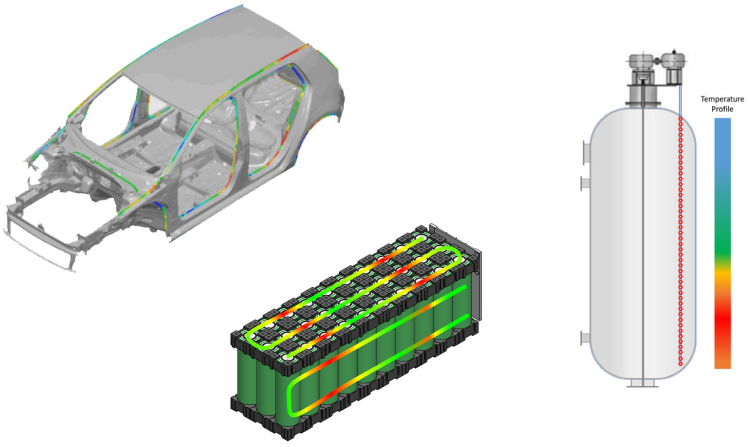
ODiSI 7100 Series

Optical Distributed Sensor Interrogators

The ODiSI 7100 Series is an innovative measurement system specifically designed to address the test challenges of 21st century advanced materials and systems.

The ODiSI 7100 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.



Instrumenting an automotive frame, battery pack or distillation column with high- definition strain or temperature sensors yields comprehensive data and increased insight for model verification, testing and monitoring.

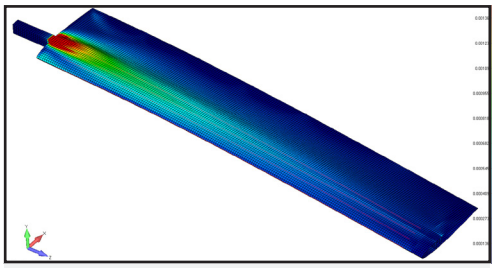
Acquire thousands of strain or temperature measurements per meter of optical fiber

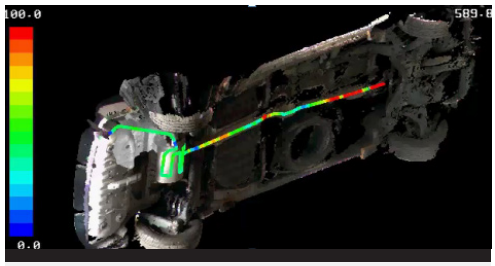
KEY FEATURES

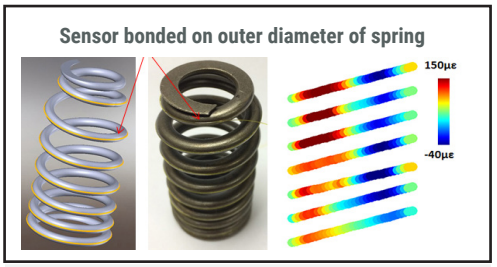
- High-definition distributed sensing — thousands of measurements with sub-millimeter gage pitch
- Real-time multichannel system with each channel supporting up to 100 m of high-def sensing fiber
- Flexible, lightweight and easy-to-install sensors reduce time to first measurement
- Passive, corrosion 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.

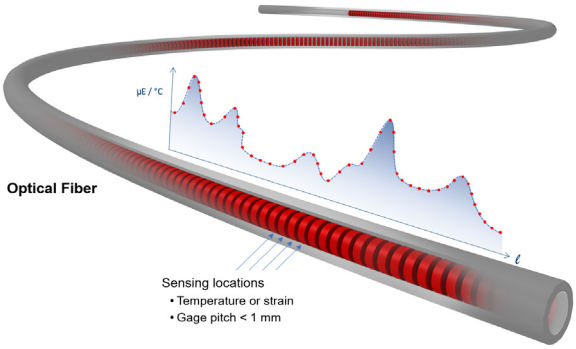
Ensure Quality

With no "line of sight" issues and the ability to bond to curved and difficult-to-gage locations, ODiSI sensors go where no other sensors can and deliver more comprehensive data.

HIGH-DEFINITION DISTRIBUTED FIBER OPTIC SENSING

The ODiSI system captures strain and temperature data with unmatched spatial resolution and precision, delivering valuable benefits for measurement and control applications:

- Capture details not available with conventional point sensors or other fiber optic sensing technologies
- Real-time data from demanding environments and difficult-to-instrument locations



HD Rayleigh Sensors for Maximum Spatial Resolution

High-definition (HD) fiber optic sensors are distributed sensors based on the naturally-occurring Rayleigh backscatter in optical fiber, delivering maximum spatial resolution for static and quasi-static applications. HD strain sensors, constructed with polyimide-coated fiber with a diameter of 155 µm, are NIST-traceable calibrated, deliver a gage pitch down to 0.65 mm and are available in lengths from 1 m to 100 m.

HD sensors are supplied with calibrated scaling coefficients and a reference key for easy plug-and-play operation with the ODiSI system. Measurement gage pitch (spacing) and location are completely software-configurable.

HD-SC Strain Compensated Temperature Sensors

HD-SC temperature sensors utilize an advanced interrogation mode of the ODiSI to increase the accuracy of measurements when the sensors are subjected to strain, such as in embedded and surface-mount installations.

Continuous Fiber Grating (CFG) Sensors

CFG sensors utilize fiber with fiber Bragg gratings (FBG) continuously inscribed along the fiber. When used with the ODiSI, CFG sensors exhibit an increased tolerance to vibration and improved dynamic performance.

	High-Definition (HD) Sensors - Strain & Temperature	Continuous Fiber Grating (CFG) Sensors	Strain-Compensated (HD-SC) Temperature Sensors
Application feature	Maximum spatial resolution, maximum sensor length	Increased dynamic performance	Temperature sensing with embedded or mounted sensors
Sensor gage pitch	0.65 mm, 1.3 mm, 2.6 mm and 5.2 mm	6 mm	1.04 cm
Sensor lengths	1 to 100 m	1 to 15 m	1 to 5 m
Measurement rate	Up to 250 Hz	Up to 62.5 Hz	2.5 Hz
Remote module compatibility	Standard & Extended Range	Standard	Extended Range

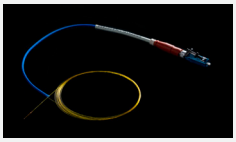
ODiSI SYSTEM

ODiSI controller with the ODiSI application software (Linux OS)

ODiSI mainframe
(Up to 8 channels)

Rugged standoff cables
(for each channel)

Remote modules - interface to sensor



Fiber optic sensors
- High-definition strain
- High-definition temperature
- Strain-compensated temperature
- Continuous fiber grating (CFG) sensors

ODiSI SYSTEM CONFIGURATIONS

The ODiSI system comes configured with up to 8 channels able to measure standard Rayleigh HD sensors or CFG sensors. In standard mode, with Standard Remote Modules, each channel supports an HD-FOS sensor up to 20 m in length, or a CFG sensor up to 15 m in length. When used with the optional Extended Range Remote Modules, each channel can support sensors up to 100 m in length, as well as HD-SC strain-compensated temperature sensors.

Measurement Mode		Model ODiSI 710x
	Number of Channels	1, 8
High-Definition (HD) Strain & Temperature Sensors	Compatibility	√
	Gage Pitches	0.65 mm, 1.3 mm, 2.6 mm, 5.2 mm
	Max Meas. Rate	250 Hz
Strain-Compensated Temperature Sensors (requires Extended Range Remote Modules)		√
Continuous Fiber Grating (CFG) Sensors		√

The ODiSI 7100 Series 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 systems also support a proprietary strain-compensated temperature measurement that optimizes accuracy and reliability when monitoring temperature in surface-mounted and embedded applications.

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
- Compatibility with continuous fiber grating (CFG) sensors for improved dynamic performance

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

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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

Additionally, the ODiSI Remote software allows the control and viewing of real-time data from a remote, networked ODiSI system.

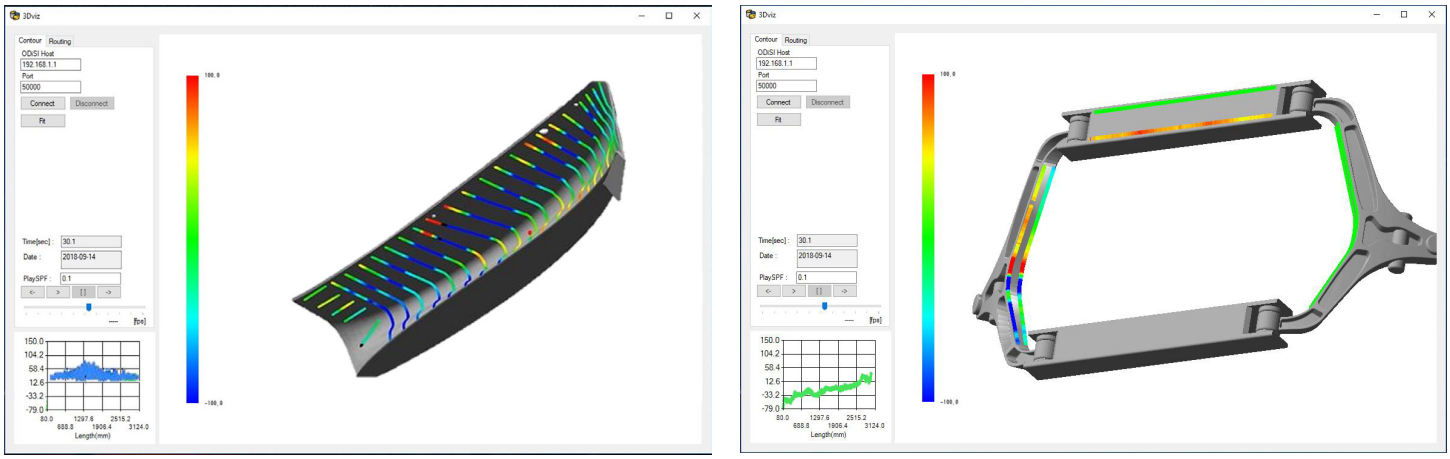
Multichannel sensor plot (strain/temperature versus length) in the ODiSI software.

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		Up to 8 channels				
Maximum sensor length per channel	Standard mode	20 m				
	Extended range	100 m[1]				
Standoff cable length[2]		10, 50, 100, 150 or 200 m				
Maximum patch cord length[3]		Up to 19 m (depending on sensor length)				
High-Definition (HD) and Continuous Fiber Grating (CFG) Modes						
		High Definition (Rayleigh) Sensors				CFG Sensors[4]
Gage pitch[5]		0.65 mm	1.3 mm	2.6 mm	5.2 mm	6 mm
Gages (measurement locations) per meter of sensor		1,538	768	384	192	166
Measurement rates for (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	62.5 Hz
	5 m mode	40 Hz	80 Hz	160 Hz	160 Hz	40 Hz
	10 m mode	25 Hz	50 Hz	100 Hz	100 Hz	25 Hz
	20 m mode	12.5 Hz	25 Hz	50 Hz	50 Hz	12.5 Hz
	50 m mode	-	10 Hz	20 Hz	20 Hz	-
	100 m mode	-	-	10 Hz	10 Hz	-
Strain measurement range		±15,000 με				
Resolution		0.1 με				
Instrument accuracy		±1 με				
System (instrument and sensor) accuracy[6]		±25 με	±30 με	±30 με	±30 με	±30 με
Measurement uncertainty[7]		±5 με	±4 με	±2 με	±2 με	±5 με
Dynamic loading rate		1 Hz	2.5 Hz	5 Hz	5 Hz	tbd
Temperature measurement range[8]		-40 to 200 °C (with standard Luna sensors)				
Temperature measurement resolution		0.1 °C				
Temperature measurement uncertainty[7]		±2.2 °C	±1.6 °C	±0.6 °C	±0.6 °C	±1.0 °C
Strain-Compensated Temperature Mode[9]						
Gage pitch[5]		1.04 cm				
Measurement rate (all lengths)		2.5 Hz				
Resolution		0.1 °C				
Measurement uncertainty[7]		±0.9 °C				
Strain compensation		Over an applied strain range of 0 to 1800 με, measurement accuracy is ± 2.8 °C [10]				

NOTES

1. Sensor lengths longer than 20 m, as well as HD-SC strain-compensated sensors, require optional Extended Range Remote Modules.
2. 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.
3. A patch cord can be used to connect the remote module's tether to the sensor. For each channel, 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.
4. Continuous fiber grating (CFG) mode requires Luna CFG sensors. Accuracy and uncertainty specifications for CFG sensors are preliminary.
5. Gage pitch is the distance between centerpoints of consecutive gages.
6. 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.
7. Measurement uncertainty at zero and across the full strain range. 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.
8. Temperature measurement range with standard temperature sensors (HD6T and HD6SCT). Wider range is available with other sensor fiber.
9. Strain-compensated temperature mode requires Luna HD-SC temperature sensors and Extended Range Remote Modules.
10. RMS error with the HD-SC sensor subjected axial strain over the range of 0 to1800 με. Also includes effects of the ODiSI interrogator.

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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)	48 x 34 x 9 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 710x	ODiSI 7101/7108 Distributed Sensing Instrument	System for maximum speed and resolution (gage pitch down to 0.65 mm). Includes mainframe with up to 8 channels, instrument controller laptop and ODiSI application software. Standoff cables and Remote modules sold separately.
OPT07150	Standard Remote Module	Standard Length Remote Module. Compatible with HD and CFG sensors up to 20m long
OPT07100	Extended Range Remote Module	Remote module supporting extended sensor lengths of 50 m and 100 m, in addition to standard sensor lengths. Compatible with strain-compensated temperature (HD-SC) sensors and CFG sensors.
OPT07100-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
HD6SXXLC300P	HD strain sensor, LC2+ connector, polyimide coating, 300 °C, length = XX m (1 to 100 m)
HD6TXXLC220P	HD temperature sensors with PTFE sleeving, length = XX m (1 to 5 m)
HD6SCTXXLC220P	HD strain-compensated temperature sensors with PTFE sleeving, 200 °C, length = XX m (1 to 5 m)
HDCFGXXXLCP	HD continuous fiber grating (CFG) sensors, length = XXX m (1 to 15 m)
FOSAPPKIT	Fiber Optic Sensor Application Kit Materials (epoxy, tools, etc.) required to install 10 m of sensing fiber

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