RaySensing

Corporate & Product Brochure

Ultra-Weak FBG Sensing Technologies and Solutions

A product-manual-style overview of Raysensing technologies, core products, engineering applications and customization capabilities.

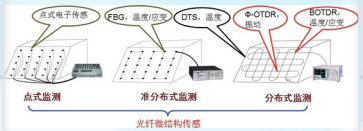
UW-FBG Sensors | DSS/DTS | UWDAS | Special Sensing Cables | Custom Modules

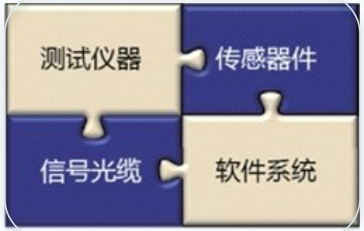
Yichang Raysensing Optoelectronics Technology Co., Ltd.

Company Overview

National high-tech orientation, optical sensing products and integrated monitoring solutions

Raysensing focuses on ultra-weak fiber Bragg grating sensing technology and application-oriented optical sensing systems. The company develops and supplies ultra-weak grating sensor arrays, DSS/DTS analyzers, UWDAS analyzers, special sensing cables, engineering monitoring systems and optoelectronic subsystems for civil engineering, geotechnical, energy, electric power, transportation and aerospace scenarios.





Company Positioning

An engineering-oriented provider of ultra-weak FBG sensing technologies, instruments and monitoring solutions.

Main Business

Sensor arrays, special cables, sensing systems and optoelectronic modules.

Core Product Directions

- Ultra-weak FBG sensor arrays
- Special sensing cables
- DSS/DTS and DAS sensing systems
- Engineering monitoring and platform integration
- Optoelectronic devices and custom submodules

Technology Prospect

The product architecture supports point sensing, quasi-distributed sensing and distributed sensing. Different sensing methods can be combined to build scalable monitoring networks for structures and assets.

Ultra-Weak FBG Sensing Technology

From grating fabrication to high-density sensing networks

Technology Principle

Ultra-weak gratings are written into optical fiber using phase-mask or femtosecond-laser processes. Multiple low-reflectivity gratings are integrated along a single fiber, with customizable wavelength and spacing. The array does not require stripping and serial fusion splicing, enabling good mechanical reliability, low insertion loss, long-distance sensing and multi-point measurement.

1 ting Array

Ultra-weak FBGs written along the fiber

2 tical Pulse

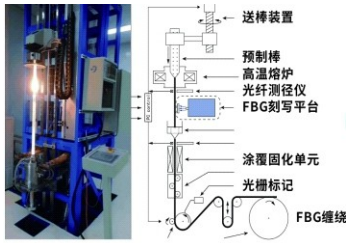
Near-infrared pulses launched into the fiber

3 lected Signal

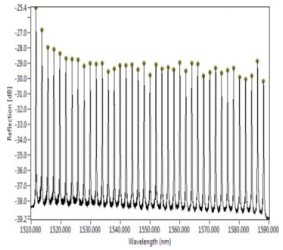
Weak reflections return from each grating point

4 alyzer

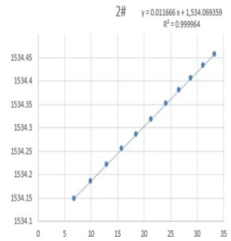
Position, wavelength, strain, temperature or phase is demodulated



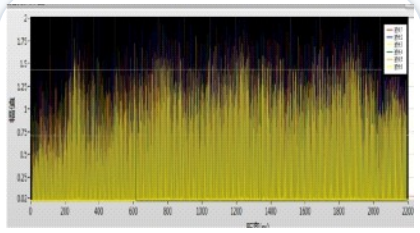
UW-FBG principle and equipment



0.1% grating array reflection



Calibration linearity



1000-point dynamic signal

Key Advantages

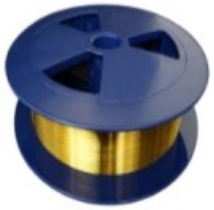
Large number of sensing points on a single fiber | Low reflectivity and high-density multiplexing | High spatial resolution | Compatible with DSS/DTS/DAS architectures | Low splicing and deployment complexity

Main Product System

Product families from sensing elements to analyzers, cables and system-level modules

UW-FBG Sensor Arrays

Ultra-weak FBG arrays and sensors for strain, temperature, hu
enhancement.



Special Sensing Cables

Strain, temperature and vibration sensing cables with applicati s.

DSS/DTS Analyzers

Embedded, rack-mounted and portable wavelength analyzers for strain/temperature
demodulation.

UWDAS Analyzers

High-sensitivity distributed acoustic/vibration sensing analyze

System Integration Logic

Sensing Array / Cable -> Analyzer / Demodulation Module -> Data Platform / Engineering Application -> Monitoring, Alarm and Decision Support

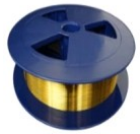
Ultra-Weak FBG Sensor Arrays & Sensors

Dense multiplexing, customizable spacing and wavelength, and low insertion-loss sensing

Product Description

Ultra-weak FBG sensor arrays contain many gratings with typical reflectivity around 0.01% to 0.1% written in a single optical fiber. Grating wavelength and spacing can be customized according to application requirements. The array requires no stripping or serial fusion splicing along the sensing section, which improves mechanical performance and enables long-distance, multi-point simultaneous monitoring.

High-temperature array



Micro-vibration array

Bare fiber array

900 um array

DAS array

Point strain sensor

Non-stress sensor

Surface strain sensor

Grating temperature sensor

High-temperature sensor

Typical Applications

- Distributed strain sensing
- Structural deformation monitoring and inversion
- High-precision chain-type temperature sensing
- Humidity sensing and DAS signal enhancement

Manual-Style Ordering Considerations

Product selection usually considers fiber type, grating spacing, wavelength configuration, coating / diameter, operating temperature and special remarks. Standard and customized configurations are both supported.

Representative Families

RS-UWFBG-S series: strain, high-temperature, humidity-sensitive and tight-buffered arrays. RS-UWFBG-D series: DAS-enhanced arrays. RS-UWFBG-R series: GFRP/CFRP smart reinforcement and strip sensors.

Special Sensing Cables

Application-oriented cable structures for strain, temperature and vibration monitoring

Product Description

Special sensing cables are built around ultra-weak FBG sensing elements and optimized cable structures such as steel armor, braided layers, FRP/CFRP reinforcement, metal tubes and polymer jackets. A single cable can integrate a large number of gratings, with strong mechanical protection, high sensitivity and improved strain transfer efficiency.

Main Cable Types

- Internal or external fixed-point strain sensing cables
- Pre-stressed and distributed strain sensing cables
- Stainless-steel packaged temperature sensing cables
- Buried, high-sensitivity and composite vibration sensing cables

Internal fixed-point strain cable

External fixed-point strain cable

Pre-stressed strain cable

Distributed strain cable

Temperature cable

Buried vibration cable

High-sensitivity vibration cable

Composite sensing cable

GFRP smart reinforcement

CFRP strip sensor

Typical Applications

Tunnel convergence, crack monitoring, inclinometers, large steel structures, slope and settlement monitoring, distributed fire alarm, petrochemical facilities, battery storage, pipeline leakage and perimeter security.

UW-FBG DSS/DTS Analyzers

Wavelength demodulation modules and instruments for strain and temperature sensing

Product Description

The DSS/DTS analyzer family is designed for ultra-weak FBG wavelength demodulation. Near-infrared laser pulses are transmitted into the sensing fiber, reflected by ultra-weak grating arrays and detected by high-speed photoelectric acquisition. ARM + FPGA SoC platforms support real-time analysis of sensor position, wavelength, temperature and strain.

Interrogation module

Distributed demodulation module

Multi-channel rack analyzer

Portable wavelength analyzer

Strain Accuracy	<= 2 microstrain
Temperature Accuracy	<= 0.2 deg C
Wavelength Range	1528 nm - 1568 nm
Channels	Typical 4 channels, extendable
Spatial Resolution	0.5 m typical, 0.1 m customizable
Interfaces	Gigabit Ethernet, RS232, USB / HDM

Typical Applications

- Tunnel, bridge, pile, mine, highway and large-venue health monitoring
- Low-frequency vibration monitoring of bridges and perimeters
- Teaching, demonstration and experimental fiber sensing networks

Representative Models

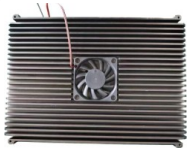
RS-HFBGA-01 embedded demodulation module | RS-HFBGA-02 high-resolution module | RS-HFBGA-03 3U rack-mounted wavelength analyzer | RS-HFBGA-04 portable wavelength analyzer

uwDAS Analyzers

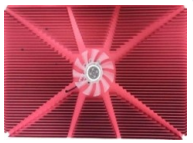
Ultra-weak grating enhanced distributed acoustic and vibration sensing

Product Description

The uwDAS analyzer family uses ultra-weak grating enhanced reflection for distributed acoustic and micro-vibration sensing. Reflected signals from grating positions interfere after phase compensation, carrying vibration information along the fiber. High-performance ARM + FPGA processing supports real-time phase analysis and massive data handling.



DAS module



Long-range DAS module

uwDAS rack analyzer

Portable DAS analyzer

Sensitivity	<= 0.5 ne
Dynamic Range	30 dB
Center Wavelength	1550.12 nm typical
Refresh Rate	33 kHz @ 2.5 km typical
Spatial Resolution	2 m / 5 m typical, customizable
Distance	2.5 km to 10 km typical, extended ve available

Typical Applications

- Vibration monitoring of tunnels, railways, highways and dams
- Vehicle trajectory, debris-flow acoustic monitoring and perimeter intrusion
- Pipeline leakage, oil & gas production and downhole sensing

Representative Models

RS-UWDAS-01 ultra-weak grating DAS module | RS-UWDAS-02 enhanced DAS module | RS-UWDAS-03 rack-mounted DAS analyzer | RS-UWDAS-04 portable DAS analyzer

Other Instruments, Functional Sensors & Optoelectronic Devices

Supplementary devices for flexible distributed and quasi-distributed sensing systems

Functional Sensor Extension

Ultra-weak grating functional sensors extend the application range of distributed cables. Conventional FBG mechanical sensor structures can be optimized with ultra-weak grating sensing units to create strain, temperature, displacement and other point sensors that connect to UW-FBG analyzers.

Examples

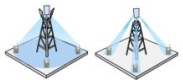
- Displacement sensor, pressure sensor and hydrostatic level gauge
- Rebar meter, force sensor, angle sensor and other functional sensors
- Handheld and rack-mounted FBG interrogation instruments


Mini module


Handheld interrogator


Distributed module


Rack analyzer


Shape sensing


Wind sensor


Display module


Strain gauges


Displacement sensor


Camera / sensing device


Optoelectronic modules


DAS module

Custom Optoelectronic Submodules

Customized pulsed EDFA, SOA optoelectronic modulation module, optical switches, optical circulators, attenuators, portable instrument integration, LabVIEW interface redevelopment and C# instrument UI software development.

Engineering Application Cases

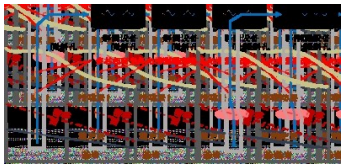
Monitoring scenarios retained from the source leaflet and reorganized into product-manual sections

Bridge Intelligent Monitoring

Distributed sensing for bridge cables, structures and safety evaluation.

Dam Deformation Monitoring

Distributed strain sensing, inverse deformation analysis and real-time monitoring.



Oil & Gas / Well Logging

uwDAS/DTS systems and vibration sensing cables for d[illegible]n information.

Tunnel Multi-Parameter Monitoring

Sensing cables for tunnel settlement, deformation, tempera[illegible]toring.

Application Value

Early warning, structu

Application Details: Bridge & Dam Monitoring

Structural safety monitoring based on distributed sensing and deformation analysis

Bridge Intelligent Monitoring

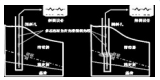
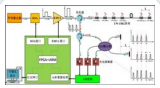
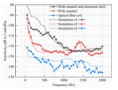
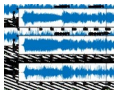
Used for bridge safety monitoring, cable force / strain observation, structural deformation evaluation and long-term online monitoring. UW-FBG sensing cables support multi-point deployment and high-density data acquisition along key structural members.





Dam Deformation Monitoring

Distributed strain sensing can be deployed across dam structures to obtain multi-point monitoring data. Combined with modeling and inversion, the system supports deformation analysis, safety assessment and early warning.

Related Products

Special strain sensing cables, UW-FBG sensor arrays, DSS/DTS analyzers and engineering monitoring platforms can be configured according to structure size, measurement density, spatial resolution and data refresh requirements.

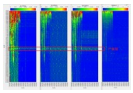
Application Details: Oil & Gas and Tunnel Multi-Parameter Monitoring

Field sensing for vibration, leakage, deformation and temperature

Oil / Well Logging

uwDAS and DTS analyzers can be combined with special sensing cables for downhole acoustic sensing, vibration event detection and production-related information analysis. The system is suited to high-value field data acquisition and monitoring.

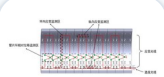
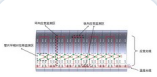




Tunnel Multi-Parameter Monitoring

Distributed sensing cables can monitor settlement, deformation, cracking, temperature and vibration in tunnel environments. The system supports long-distance deployment, continuous monitoring and abnormal-event warning.



Related Products

UWDAS analyzers, vibration sensing cables, temperature sensing cables, special strain cables and system integration software are selected based on monitoring distance, spatial resolution, field protection level and alarm logic.

Product Selection Guide

Manual-style configuration logic for engineering projects

Monitoring Objective	Typical Product Combination
Strain / deformation	UW-FBG S-series arrays + strain sensing cable + DSS analyzer
Temperature field / fire alarm	UW-FBG temperature cable + DSS/DTS analyzer + alarm platform
Vibration / acoustic event	DAS-enhanced array or vibration cable + UWDAS analyzer
Composite monitoring	Composite sensing cable + DSS/DTS + UWDAS + platform integration
Custom system	Functional sensors + optoelectronic modules + customized software

Engineering Configuration Inputs

Required sensing length, number of sensing points, spatial resolution, refresh rate, protection structure, operating temperature, installation method, data interface and platform integration requirements.

RaySensing

Integrated Optical Sensing Solutions

For project consultation, product selection and customized system development, contact Raysensing.

Contact Information

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