS

DELTA THERM complements established experimental and analytical stress analysis techniques.

The *DELTA THERM 1000* can be used to

- Verify numerical and analytical models and calculations
- Measure stress concentration and stress intensity factors
- Survey a structure for potential problem sites
- Perform design comparisons
- Track damage in composite materials

The *DELTA THERM 1000* is an essential tool in the move towards complete integration of design, prototyping, and testing. It is the perfect partner to many important new technologies, such as

• **Rapid Prototyping**

The *DELTA THERM 1000* can evaluate components produced by rapid prototyping technologies early in the design cycle.

• **Finite Element Analysis**

The *DELTA THERM 1000* can be used to provide efficient full-field verification of the accuracy of finite element models.

• **Nondestructive Evaluation**

The *DELTA THERM 1000* can also be used for thermal NDE.

Thermoelastic Stress Analysis (TSA) produces a full-field stress map by imaging temperature changes with a sensitive infrared camera. All materials, whether solid, liquid or gas, change temperature when compressed or expanded. In solids, stresses cause small temperature changes described by the thermoelastic equation

$$\Delta T = \frac{-\alpha T}{\rho C_p} (\Delta \sigma)$$

To provide accurate measurements, the temperature changes induced by the thermoelastic effect are repeated and time-averaged during a continuous dynamic loading, usually provided by a closed-loop hydraulic load frame.

A special infrared camera, known as a differential thermographic system, correlates the load-induced IR signals with the reference signal from the load system. This allows a thermal resolution of 1.0mK, which translates to the following stress resolutions:

Material	Stress Resolution	
Steel	150psi	1.0MPa
Aluminum	60psi	0.4MPa
Epoxy	8.0psi	55kPa

Stress sensitivity is similar to that of a common strain gage.



USER INTERFACE

Detailed analysis and high quality presentation is performed using Stress Photonics' **DELTAVISION™** software. The software allows **DELTATHERM 1000** users to take advantage of powerful Windows software and network resources to process and present data quickly and easily.

FLEXIBLE

DELTAVISION runs within Windows, Windows for Workgroups, Windows 95, or Windows NT operating systems. With simple cut and paste operations, **DELTAVISION** is compatible with most word processors.

CAPABLE

- Superior graphics performance
- A variety of graphical data presentations
- Advanced data manipulation routines
- Quick and easy pull down menus
- Easy cut and paste of both TIFF & PICT

PROCESSING ELECTRONICS

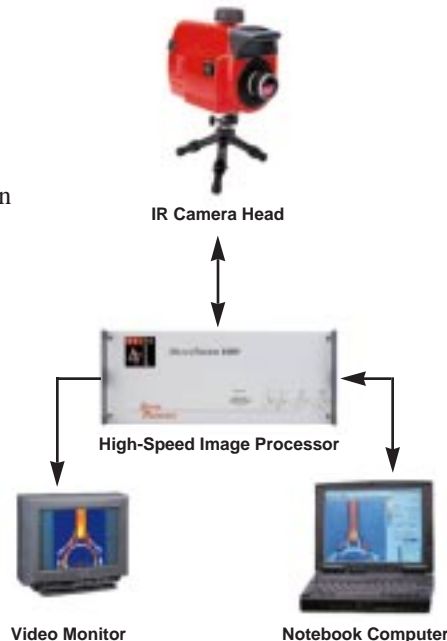
The **DELTATHERM** processing electronics provide a range of capabilities. Data collected from the infrared camera head is processed at 434 frames per second. The processed images can be sent to a computer via the parallel port and/or to a video monitor for immediate display.

Computer Data

- Time averaged TSA (AC) images for high quality results (user definable average)
- Time averaged thermal (DC) images for high quality temperature information
- Rapidly updated images for changing stresses
- User definable gain for adjusting contrast

Video (NTSC) Display

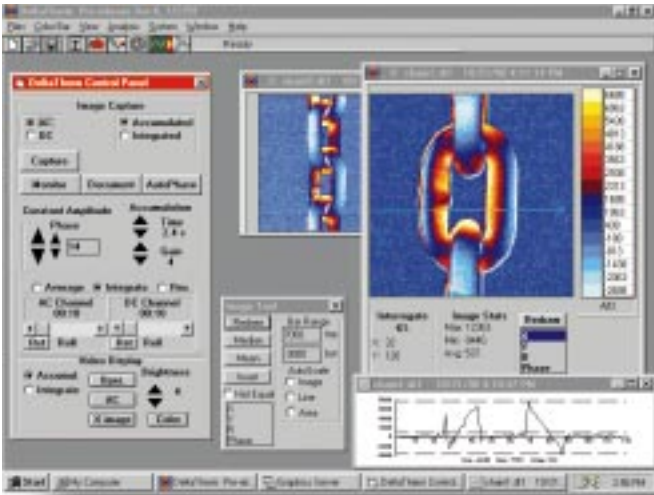
- "Live" thermal image for setup, aiming and focusing
- Current TSA image for near real time qualitative stress
- User definable independent gain for adjusting video contrast



SIMPLE

The **DELTATHERM 1000** has many features that make operation simple.

- Video camera-like aiming and focusing
- Virtual instrument panel for control and image acquisition
- Video monitor feedback for quick and easy adjustments and optimization



DELTA THERM™ 1000



DELTA THERM 1000 image of the stresses in a hook and clevis loaded at 10Hz. Image acquisition time: 30s.



FAST

DELTA THERM is remarkably fast. The 128 x 128 detector array contains 16,384 on-chip integrators which collect data simultaneously, producing a near-live full-field stress image. The high-speed digital electronics correlate load and temperature information for immediate video presentation of stress patterns.

PORTABLE

When portability is required, *DELTA THERM* can be fully operated with just three of the system components:

- The optical camera head < 8 lb
- The image processor < 16 lb
- The notebook computer < 5 lb

The small size and light weight of

ROBUST

- No moving parts to wear out or break
- Large, rugged liquid nitrogen Dewar with 5 hour hold time
- Long camera cable for safe and convenient operation
- Microsoft Visual Basic control software provides user integration capability
- Padded shipping and storage case

VERSATILE

- **Simple Optics**
Compact interchangeable lenses
- **Wide Temperature Range**
Essentially unlimited with accessories
- **Flexible Loading**
Constant or variable amplitude
- **Adaptable Housing**
Multiple hard mounting points
- **Customizable Software**

COMPLETE

- The *DELTA THERM* system includes
- IR camera head with optics
 - High-speed image processor
 - Notebook computer with
 - *DELTA VISION* & MS Office
 - Network interface & video PCMCIA cards
 - Video monitor and tripod
 - Instrument shipping/storage case

*DELTA THERM*TM 1000
 Stress Photonics Inc.
 3002 Progress Road • Madison, WI 53716
 Telephone (608) 224-1230 • FAX (608) 224-1233
 email: info@StressPhotonics.com
<http://www.StressPhotonics.com>



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