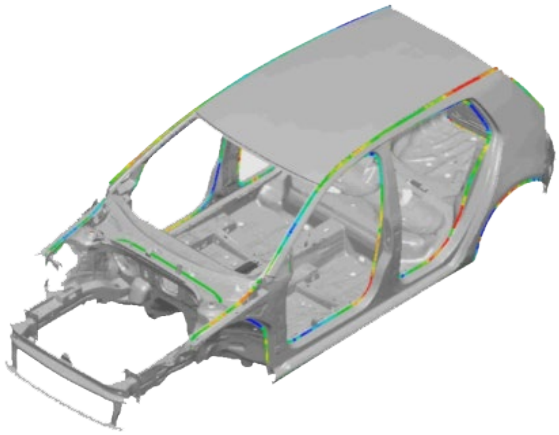
ODiSI 6000 Series

Optical Distributed Sensor Interrogators

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

The ODiSI 6000 Series provides thousands of strain or temperature measurements per meter of a single high-definition fiber sensor. The ultra-high resolution data can fully map the contour of strain for a structure under test or the continuous temperature 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.

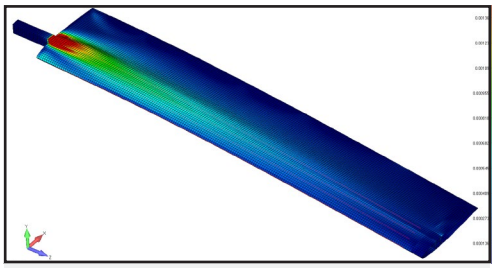
Acquire thousands of strain or temperature measurements per meter of optical fiber.

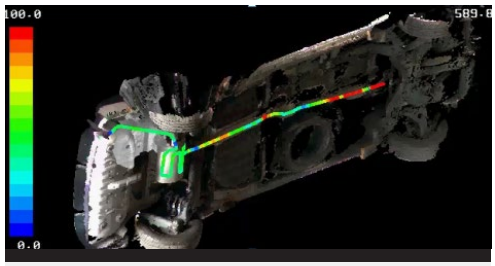
KEY FEATURES

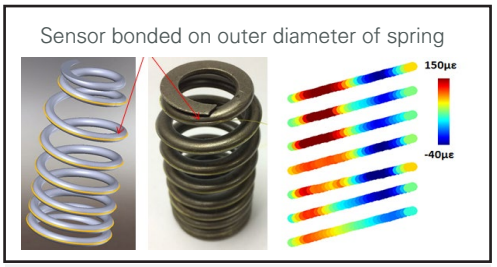
- **High-definition distributed** sensing — thousands of measurements with sub-millimeter gage pitch
- **Real-time multichannel system** with each channel supporting up to 100 m of high-def sensing fiber
- **Flexible, lightweight** and easy-to-install sensors reduce time to first measurement
- Passive, corrosion resistant, dielectric **sensors go where other sensors can't** — in bends, corners, embedded inside materials
- **Long sensor life** — no drift or recalibration, cycle counts >10^7

APPLICATIONS

- Characterize strain 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
- Detect small cracks and defects in critical structures
- Embed sensors within materials to create "smart parts"







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

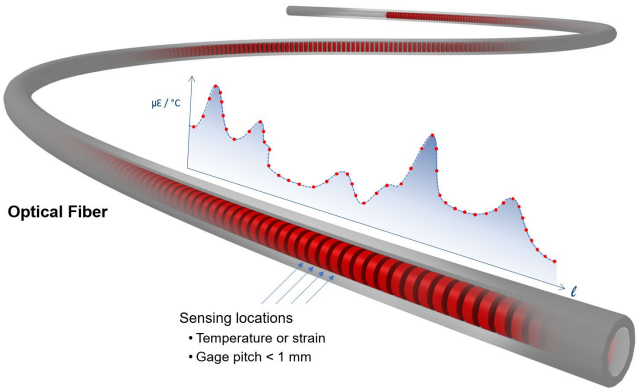
With continuous, high resolution mapping of strain and temperature, "hot spots" and large strain gradients are easily identified, located and accurately characterized.

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. The result is more comprehensive data and the full picture of performance.

HIGH-DEFINITION DISTRIBUTED FIBER OPTIC SENSING

The ODiSI system measures strain and temperature data using standard optical fiber with unmatched spatial resolution and precision. High-definition fiber optic sensing (HD-FOS) is a distributed sensing technology that is based on the naturally occurring Rayleigh backscatter in optical fiber and delivers maximum spatial resolution for static and quasi-static applications.

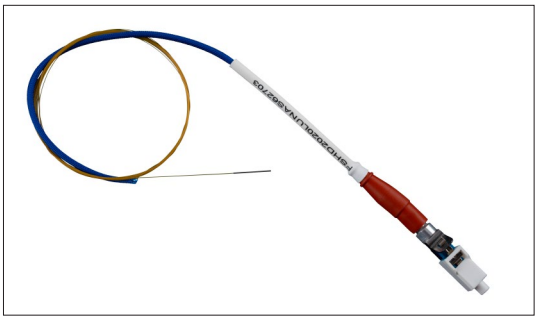


This unique measurement system delivers several valuable benefits for measurement and control applications:

- Map strain or temperature fields with ultra-high spatial resolution
- Capture strain and temperature details not available with conventional point and multipoint sensors
- Real-time data from demanding environments and difficult-to-instrument locations

STRAIN AND TEMPERATURE SENSORS

Luna's high-definition (HD) strain sensors, constructed using polyimide-coated low bend loss fiber with a diameter of 155 µm, are NIST-traceable calibrated for standard lengths ranging from 1 m to 100 m and are available with a temperature rating of 220 °C or 300 °C.



Flexible HD strain sensor, available in ready-to-use lengths from 1 m to up to 100 m.

HD temperature sensors are encapsulated in a PTFE tube, are rated to a maximum temperature of 200 °C, and available with strain compensation for embedded and surface-mount applications (HD-SC sensors).

HD sensors are supplied with calibrated scaling coefficients and a unique reference key that enables easy plug-and-play identification and operation with the ODiSI system. Measurement gage pitch (spacing) and location is software-configurable through the ODiSI application software.

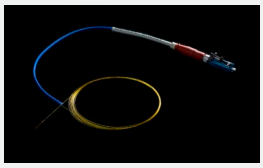
LUNA

ODiSI SYSTEM

ODiSI controller with the ODiSI application software (Linux OS)

ODiSI mainframe with 1, 2, 4 or 8 channels

Rugged standoff cables and remote modules connect sensors to ODiSI mainframe



Fiber optic sensors
- High-definition strain
- High-definition temperature
- Strain-compensated temperature

ODiSI SYSTEM AND MEASUREMENT CONFIGURATIONS

The ODiSI system comes configured with 1, 2, 4 or 8 channels able to measure standard Rayleigh HD-FOS sensors. In standard mode, each channel supports an HD-FOS sensor up to 20 m in length. When used with extended range remote modules, each channel can support sensors up to 100 m in length.

The ODiSI 610*x* models can be configured to measure strain or temperature with a gage pitch (spacing of adjacent gage centerpoints) of 0.65 mm, 1.3 mm, 2.6 mm or 5.2 mm. The ODiSI 600*x* models support a gage pitch of 5.2 mm. Both ODiSI systems also support a proprietary strain-compensated temperature measurement that optimizes accuracy and reliability when monitoring temperature in surface-mounted and embedded applications.

Model		ODiSI 600x	ODiSI 610x
Number of Channels		1, 2, 4 or 8	1, 2, 4 or 8
High-Definition (HD) Strain & Temperature Sensors	Sensor Lengths	1 to 100 m	1 to 100 m
	Gage Pitches	5.2 mm	0.65 mm, 1.3 mm, 2.6 mm, 5,2 mm
	Max Meas. Rate	30 Hz	250 Hz
Strain-Compensated Temperature Sensors	Sensor Lengths	1 to 5 m	1 to 5 m
	Min Gage Pitch	1.04 cm	1.04 cm
	Max Meas. Rate	2.5 Hz	2.5 Hz

The ODISI system is a complete data acquisition solution with many features for logging data, visualizing data and integrating data with external systems.

Easy-to-Use Software
- Quickly identify and configure sensors
- View real-time data, plotted versus length or time
- Log measurement data to disk
- Replay saved data

Real-Time Streaming Data and Visualization
- Real-time remote access to ODiSI system and measured data via thin client software
- View and stream measurements in real time to a file or via TCP-IP to another computer
- Optional software for 3D and 2D visualization of data (real-time or file playback)

Reliability and Traceability
- Continuous optical alignment and calibration with every scan, requiring no user intervention
- Strain sensors calibrated with NIST-traceable fixtures
- Optional strain-compensation mode for more accurate temperature measurements

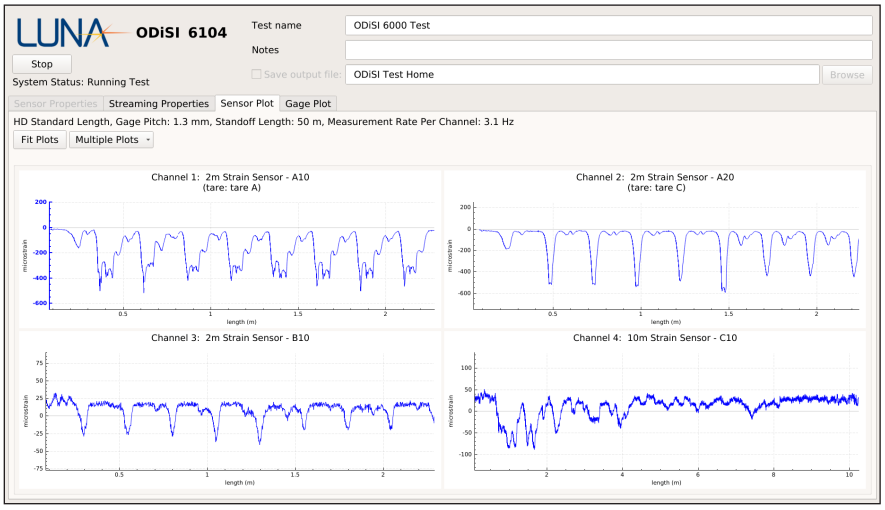
Ease of Integration
- IEEE 1588 PTP network time synchronization
- JSON-based digital streaming data format
- Sync output TTL pulse
- Start and stop triggering functions
- Optional USB module for analog outputs

LUNA

ODiSI APPLICATION SOFTWARE

The ODiSI system includes easy-to-use software to configure the system and to acquire, visualize and log measurement data.

- Automatic plug-and-play sensor identification
- Quickly identify and configure modes, timing, triggering and data logging
- Interactive touch-to-locate tool for identifying locations of key gages
- Save, replay and export measurement data files
- Real-time streaming of data over Ethernet



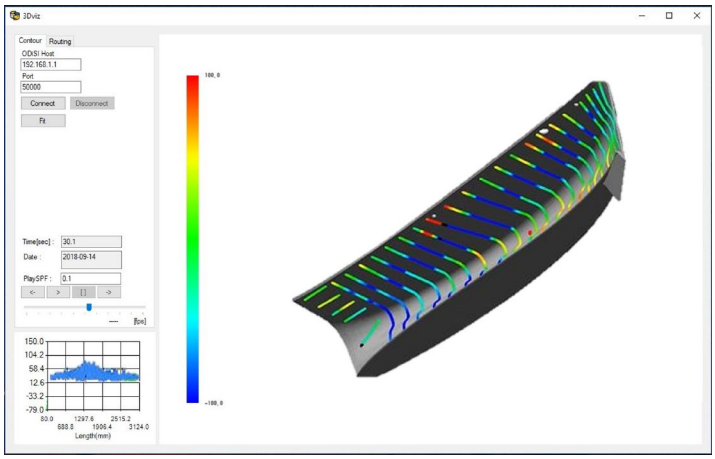
Multichannel sensor plot (strain/temperature versus length) in the ODiSI software.

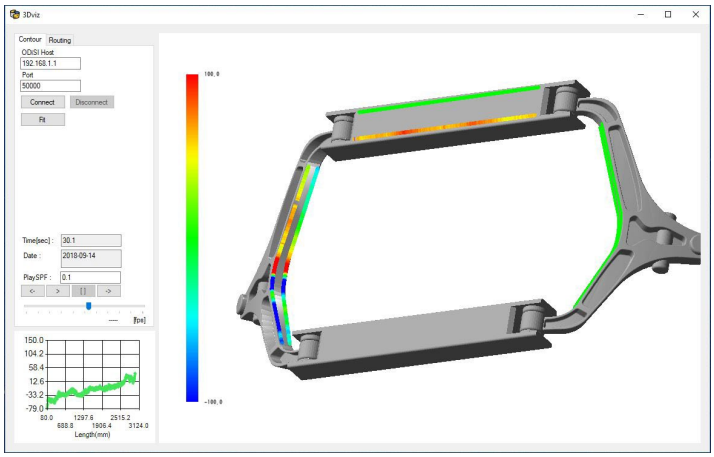
Additionally, the ODiSI Remote software allows the control and viewing of real-time data from a remote, networked ODiSI system. The ODiSI Remote Software can perform basic control (start, stop, etc.), display live real-time streaming data or replay previously saved measurement data. The ODiSI Remote software is available for Windows OS and Linux OS.

3DViz - 2D AND 3D VISUALIZATION SOFTWARE

The ODiSI 3DViz software enables strain or temperature data to be visualized in three dimensions directly on a CAD model 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 onto the model or image, and then view color-coded temperature or strain data directly on the image or 3D model.

Data can be loaded from a previously acquired ODiSI data file or streamed in real-time from an ODiSI system that is connected to the network. The visualization software can create videos of the evolution of strain and temperature over time to provide greater insight into designs. Refer to the 3DViz data sheet for more details.





The ODiSI 2D and 3D Visualization Software displays real-time data, as well as previously recorded data on 2D images or 3D models, which can be manipulated and moved to visualize different perspectives.

PERFORMANCE

Parameter		Specification				
Number of channels		1, 2, 4 or 8 channels				
Maximum sensor length per channel	Standard mode	20 m				
	Extended range	100 m				
Standoff cable length[1]		10, 50, 100, 150 or 200 m				
Maximum patch cord length (patch cords can be added between remote module and sensor)		Up to 19 m (depending on sensor length)[2]				
High-Definition Strain and Temperature Mode[3]						
		ODiSI 610*x*				ODiSI 600*x*
Gage pitch[4]		0.65 mm	1.3 mm	2.6 mm	5.2 mm	5.2 mm
Gages (measurement locations) per meter of sensor		1,538	768	384	192	192
Measurement rates (Rates are aggregate; divide by number of active channels to determine the per-channel rate)	2.5 m mode	62.5 Hz	125 Hz	250 Hz	250 Hz	30 Hz
	5 m mode	40 Hz	80 Hz	160 Hz	160 Hz	20 Hz
	10 m mode	25 Hz	50 Hz	100 Hz	100 Hz	12.5 Hz
	20 m mode	12.5 Hz	25 Hz	50 Hz	50 Hz	6.3 Hz
	50 m mode	-	10 Hz	20 Hz	20 Hz	2.5 Hz
	100 m mode	-	-	10 Hz	10 Hz	1 Hz
Strain measurement range		±15,000 με				
Resolution		0.1 με				
Instrument accuracy		±1 με				
System (instrument and sensor) accuracy[5]		±25 με	±30 με	±30 με	±30 με	±30 με
Measurement uncertainty at zero strain[6]	Standard	±5 με	±4 με	±2 με	±2 με	±2 με
	Extended range	±5 με	±4 με	±2 με	±2 με	±2 με
Measurement uncertainty across full strain range[6]		±5 με	±4 με	±2 με	±2 με	±2 με
Dynamic loading rate		1 Hz	2.5 Hz	5 Hz	5 Hz	1 Hz
Temperature measurement range		-40 to 200 °C				
Temperature measurement resolution		0.1 °C				
Measurement uncertainty[6]		±2.2 °C	±1.6 °C	±0.6 °C	±0.6 °C	±0.6 °C
Strain-Compensated Temperature Mode[3]						
Gage pitch[4]		1.04 cm				
Gages (measurement locations) per meter of sensor		96 gages/m				
Measurement rate (all lengths)		2.5 Hz				
Resolution		0.1 °C				
Measurement uncertainty[6]		±0.9 °C				
Strain compensation		Over an applied strain range of 0 to 1800 με, measurement accuracy is ± 2.8 °C [7]				

NOTES

1. Standoff cables connect the ODiSI mainframe to the remote modules and sensors, and are available in standard lengths of 10, 50 and 100 m. Additionally, two cables can be combined to form standoff lengths of 150 and 200 m.
2. Patch cords can be used to connect the remote module's tether to the sensor. The total length of the patch cord plus the active sensor fiber must not exceed 20 m for Standard length mode or 100 m for Extended Range mode.
3. High-definition strain and temperature mode is used with standard HD sensors. Strain-compensated temperature mode requires HD-SC sensors.
4. Gage pitch is the distance between centerpoints of consecutive gages.
5. Accuracy reflects ODiSI measurements compared to NIST-traceable extensometer measurements. Data based on average of 150 measurements at each of seven increments of strain, from 0 to maximum strain. System accuracy includes errors from ODiSI instrument and Luna strain sensors.
6. Measurement uncertainty is equal to twice the standard deviation calculated from a set of 1000 measurements. Measurement uncertainty includes the effects of the ODISI interrogator and Luna sensors.
7. RMS error with the HD-SC sensor subjected axial strain over the range of 0 to1800 με. Also includes effects of the ODiSI interrogator.

LUNA

Parameter	Specification
Environmental and Physical	
Class 1 laser	<10 mW
Operating temperature range — mainframe and controller	5 to 40 °C
Operating temperature range — standoff cable and remote module	5 to 60 °C
Storage temperature range	0 to 40 °C
Operating and storage relative humidity (non-condensing)	10 to 90 % RH
Operating altitude	-15 to 3,000 m
Dimensions — mainframe (W x D x H)	34 x 35 x 11 cm
Dimensions — laptop controller (W x D x H)	36 x 24 x 1.7 cm
Weight (mainframe and controller)	17 lb (7.8 kg)
Power (mainframe and controller)	160 W
Certifications	

ODiSI ORDERING

Catalog #	Description	Includes
ODiSI 610x	ODiSI 6101/2/4/8 Distributed Sensing Instrument	System for maximum speed and resolution (gage pitch down to 0.65 mm). Includes system with 1, 2, 4 or 8 channels, instrument controller laptop and ODiSI application software. Also includes one standoff cable and standard length remote module for each channel.
ODiSI 600x	ODiSI 6001/2/4/8 Distributed Sensing Instrument	System with standard gage pitch of 5.2 mm. Includes system with 1, 2, 4 or 8 channels, instrument controller laptop and ODiSI application software. Also includes one standoff cable and standard length remote module for each channel.
OP06150	Extended Range Remote Module	Remote module supporting extended sensor lengths of 50 m and 100 m (in addition to Standard sensor lengths).
OPT06100-R	Rack Mount Controller Option	Rack mount (1U) instrument controller (substituted for laptop).
OPT06020	USB-3106 Analog Output	16-channel analog output module for ODISI (voltage or current outputs).
OPT06125	3Dviz - 3D/2D Visualization Software	Visualization software for mapping real-time or saved ODiSI data onto 3D models and 2D images. Compatible with Windows OS.
OPT06123	3Dviz - 2D Visualization Software	Visualization software for mapping real-time or saved ODiSI data onto 2D images. Compatible with Windows OS.

SENSOR ORDERING

Catalog #	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 PTFE sleeving, 200 °C, length = XX m
HD6SCTXXLC220P	HD strain-compensated temperature sensors with PTFE sleeving, 200 °C, length = XX m
FOSAPPKIT	Fiber Optic Sensor Application Kit Materials (epoxy, tools, etc.) required to install 10 m of sensing fiber

LUNA

+1.866.586.2682
solutions@lunainc.com
www.lunainc.com

*Specifications subject to change without notice.