LUNA

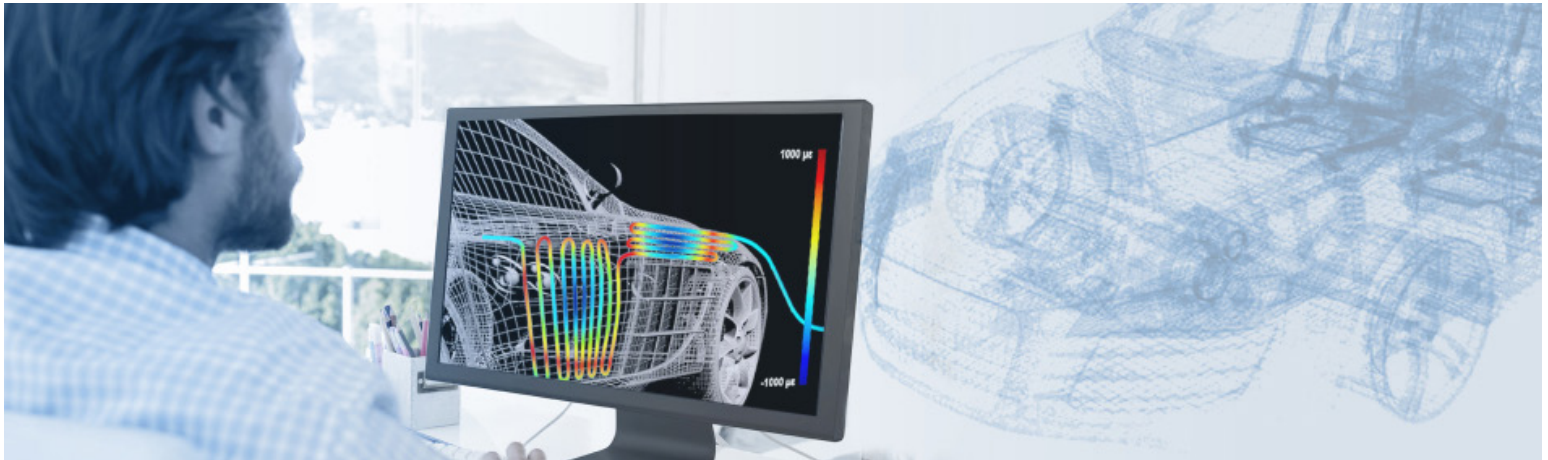## KEY FEATURES

- Multichannel measurements of strain - multiplex over 300,000 measurement locations

- Flexible, lightweight and easy to install sensors reduce time to first measurement

- Passive, corrosion resistant, dielectric, flexible sensors go where other sensors can't - in bends, around corners, embedded inside materials

- Long sensor life - no drift or recalibration required, cycle counts $>10^7$

- Large strain range and high resolution allow for mapping of complex strain fields and large strain gradients

APPLICATIONS

- Characterize strain on/in new materials and complex structures

- Profile temperature in-situ to maximize the efficiency of critical processes

- Measure two- and three-dimensional strain fields to validate FE models

- Evaluate multi-material joining

- Embed sensors within materials to create "smart parts"

ODiSI 6000 Series

Optical Distributed Sensor Interrogators

The ODiSI 6000 Series is a novel measurement system specifically designed to address the test challenges of 21st century advanced materials and systems.

The ODiSI provides thousands of strain or temperature measurements per meter of a single high-definition fiber sensor. The high-definition data can fully map the contour of strain for a structure under test, or the continuous thermal profile of a process in real time.
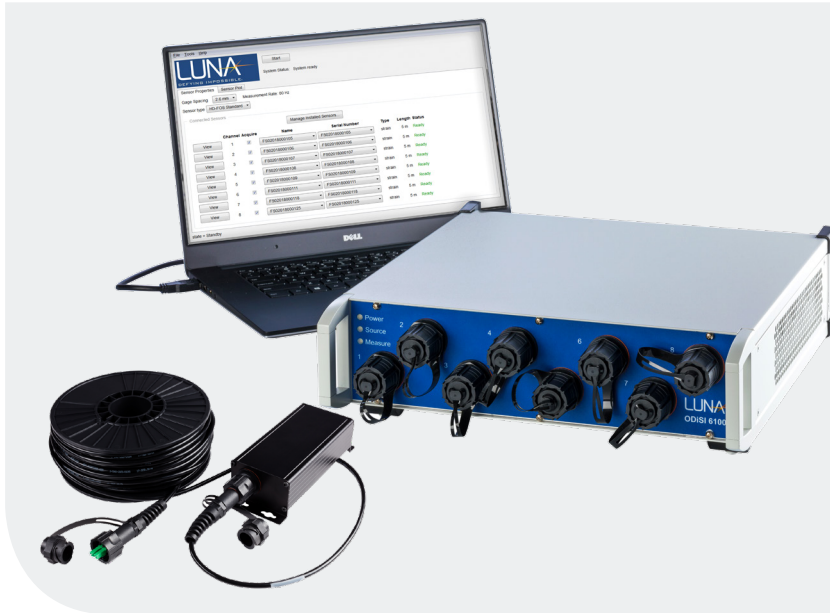
The sensor is flexible, low profile, requires no electrical source, and can be bonded to sharply curved surfaces, embedded within structures, or mounted directly to electrical surfaces.
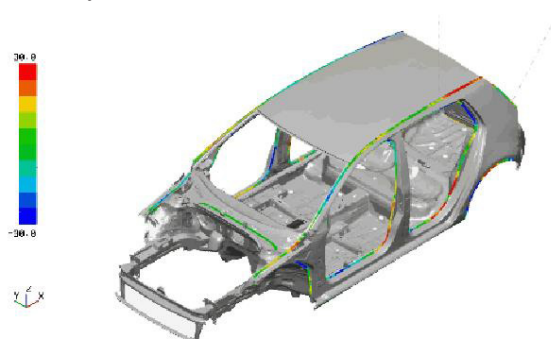
An automotive frame is instrumented with fiber and then tested under load. Test data is then superimposed on the CAD model

ODiSI 6100 BASE CONFIGURATION

Included with Base Configuration:

- ODiSI 6000 or 6100 mainframe
- ODiSI controller laptop running Linux OS and ODiSI operating software
- One 50 m, rugged standoff cable per channel to connect ODiSI interrogator and one "remote module" per channel which connects ODiSI sensors to the standoff cable

Model	Channels
ODiSI 6001	1
ODiSI 6102	2
ODiSI 6104	4
ODiSI 6108	8

Additional Base Configuration Features:

Real-Time Streaming Data

- Stream measurements in real-time at the maximum measurement rate to a file or via TCP-IP to another computer

Ease of Integration / Ease of Use

- Intuitive, easy to setup and use graphical user interface
- IEEE 1588 PTP (Precision Time Protocol) synchronization
- JSON-based digital streaming data
- Sync output TTL pulse

Reliability

- Continuous automatic optical alignment without user intervention
- System and sensor health check ensures high data fidelity

Traceability

- Optical frequencies validated with every acquisition scan for accurate measurements
- Strain sensors and associated coefficients calibrated with NIST traceable fixtures
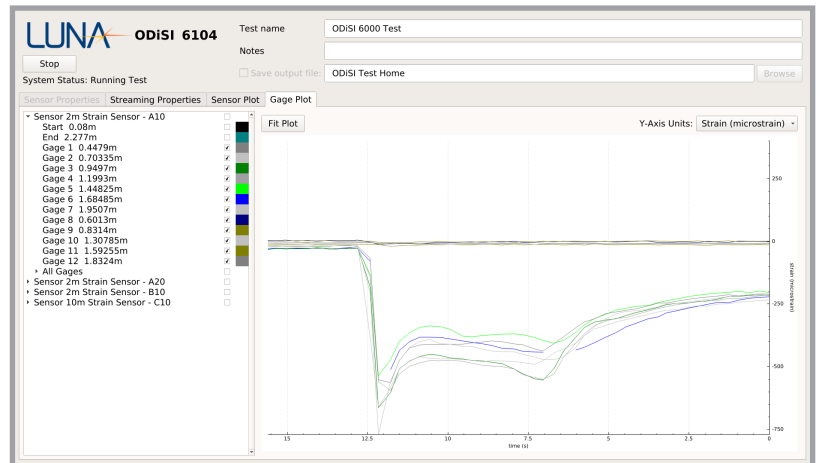
ODiSI 6000 Series Graphical User Interface Software

ODiSI STANDARD SENSOR CONFIGURATION

ODiSI comes configured to measure standard "Rayleigh" High Definition Fiber Optic Sensors (HD-FOS). HD-FOS operation is based on measurement of the Rayleigh backscatter in optical fiber and delivers maximum spatial resolution for static and quasi-static applications.

- Gage pitch (spacing) from 2.6 mm to 0.65 mm (1,538 gages per meter)
- Standard sensor lengths up to 10 m (extended ranges up to 50 m are also available)
- Standard measurement rates up to 62 Hz on a single channel (higher rates available with Rayleigh Accelerator option)

EXTENDED RANGE FEATURE

This optional feature allows up to four channels of the ODiSI 6100 to measure strain sensors with extended lengths of up to 50 m, enabling the measurement and monitoring of large-scale structures.

- Option adds extended 20 m and 50 m sensing length modes on up to 4 channels
- Extended range channels must be purchased seprately, and require extended length HD-FOS remote modules

RAYLEIGH ACCELERATOR

This feature accelerates the measurement speeds for HD-FOS Rayleigh sensors by a factor of 4x. The Rayleigh Accelerator is field upgradeable through a combination of software and the addition of a small Thunderbolt® 3 expansion chassis with accelerator card.

- Option increases measurement rates 4x
- Measurement rates up to 250 Hz on a single channel (for 2.6 mm gage pitch)
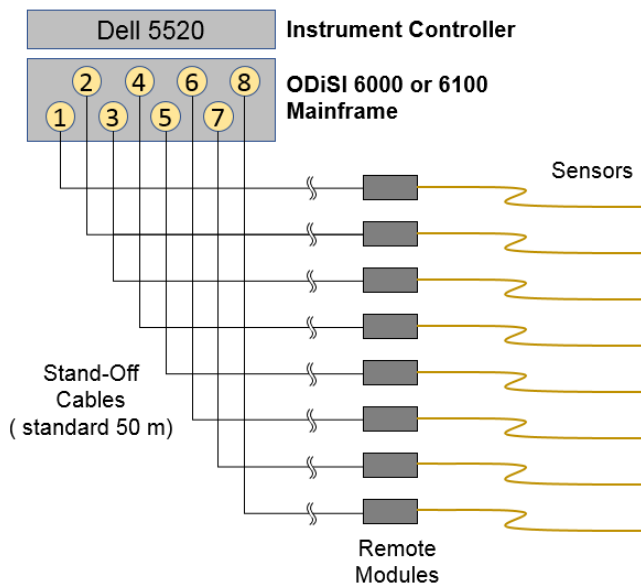
Graphical depiction of an 8-channel ODiSI 6108 configuration showing stand-off cables, remote modules and sensors

http://www.henkel-adhesives.com/
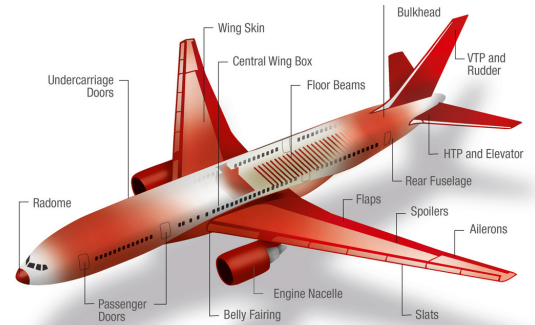
Transform Structural Testing

ODiSI is ideal for strain measurements on and in composite materials, including materials characterization, FE model verification and full scale test.
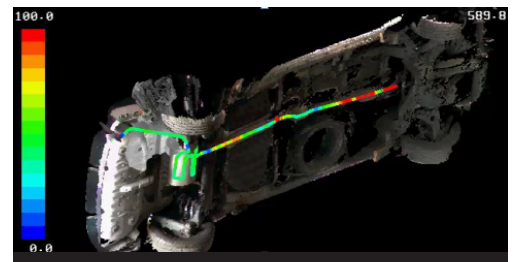
Accelerate Design

With continuous, high resolution mapping of strain and temperature, "hot spots" and large strain gradients are easily located and accurately characterized.
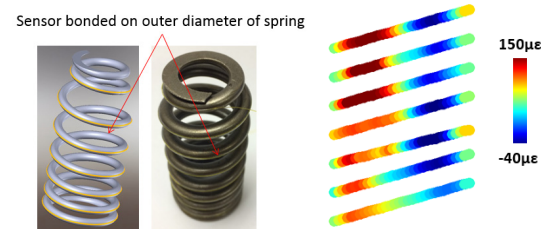
Ensure Quality

With no "line of sight" issues and the ability to bond to curved and otherwise difficult-to-gage locations, ODiSI sensors go where no other sensors can so you get the full picture of performance.

2D and 3D VISUALIZATION SOFTWARE

ODiSI 2D and 3D Visualization Software allows strain or temperature data to be visualized in three dimensions directly on a CAD drawing or in two dimensions on a standard photo or 2D image. Simply load an .stl or graphics file of the test article, map the sensor routing and view temperature or strain data directly on the image or on the 3D model.

Data can be loaded from a previously acquired ODiSI data file or streamed in real-time from an ODiSI system. The visualization software can create movies of the evolution of strain and temperature over time to gain greater insight into your design.

- Easily interpret and communicate complex data
- Visualize large data files using contour and 3D mapping
- Quickly focus on critical areas of interest in space and/or time
- Visualize and share ODiSI data mapped on imported .stl files
- Visualize data in real time from an ODiSI system or playback file data
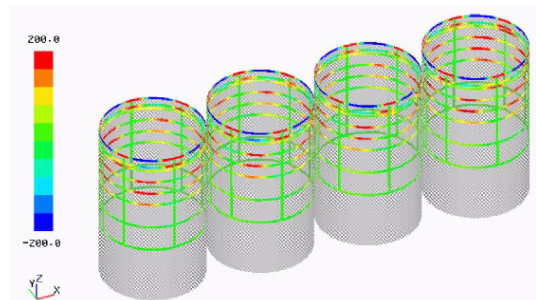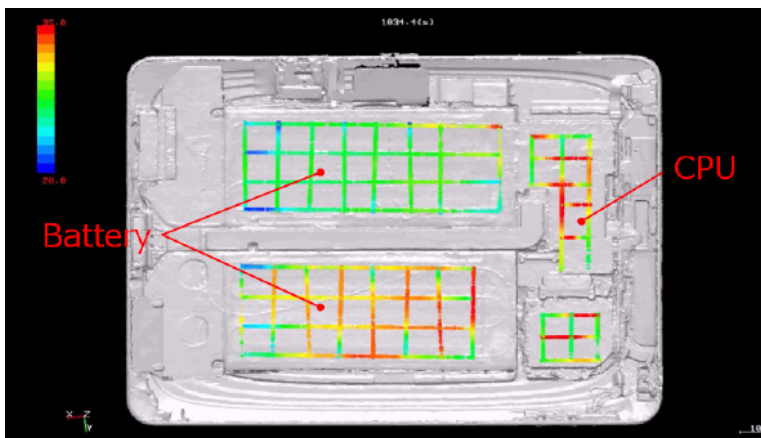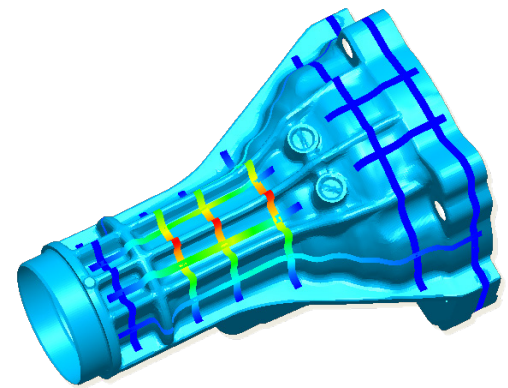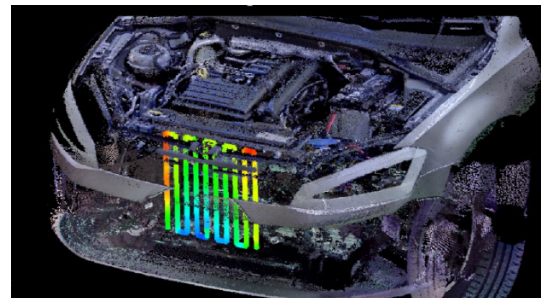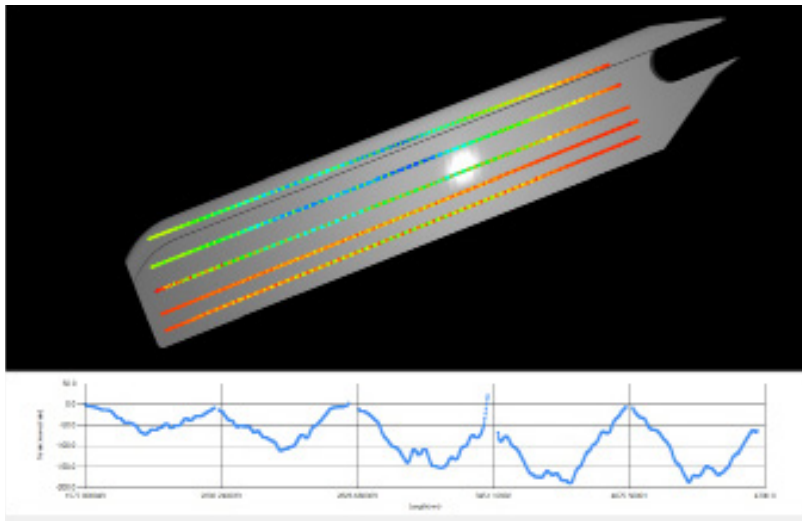
PERFORMANCE

PARAMETER		SPECIFICATION			UNITS
Gage Pitch[1]		**0.65 mm**	**1.3 mm**	**2.6 mm**	
Number of channels		1, 2, 4 or 8 channels			
Maximum sensor length per channel	Standard	10			m
	Extended	50 (on up to 4 channels)			m
Gages (measurement locations) per meter		1,538	768	384	gages/m
Maximum gages per sensor	10 m sensor	15,380	7,680	3,840	gages/ch
	50 m sensor	76,900	38,400	19,200	gages/ch
Standoff cable length		50 or 100			m
Measurement Rates (Rates are aggregate; divide by number of active channels to determine the per-channel rate)					
Standard length sensor rates (with Rayleigh accelerator)	2.5 m mode	15 (62.5)	31 (125)	62 (250)	Hz
	5 m mode	10 (40)	20 (80)	40 (160)	Hz
	10 m mode	6 (25)	12 (50)	25 (100)	Hz
Extended range sensor rates (with Rayleigh accelerator)	20 m mode	3 (12.5)	6 (25)	13 (50)	Hz
	50 m mode	-	2.5 (12.5)	5 (20)	Hz
HD Strain Measurement					
Strain measurement range		±12,000			µε
Resolution		1			µε
Instrument accuracy		±1			µε
System (instrument and sensor) accuracy[2]		±25	±30	±30	µε
System repeatability at zero strain[3]	Standard	< ±20	< ±10	< ±5	µε
	Extended	< ±40	< ±30	< ±20	µε
System repeatability across full strain range[4]		±0.55	±0.35	±0.15	%
Dynamic Loading Rate		1	2.5	5	Hz
HD Temperature Measurement					
Temperature measurement range (standard sensor)		-40 to 200			°C
Resolution		0.1			°C
Accuracy (consult factory)		-			°C
Repeatability		±0.06	±0.03	±0.01	%

ENVIRONMENTAL AND PHYSICAL

PARAMETER	ODiSI 6000 SERIES	ODiSI CONTROLLER	RAYLEIGH ACCELERATOR	UNITS
Class 1 Laser	<10	n/a	n/a	mW
Operating temperature range	5 - 40	0 - 40	0 - 35	°C
Storage temperature range	0 - 40	-40 - 70		°C
Operating relative humidity (non-condensing)	10 - 90	10 - 90	20-90	% RH
Storage relative humidity (non-condensing)	10 - 90	10 - 95		% RH
Operating altitude	-50 to 10,000 (-15 to 3,000)	-50 to 10,000 (-15 to 3,000)		ft (m)
Dimensions W x D x H	13.5 x 13.9 x 4.3 (34 x 35 x 11)	14 x 9.3 x 0.7 (36 x 24 x 17)	5.6 x 8.6 x 3.5 (14 x 22 x 9)	in (cm)
Weight	13 (6)	4 (1.8)	3.7 (1.7)	lb (kg)
Power	30	130	60	W

NOTES

1. Gage pitch is the distance between centerpoints of consecutive gages.
2. Accuracy reflects ODiSI measurements compared to NIST traceable extensometer measurements. Data based on average of 150 scans at each of seven increments of strain, from 0 to maximum strain. System accuracy includes errors from ODiSI instrument and Luna strain sensors.
3. Repeatability at zero strain refers to offset from zero with no strain applied. No filtering is applied. Includes effects of instrument and Luna sensors.
4. Repeatability across strain range refers to average repeatability over full strain range. Repeatability is measured and reflects 2σ standard deviation from the mean with sample size of 150 scans. No filtering is applied. System repeatability includes effects of instrument and Luna sensors.

PRODUCT CERTIFICATIONS

ODiSI ORDERING INFORMATION

Catalog Number	Description	Includes
ODiSI 6001, ODiSI 6102, ODiSI 6104, ODISI 6108	ODiSI 6000 Series Distributed Sensing Instrument	Instrument controller, 1, 2, 4 or 8 channels enabled instrument, HD standard length mode (up to 10 m sensor lengths). Also includes one standoff cable and one remote module for each channel and ruggedized case shipping case.
OPT06100-R	Rack Mount Option	Rack mount accessory for 6000 Series
OPT06114/5	Extended Range Option	Adds 20 m and 50 m HD sensing option on all active channels. Note: only 4 channels can be active in extended range mode simultaneously. Includes one extended range remote module.
OPT06120	Rayleigh (HD) Accelerator	Increases measurement rates in HD/Rayleigh mode by 4x (see Specifications table for rates). Includes Thunderbolt® 3 expansion chassis and accelerator card.

SENSOR ORDERING INFORMATION

Catalog Number	Sensors Description
HD6SXXLC220P	HD strain sensor, LC2+ connector, polyimide coating, 220 °C, length = XX m
HD6SXXLC300P	HD strain sensor, LC2+ connector, polyimide coating, 300 °C, length = XX m
HD6TXXLC220P	HD temperature sensors with Teflon sleeving, 220 °C, length = XX m
FOSAPPKIT	Fiber Optic Sensor Application Kit Materials (epoxy, tools, etc.) required to install 10 m of sensing fiber (does not include fiber)

Luna Sales and Support Contact Information

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