

CA9037 LASER SWEEP FIBER GRATING SENSOR INTERROGATING SYSTEM

Technical Specifications v1.00
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 UC INSTRUMENTS CORP.

www.ucinstruments.com

CA9037 LASER SWEEP FIBER GRATING SENSOR INTERROGATING SYSTEM

UC INSTRUMENTS' CA9037 high resolution fiber grating sensor interrogating system is a PC-based, high laser power, high wavelength accuracy, multi-channel and large number FBG sensors capability interrogating system. The system includes an external device, PC-based application software and optional high performance laptop. With a build-in tunable laser source and multichannel detectors(from 2 ~ 64 channels optional), the system can performance a high accuraccy FBG sensors interogating and optical spectrum analyzer. It can be used for a wide variety of fiber optic sensors(temperature, strain, water presure, tilt-meter, displacement, accererometer sensors) . The system provides users with a complete understanding of how the spectral shape of the fiber Bragg grating sensors react to varying physical conditions- rather than only reporting shifts in central wavelengths. This instrument is used both as the first step in the development of high-volume custom sensing systems and in long term field measurements. Multi-channels allow simultaneous interrogation of multiple sensors on two fibers or both channel analysis. Either channel can be used to interrogate gratings in transmission or reflection and the system can be adapted to many typesof sensors. All data can be transferred to an external PC via RS232 or USB communication ports.

It is a low-cost, high performance fiber Bragg grating (FBG) interrogation systems for various engineering and civil applications. It features PC-based, high accuracy, large dynamic range FBG sensors measurement ability and accuracy optical spectrum analyzing ability.

Features

- Spectrum measurement over 40 nm with 2 pm Scan-to-scan repeatability
- 2~ 64 channels detectors enabling the measurement of sensors in transmission and reflection
- Built-in single board computer, display, and instrument control panel
- Display strain, pressure, temperature and other parameters in text and history curves per application apply to.
- Data is easily transferred to PC via RS232 or USB interface
- Light source, power sensor and data analyze were built into a single compact system.
- High accuracy, high optical power, long distance, multi-channel testing capability.

Applications

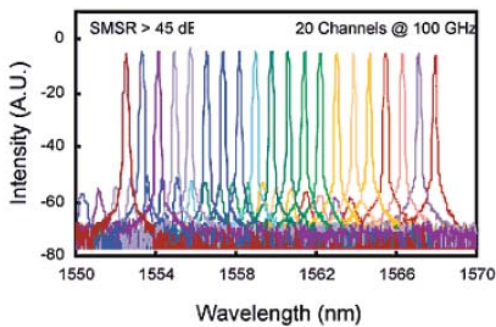
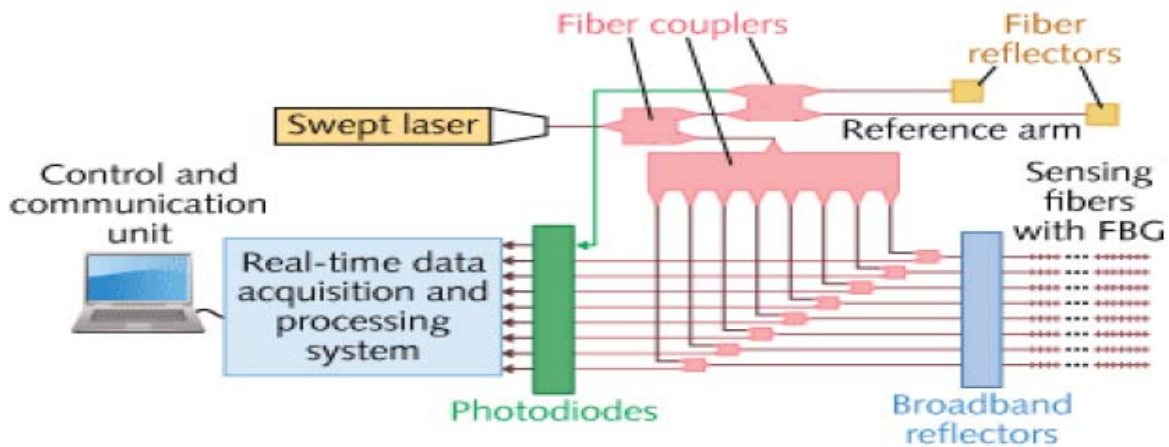
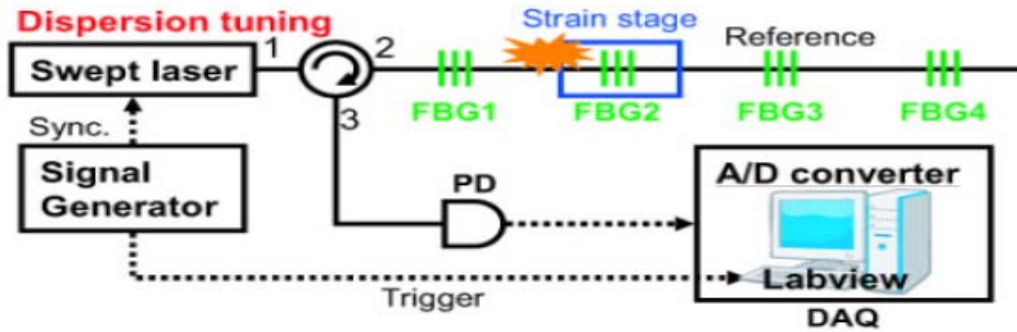
- Useful in the design and selection of fiber Bragg grating based sensors for strain, temperature, pressure, etc.
- High accuracy, resolution and full profile data provide comprehensive feedback on fiber Bragg grating and big dynamic range power sensor capabilities
- Built-in data acquire and analysis software functions provide high resolution, high accuracy fiber Bragg grating center wavelength measurements
- Full-spectrum measurements aid in understanding how sensors' characteristics change under various physical conditions
- Useful for analysis of a wide variety of passive optical sensors – FBGs sensor and other passive fiber optical components testing.

Specifications

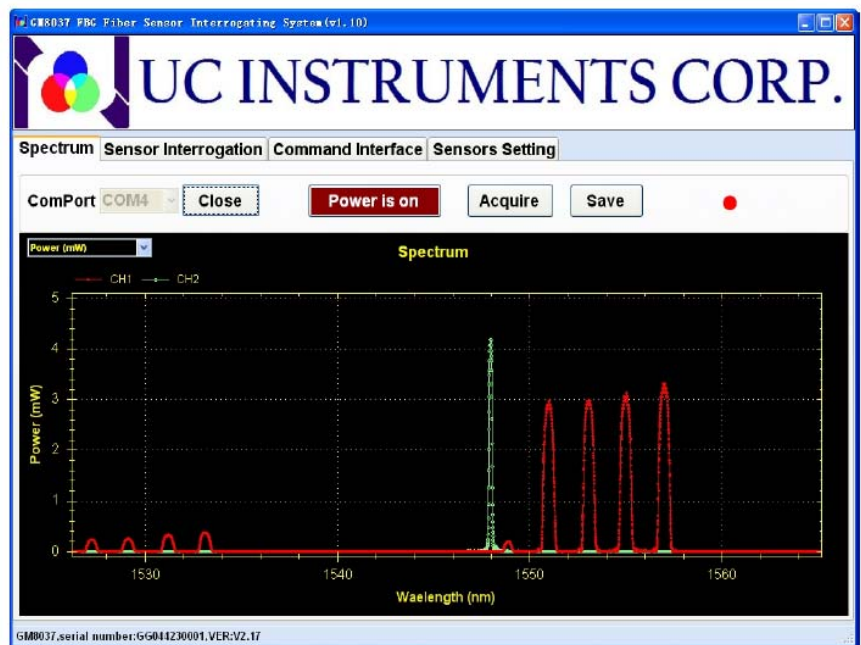
Model #	CA9037
<i>Build-in Laser Sweep Wavelength range</i>	1527.00 to 1567.00 nm
<i>Build-in Laser Output Power</i>	>= 20 mW
<i>Wavelength resolution</i>	1.0 pm
<i>Optical Channel Number</i>	2/8/16/32/64 channel optional
<i>Maximum FBG sensor Per Channel</i>	20 units sensors capability
<i>Build-in Laser Wavelength repeatability</i>	+/- 3 pm, typ. +/- 1 pm
<i>Photo Sensor Dynamic Range</i>	> 70 dB
<i>Sweep speed</i>	1.5 second data refresh over 40 nm with 10 pm resolution
<i>Connector</i>	FC/APC
<i>Typical grating configuration</i>	Reflectivity: 90%, BW: 0.25nm
<i>Communication Interface</i>	RS232 and USB
<i>Power</i>	AC 100 - 240 V \pm 10%, 48 - 66 Hz, 100 VA max.
<i>Environmental</i>	-40 ° C to +80 ° C
<i>Storage temperature</i>	0 ° C to +45 ° C
<i>Operating temperature</i>	<95% R.H. from 0 ° C to +45 ° C
<i>Humidity</i>	
<i>Work Environmental</i>	-10 ° C to +70 ° C
	0 ° C to +45 ° C
	<95% R.H. from 0 ° C to +45 ° C
<i>Dimensions</i>	Standard 4U rack
<i>Weight</i>	<20.0 lbs

***** Note: Per customers' request, we can also help customers integrate up to 128 channel system**

Laser Sweep FBG Sensing System Work Principle:

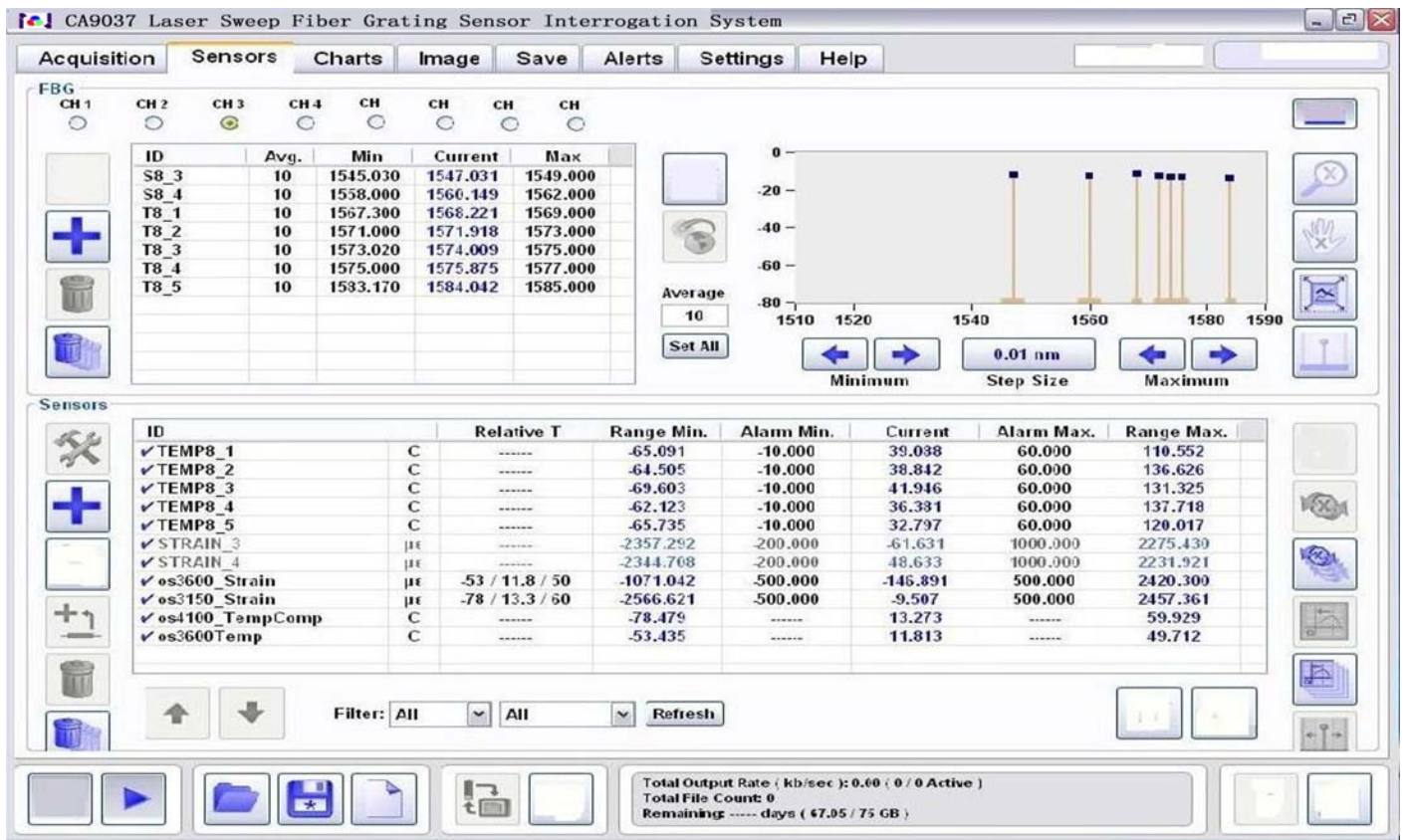


Sweep Tunable Laser Source



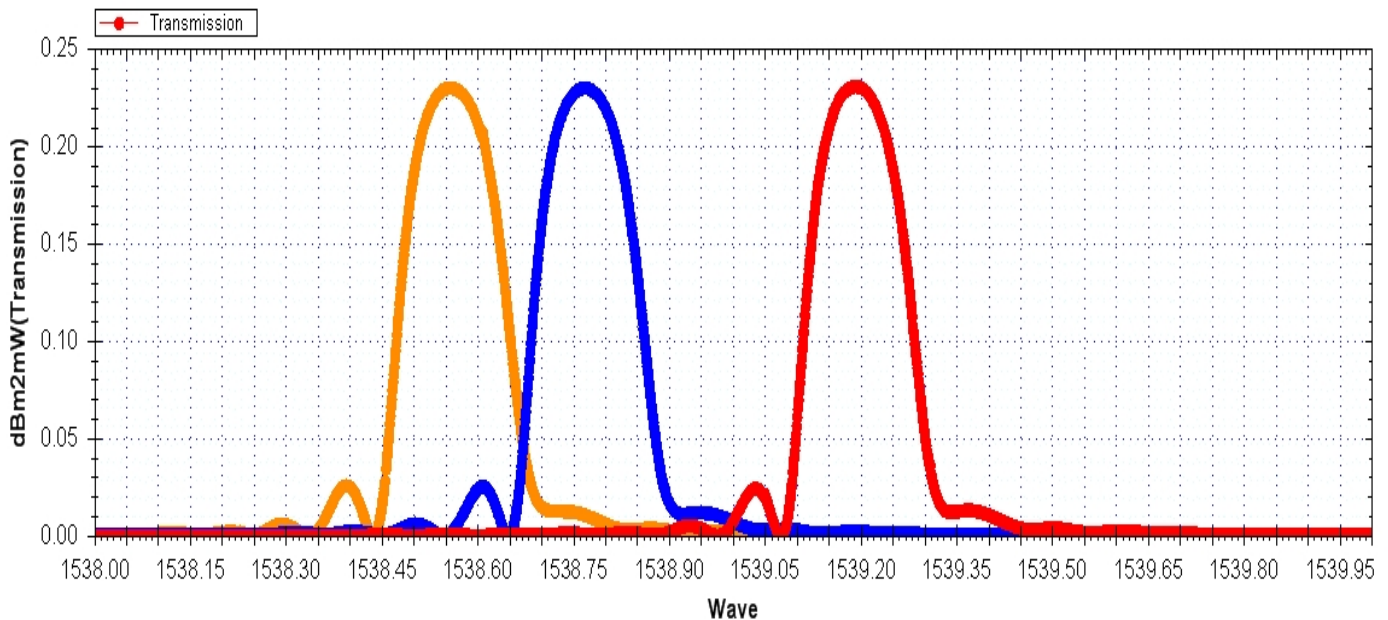
Fiber Sensing Optical Spectrum

CA9037 Software Interface:



A Real Fiber Grating Sensor Sweep Spectrum

#5:Y:\project\FBG传感器 TEST SYSTEM\0602data\Demo001611.csv



A Real Fiber Grating Sensor 0° , 23° , 100° C Sweep Spectrum

Subway Tunnel Construction FBG Strain Sensing Application:



Ways to measure the deformation of the tunnel after installing two 1000mm strain sensors in parallel.

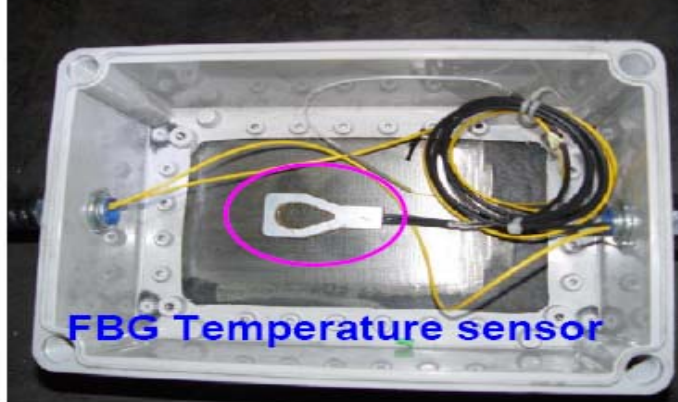
Dam FBG Strain Sensing and Tilt Sensing Application:



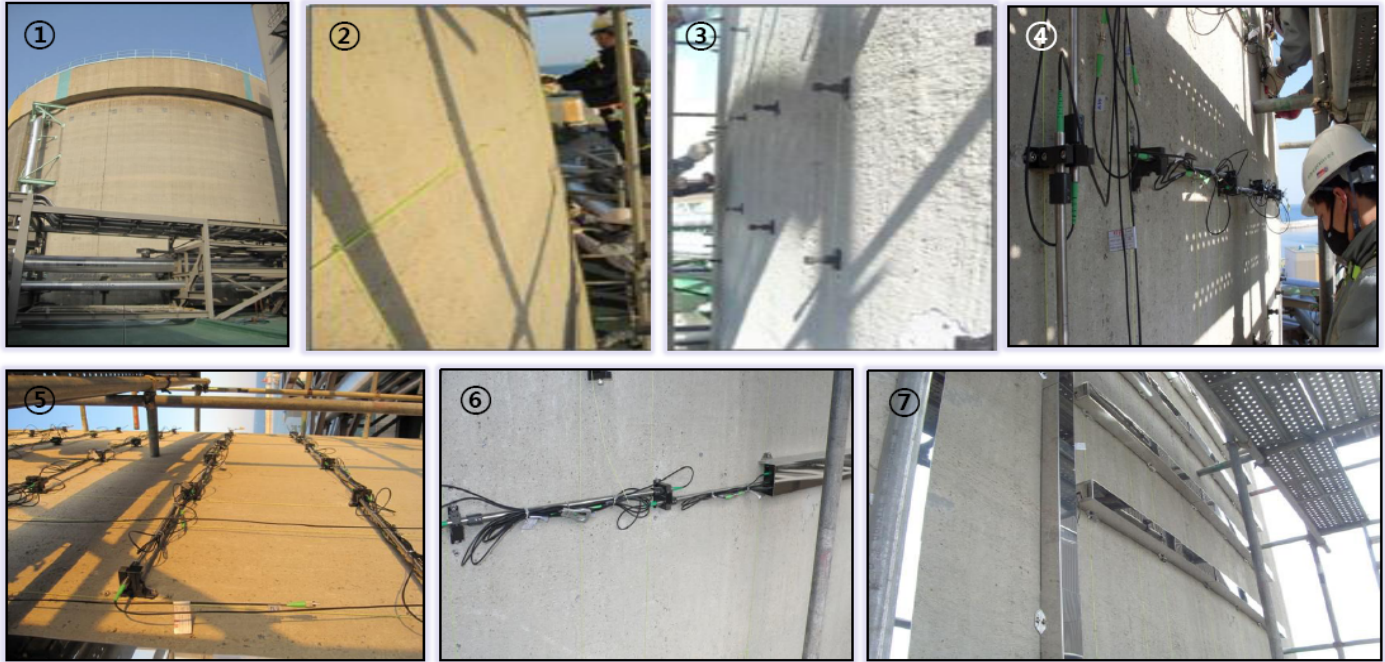
Bridge Displacement Sensing Application:



Costruction FBG Temperature and Accelerometer Sensing an Application:



Nuclear Power Station Displacement and Strain Sensor Application:



Power Station Power Switch With Temperature Sensing Application:



FBG Sensor Accesories Option:

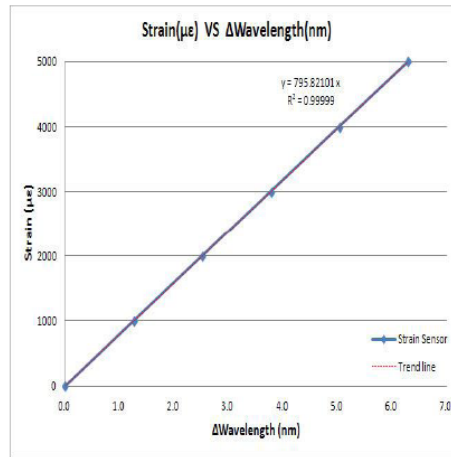
1. FBG Strain Sensor:



"USA, EU, China, Japan, Canada patents" registered

- ✓ Safety evaluation of structures
- ✓ Long-term strain measurements of the structures
- ✓ Strain and stress measurements of the structures
- ✓ strain measurements of the structures by external forces
- ✓ Deformation Measurement of the outside of the structures or of body
- ✓ High sensitivity due to the use of wavelength setting bolts

Model	FBG-ST-310
Gauge length(mm)	100 (Decision on the use)
Measurement range(με)	±2,000 (Decision on the use)
FWHM(-3 dB point)	≤ 0.1 nm
Resolution(%)	± 0.05 % F.S
Accuracy(%)	± 0.25 % F.S
Sensitivity(με)	≥ 1,000 @ 120g tension
Wavelength(nm)	1,511 ~ 1,584
Reflectivity(%)	≥ 70
Operating temperature(°C)	-20 ~ 80



Wavelength set division

SET-A		SET-B	
No.	Operating Wavelength range (nm)	No.	Operating Wavelength range (nm)
1	1511.1~1516.2	1	1514.1~1519.2
2	1517.1~1522.2	2	1520.1~1525.2
3	1523.1~1528.2	3	1526.1~1531.2
4	1529.1~1534.2	4	1532.1~1537.2
5	1535.1~1540.2	5	1538.1~1543.2
6	1541.1~1546.2	6	1544.1~1549.2
7	1547.1~1552.2	7	1550.1~1555.2
8	1553.1~1558.2	8	1556.1~1561.2
9	1559.1~1564.2	9	1562.1~1567.2
10	1565.1~1570.2	10	1568.1~1573.2
11	1571.1~1576.2	11	1574.1~1579.2
12	1577.1~1582.2	12	1580.1~1585.2
13	1583.1~1588.2		

- 13 kinds of Set-A, 12 kinds of Set-B.
- Can make a total of 25 kinds from FBG Strain Sensor.

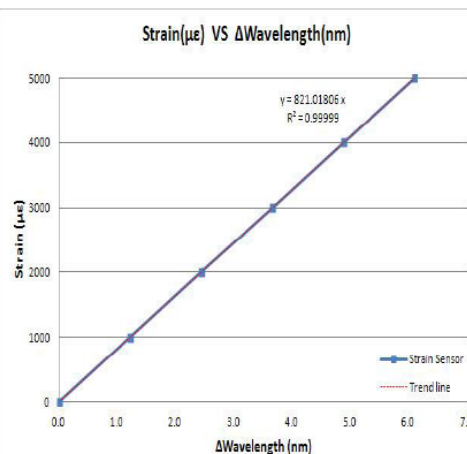
2. FBG Long Gauge Strain Sensor:



"USA, EU, China, Japan, Canada patents" registered

- ✓ Safety evaluation of structures
- ✓ Long-term strain measurements of the structures
- ✓ Strain and stress measurements of the structures strain measurements of the structures by external forces
- ✓ Deformation Measurement of the outside of the structures or of body
- ✓ High sensitivity due to the use of wavelength setting bolts
- ✓ Easy to install on a curved surface or slope by applying ball joints

Model	FBG-ST-330
Gauge length(mm)	250~1,500 (Decision depend on the use)
Measurement range(με)	±2,000 (Decision depend on the use)
FWHM(-3 dB point)	≤ 0.1 nm
Resolution(%)	± 0.05 % F.S
Accuracy(%)	± 0.25 % F.S
Sensitivity(με)	≥ 1,000 @ 120g tension
Wavelength(nm)	1,511 ~ 1,584
Reflectivity(%)	≥ 70
Operating temperature(°C)	-20 ~ 80

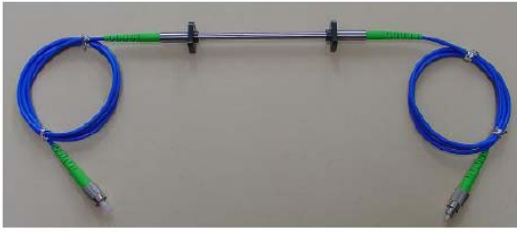


Wavelength set division

SET-A		SET-B	
No.	Operating Wavelength range (nm)	No.	Operating Wavelength range (nm)
1	1511.1~1516.2	1	1514.1~1519.2
2	1517.1~1522.2	2	1520.1~1525.2
3	1523.1~1528.2	3	1526.1~1531.2
4	1529.1~1534.2	4	1532.1~1537.2
5	1535.1~1540.2	5	1538.1~1543.2
6	1541.1~1546.2	6	1544.1~1549.2
7	1547.1~1552.2	7	1550.1~1555.2
8	1553.1~1558.2	8	1556.1~1561.2
9	1559.1~1564.2	9	1562.1~1567.2
10	1565.1~1570.2	10	1568.1~1573.2
11	1571.1~1576.2	11	1574.1~1579.2
12	1577.1~1582.2	12	1580.1~1585.2
13	1583.1~1588.2		

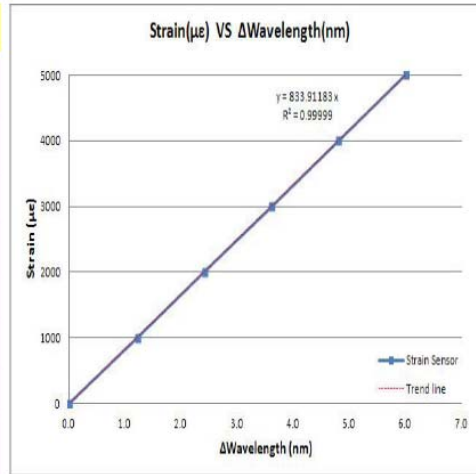
- 13 kinds of Set-A, 12 kinds of Set-B.
- Can make a total of 25 kinds from FBG Strain Sensor.

3. Embaded FBG Strain Sensor:



- ✓ Safety evaluation of structures
- ✓ Long-term strain measurements of the structures
- ✓ Strain and stress measurements of the structures
- ✓ strain measurements of the structures by external forces
- ✓ Deformation Measurement of basement of the structures or of body

Model	FBG-ST-320
Gauge length(mm)	100 ~1,000 (Decision depend on the use)
Measurement range(με)	±2,000 (Decision on the use)
FWHM(-3 dB point)	≤ 0.1 nm
Resolution(%)	± 0.05 % F.S
Accuracy(%)	± 0.25 % F.S
Wavelength(nm)	1,511 ~ 1,584
Reflectivity(%)	≥ 70
Operating temperature(°C)	-20 ~ 80



Wavelength set division

SET-A		SET-B	
No.	Operating Wavelength range (nm)	No.	Operating Wavelength range (nm)
1	1511.1~1516.2	1	1514.1~1519.2
2	1517.1~1522.2	2	1520.1~1525.2
3	1523.1~1528.2	3	1526.1~1531.2
4	1529.1~1534.2	4	1532.1~1537.2
5	1535.1~1540.2	5	1538.1~1543.2
6	1541.1~1546.2	6	1544.1~1549.2
7	1547.1~1552.2	7	1550.1~1555.2
8	1553.1~1558.2	8	1556.1~1561.2
9	1559.1~1564.2	9	1562.1~1567.2
10	1565.1~1570.2	10	1568.1~1573.2
11	1571.1~1576.2	11	1574.1~1579.2
12	1577.1~1582.2	12	1580.1~1585.2
13	1583.1~1588.2		

- 13 kinds of Set-A, 12 kinds of Set-B.
- Can make a total of 25 kinds from FBG Embedded Strain Sensor.

4. FBG Displacement Sensor:



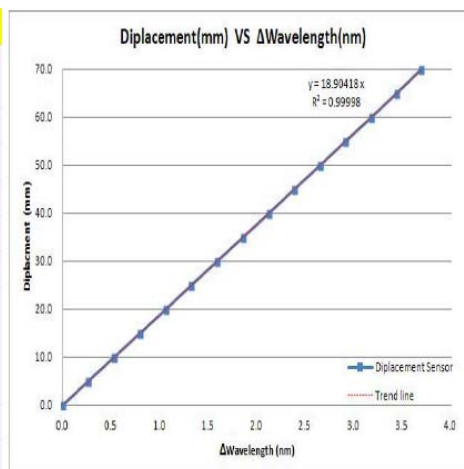
- ✓ Safety evaluation of structures
- ✓ Displacement Measurement for the deflection of structures
- ✓ Displacement Measurement for the crack of structures
- ✓ Measurement for the contraction and expansion of structures
- ✓ Measurement for the relaxation of joints of structures
- ✓ Displacement Measurement for the crack of joints of structures
- ✓ Built-in FBG Temperature sensor for temperature compensation

Wavelength set division

SET-A		SET-B	
No.	Operating Wavelength range (nm)	No.	Operating Wavelength range (nm)
1	1511.1~1516.2	1	1514.1~1519.2
2	1517.1~1522.2	2	1520.1~1525.2
3	1523.1~1528.2	3	1526.1~1531.2
4	1529.1~1534.2	4	1532.1~1537.2
5	1535.1~1540.2	5	1538.1~1543.2
6	1541.1~1546.2	6	1544.1~1549.2
7	1547.1~1552.2	7	1550.1~1555.2
8	1553.1~1558.2	8	1556.1~1561.2
9	1559.1~1564.2	9	1562.1~1567.2
10	1565.1~1570.2	10	1568.1~1573.2
11	1571.1~1576.2	11	1574.1~1579.2
12	1577.1~1582.2	12	1580.1~1585.2
13	1583.1~1588.2		

- 13 kinds of Set-A, 12 kinds of Set-B.
- Can make a total of 25 kinds from FBG Displacement Sensor.

Model	FBG-DI-310	
Measurement range(mm)	50, 100 (Decision depend on the use)	
FWHM(-3 dB point)	≤ 0.1 nm	
Resolution(%)	± 0.05 % F.S	
Accuracy(%)	± 0.25 % F.S	
Wavelength(nm)	1,511 ~ 1,584	
Reflectivity(%)	≥ 70	
Operating temperature(°C)	-20 ~ 80	
Measurement range(mm)	50	100
Sensitivity(pm/mm)	60	30
Dimension(mm)	110 * 50 * 23	208 * 50 * 23

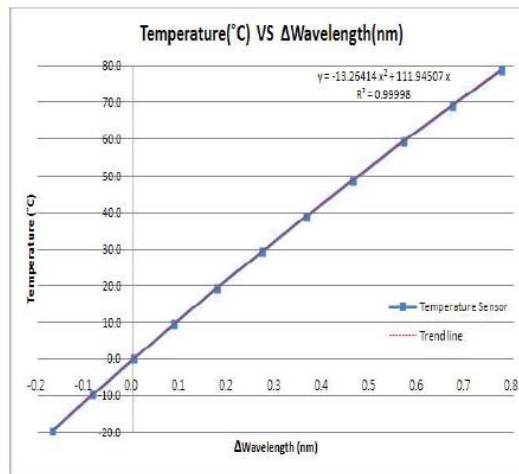


5. FBG Temperature Sensor:



- ✓ Temperature measurements inside and outside of the structures
- ✓ Water temperature measurements of dams, banks, structures
- ✓ Long-term temperature measurements in a humid place
- ✓ Safety evaluation on temperature change of structures
- ✓ Temperature measurements
- ✓ Temperature measurements during the curing of concrete structures

Model	FBG-TE-310
Measurement range(°C)	-20 ~ 80
FWHM(-3 dB point)	≤ 0.1 nm
Resolution(°C)	0.1
Wavelength(nm)	1,511 ~ 1,584
Reflectivity(%)	≥ 70
Gauge factor(pm/°C)	9.7
Dimension(mm)	54 * 31 * 5



Wavelength set Division

No.	SET Wavelength (nm)
1	1511.2
2	1514.2
3	1517.2
4	1520.2
5	1523.2
6	1526.2
7	1529.2
8	1532.2
9	1535.2
10	1538.2
11	1541.2
12	1544.2
13	1547.2
14	1550.2
15	1553.2
16	1556.2
17	1559.2
18	1562.2
19	1565.2
20	1568.2
21	1571.2
22	1574.2
23	1577.2
24	1580.2
25	1583.2
26	1586.2

6. FBG Tilt-meter Sensor:

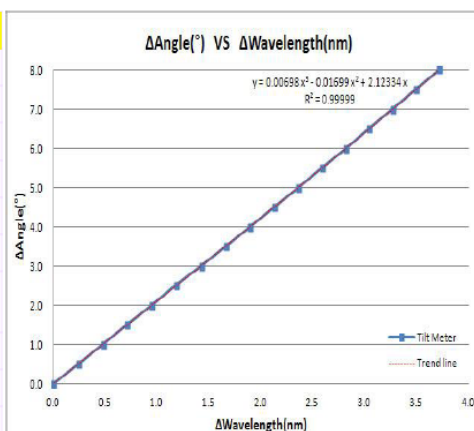


"USA, EU, China, Japan, Canada patents" registered

- ✓ Long-term measurements for the angular variation of structures
- ✓ Measurements for the angular variation of tunnels, dams and road surface
- ✓ Measurements for the angular variation of structures during construction or after completion of construction
- ✓ Measurements for the angular variation of adjacent structures due to the construction of downtown
- ✓ Safety evaluation on adjacent structures when works excavation and stacks the soil
- ✓ Built-in FBG sensor for temperature compensation

Compared to other companies of FBG tilt-meter, we only use one FBG sensors for angle measurement that can use narrow range of wavelength.

Model	FBG-TI-310
Measurement Range	8 deg (-3~5deg)
FWHM(-3 dB point)	≤ 0.1 nm
Resolution(%)	± 0.05 % F.S
Accuracy(%)	± 0.25 % F.S
Reflectivity(%)	≥ 70
Wavelength(nm)	1,511 ~ 1,584
Operating temperature(°C)	-20 ~ 80
Dimension(mm)	91 X 41 X 93
Sensitivity(pm/°)	≥ 450
Weight(kg)	≤ 1.2



Wavelength set division

SET-A		SET-B	
No.	Operating Wavelength range (nm)	No.	Operating Wavelength range (nm)
1	1511.1~1516.2	1	1514.1~1519.2
2	1517.1~1522.2	2	1520.1~1525.2
3	1523.1~1528.2	3	1526.1~1531.2
4	1529.1~1534.2	4	1532.1~1537.2
5	1535.1~1540.2	5	1538.1~1543.2
6	1541.1~1546.2	6	1544.1~1549.2
7	1547.1~1552.2	7	1550.1~1555.2
8	1553.1~1558.2	8	1556.1~1561.2
9	1559.1~1564.2	9	1562.1~1567.2
10	1565.1~1570.2	10	1568.1~1573.2
11	1571.1~1576.2	11	1574.1~1579.2
12	1577.1~1582.2	12	1580.1~1585.2
13	1583.1~1588.2		

- 13 kinds of Set-A, 12 kinds of Set-B.
- Can make a total of 25 kinds from FBG tilt-meter.

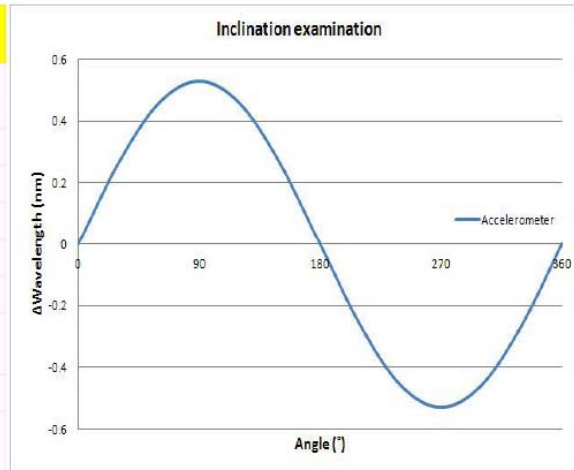
7. FBG Accelerometer Sensor:



- ✓ Safety evaluation of structures
- ✓ Long-term measurements for vibration variation of the structures
- ✓ Acceleration and stress measurements of the structures
- ✓ Vibration measurements of the structures by external forces
- ✓ Vibration Measurement of the outside of the structures or of body

“USA, EU, China, Japan, Canada patents” registered

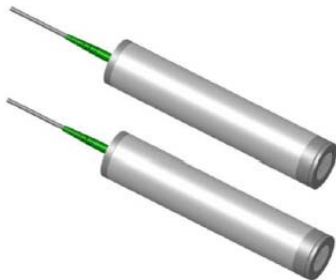
Model	FBG-AC-310
Measurement range	±2G (Decision depend on the use)
FWHM(-3 dB point)	≤ 0.1 nm
Resolution(%)	± 0.05 % F.S
Accuracy(%)	± 0.25 % F.S
Wavelength(nm)	1,511 ~ 1,584
Reflectivity(%)	≥ 70
Operating temperature(°C)	-20 ~ 80
Gauge factor(pm/G)	270
Frequency(Hz)	0 ~ 80 (Decision depend on the use)



Wavelength set division

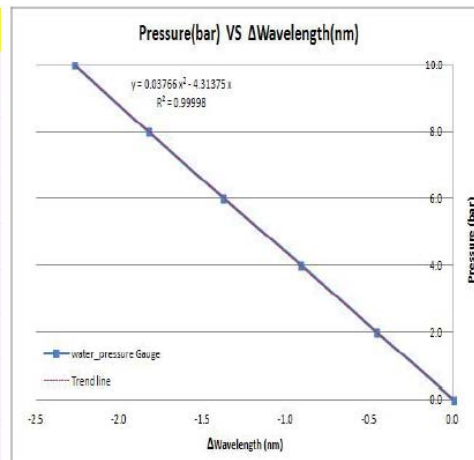
SET	
No.	Operating Wavelength range (nm)
1	1511.5~1513.8
2	1514.5~1516.8
3	1517.5~1519.8
4	1520.5~1522.8
5	1523.5~1525.8
6	1526.5~1528.8
7	1529.5~1531.8
8	1532.5~1534.8
9	1535.5~1537.8
10	1538.5~1540.8
11	1541.5~1543.8
12	1544.5~1546.8
13	1547.5~1549.8
14	1550.5~1552.8
15	1553.5~1555.8
16	1556.5~1558.8
17	1559.5~1561.8
18	1562.5~1564.8
19	1565.5~1567.8
20	1568.5~1570.8
21	1571.5~1573.8
22	1574.5~1576.8
23	1577.5~1579.8
24	1580.5~1582.8
25	1583.5~1585.8
26	1586.5~1588.8

8. FBG Water-Pressure Sensor:



- ✓ Status measurement of the drainage for excavation
- ✓ Water level measurement in river, reservoirs and wells
- ✓ Leakage measurement of Dams, artificial lakes and flow measurement to the ground water on the banks
- ✓ Pore pressure measurement for decision to a safety factor when works excavation and stacks the soil
- ✓ Water pressure measurement within the pressure pipes, the banks and the perforation
- ✓ Built-in FBG sensor for temperature compensation

Model	FBG-WP-320
Measurement range	0~10bar (Decision depend on the use)
FWHM(-3 dB point)	≤ 0.1 nm
Resolution(%)	± 0.05 % F.S
Accuracy(%)	± 0.25 % F.S
Wavelength(nm)	1,511 ~ 1,584
Reflectivity(%)	≥ 70
Operating temperature(°C)	-5 ~ 50
Dimension(mm)	φ39 * 172



Wavelength set division

SET-A		SET-B	
No.	Operating Wavelength range (nm)	No.	Operating Wavelength range (nm)
1	1511.1~1516.2	1	1514.1~1519.2
2	1517.1~1522.2	2	1520.1~1525.2
3	1523.1~1528.2	3	1526.1~1531.2
4	1529.1~1534.2	4	1532.1~1537.2
5	1535.1~1540.2	5	1538.1~1543.2
6	1541.1~1546.2	6	1544.1~1549.2
7	1547.1~1552.2	7	1550.1~1555.2
8	1553.1~1558.2	8	1556.1~1561.2
9	1559.1~1564.2	9	1562.1~1567.2
10	1565.1~1570.2	10	1568.1~1573.2
11	1571.1~1576.2	11	1574.1~1579.2
12	1577.1~1582.2	12	1580.1~1585.2
13	1583.1~1588.2		

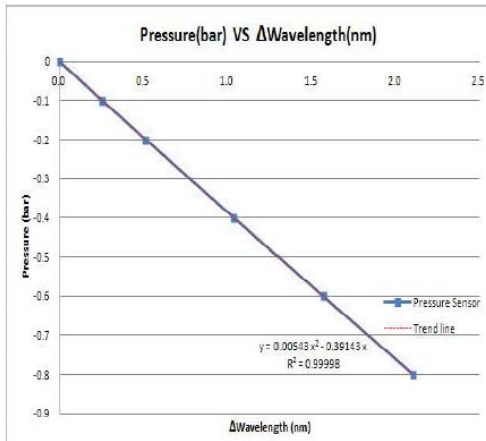
- 13 kinds of Set-A, 12 kinds of Set-B.
- Can make a total of 25 kinds from FBG Water-Pressure Gauge.

9. FBG Pressure Sensor:



- ✓ Pressure evaluation within the duct or pipe
- ✓ Long-term measurements to Pressure variation within the duct or pipe
- ✓ Pressure measurements within the various pipelines and gas pipe
- ✓ Built-in FBG sensor for temperature compensation

Model	FBG-PR-310
Measurement range	-0.8~10bar (Decision depend on the use)
FWHM(-3 dB point)	≤ 0.1 nm
Resolution(%)	± 0.05 % F.S
Accuracy(%)	± 0.25 % F.S
Wavelength(nm)	1,511 ~ 1,584
Reflectivity(%)	≥ 70
Operating temperature(°C)	-10 ~ 50
Dimension(mm)	∅39 * 172



Wavelength set division

SET-A		SET-B	
No.	Operating Wavelength range (nm)	No.	Operating Wavelength range (nm)
1	1511.1~1516.2	1	1514.1~1519.2
2	1517.1~1522.2	2	1520.1~1525.2
3	1523.1~1528.2	3	1526.1~1531.2
4	1529.1~1534.2	4	1532.1~1537.2
5	1535.1~1540.2	5	1538.1~1543.2
6	1541.1~1546.2	6	1544.1~1549.2
7	1547.1~1552.2	7	1550.1~1555.2
8	1553.1~1558.2	8	1556.1~1561.2
9	1559.1~1564.2	9	1562.1~1567.2
10	1565.1~1570.2	10	1568.1~1573.2
11	1571.1~1576.2	11	1574.1~1579.2
12	1577.1~1582.2	12	1580.1~1585.2
13	1583.1~1588.2		

UC INSTRUMENTS' Test and Measurement Support, Services and Assistance

UC INSTRUMENTS provides high performance, high value, low cost, affordable test and measurement instruments solution for our customers. Our extensive support sources can help you choose right UC INSTRUMENTS' products for your application and apply them successfully. Every instruments and system we sell a global warranty. All of our instruments with at least 18 months factory warranty.

Our Promise

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