





Your Innovative Fiber Optics Provider

-  Opto-Mechanical Automation System
-  Optical Fiber Communication
-  Optical Fiber Sensing System
-  Fiber Optic Gyroscope



CA201912-01

FIBERPRO

FIBERPRO HEADQUARTERS Tel : +82-42-360-0030 Fax : +82-42-360-0050
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Creating New Value with New Technology

FIBERPRO is a company to prevail quality test & measurement services through its products and knowledge.

"Creating New Value with New Technology" is the idea of our people thinking and guideline of our people behaving. People in **FIBERPRO** believe that the value creation comes from innovative technology.

By providing the innovative standard way of quality measurement, **FIBERPRO** can keep customers creative and innovative, which is nothing but the value creation. We act with the hope that we could be remembered as one of top test & measurement companies, and would like to be a good part of them.

FIBERPRO also understands the responsibility as a global company, and will pursue its role as a good neighbor and nice member of human society



Company History

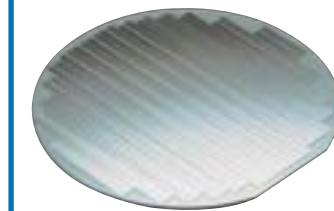
- 2019. 08. Awarded Minister of Trade, Industry and Energy
- 2019. 06. Developed PLC based CWDM (Coarse Wavelength Division Multiplexer)
Developed opto-microwave phase detector and synchronization system
- 2018. 11. Developed FBG Interrogator (FI3400)
- 2018. 10. Developed Lightwave Synthesizer (Model: LS5000)
- 2018. 09. Awarded Presidential Committee for Balanced National Development
- 2018. 04. Developed Rail Monitoring System (Track Geometry Measurement System)
- 2017. 11. Developed high performance Inertial Measurement Unit (FI 200P)
- 2017. 04. Developed Fiber-Optic Fire Detection Unit (FD3000)
Selected as a Small Giant Company by the Ministry of Employment and Labor
- 2016. 10. Developed Lightwave Equalizer
- 2015. 12. Developed Distributed Temperature Sensing System
Developed Audio Fiber Tracer (FT3000)
- 2015. 08. Developed Inertial Measurement Unit (IMU)
- 2015. 06. Developed Polarizing Y-branch Phase Modulator
- 2014. 12. Succeed on development of Fiber Optic Gyroscope for space application
- 2014. 04. Developed Gyro Compass
- 2013. 12. Developed LD, PD Auto Producing Laser Welder
Developed PON(Passive Passive Optical Network) OTDR
- 2013. 12. Developed Multi-channel Power meter
- 2012. 09. Developed Silicon Photonics wafer system
- 2012. 05. Developed VOA/AWG Chip Characteristics measurement system
- 2012. 12. Developed Optical Wafer Thickness MicroGauge
Developed VCSEL FBG Interrogator
- 2011. 07. China Subsidiary established 「赛博普路光电(武汉) 有限公司」
- 2011. 02. Established Gwangju Office
- 2010. 09. Developed 100kHz High Speed FBG Sensing Interrogator
- 2009. 12. Developed Portable Audio Fiber Tracer
- 2008. 12. Developed Multichannel Linear Birefringence Analyzer
- 2007. 09. Developed Auto Alignment / Bonding & Test System for Thermal/Athermal AWG
- 2007. 05. Developed Auto Alignment / Bonding & test System for VOA & 2x2 switch
- 2005. 11. Developed Acoustic Fiber Cable Identifier
- 2004. 03. Commercial technology development of Fiber Bragg Grating Interrogation System for Safety Diagnosis
- 2001. 03. Developed the word's fastest PDL meter
- 2001. 02. Developed Lightwave Polarization Controller
- 2000. 05. Developed Multi Channel Polarization Controller
- 1998. 02. Developed Lightwave Equalizer™(EDFA) gain equalization
- 1996. 12. Developed the word's first In-line Polarization Controller
- 1996. 10. Developed the word's first Polarization Scrambler
- 1995. 06. Developed Tunable Directional Coupler & Polarization Controller



FIBERPRO is

One of the leading manufacturers of fiber optic products and a specialist for custom-made applications.

NEW Products



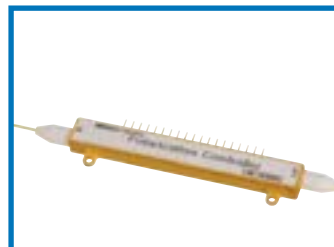
1

1 CWDM (MUX & DEMUX) :
WM1000
06P



2

2 Lightwave Synthesizer :
LS5000
13P



3

3 LN Polarization Controllers :
PC1700
17P



4

4 Distributed Temperature
Sensing System : FD3000
23P



5

5 FBG Interrogation System :
FI3300/FI3400
24P



6

6 Inertial Measurement Unit :
FI 200C
26P



7

7 Polarizing Y-branch Phase
Modulator : MD1000
27P



- 04 NEW Products
- 06 CWDM (MUX & DEMUX)
- 08 Opto-Mechanical Automation System
- 12 Optical Fiber Communication
- 20 Optical Metrology
- 22 Optical Fiber Sensing System
- 26 Fiber Optic Gyroscope

CONTENTS

CWDM (MUX & DEMUX)

⇒⇒ Coarse Wavelength Division Multiplexing

▶ CWDM (MUX & DEMUX)



CWDM (MUX & DEMUX) : WM1000

FIBERPRO's Coarse Wavelength Division Multiplexing(CWDM) Mux/Demux, WM1000, is a passive device that combines multiple signals at various wavelengths for transmission along a single optical fiber, or vice versa.

The WM1000, designed using the principle of PLCs-based Arrayed Waveguide Gratings(AWGs) technology, is ideally suitable for small form factor TOSA/ROSA devices in high speed data traffic applications at 40 GHz, 100 GHz and 400 GHz.

CWDM (MUX & DEMUX)

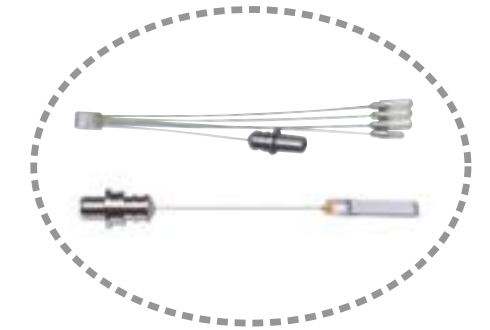
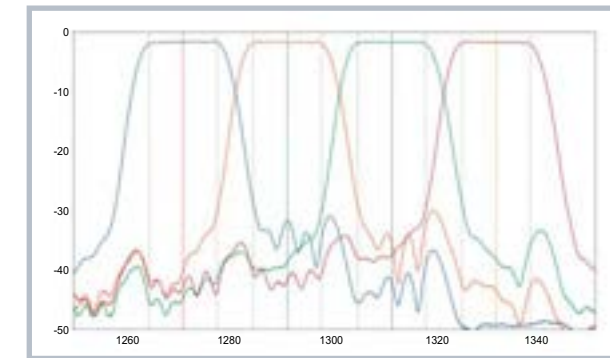
⇒⇒ Coarse Wavelength Division Multiplexing

Features

- Compact size : Suitable for QSFP28 & CFP4 modules
- Custom-made design available : Chip size, pitch, Optical specifications, Polishing angles
- High-reliability
- Low Insertion Loss

Application

- Data Center
- WDM Network
- Telecommunication



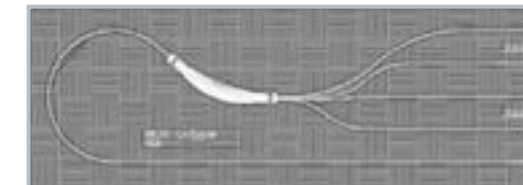
Chip Design

DEMUX chip



Pitch :
250 μm , 500 μm , 750 μm , 1,100 μm

MUX chip



Pitch :
500 μm , 750 μm , 1,100 μm - U-type



Pitch :
250 μm , 500 μm , 750 μm , 1,100 μm

Opto-Mechanical Automation System

⇒ ⇒ Optical Components Manufacturing

http://www.fiberpro.com

Auto Alignment System

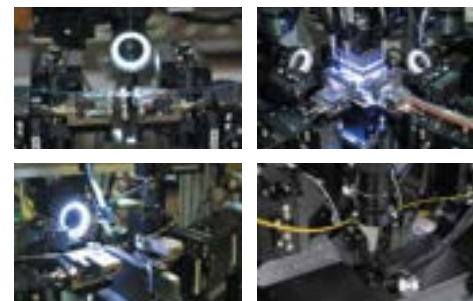


Auto Alignment System IFA-600

- Automatic alignment with excellent repeatability based on optimized alignment algorithm and precision stage control
- Automatic gap control and angle alignment using precision displacement sensor
- Quick input port alignment with multimode fiber
- Fast initial alignment based on vision processing and 2D scanning algorithm
- Convenient graphic user interface and versatile function for data management
- Remote controllable via user software
- Compact mechanical design

Application

- Photonic Integrated Circuit (SiP devices)
- Integrated Optical Circuit (LiNbO₃ chip)
- VOA (Variable Optical Attenuator)
- AWG (Arrayed Waveguide Gratings)
- PLC Splitter
- Collimator
- Other optical devices



Opto-Mechanical Automation System

⇒ ⇒ Optical Components Manufacturing

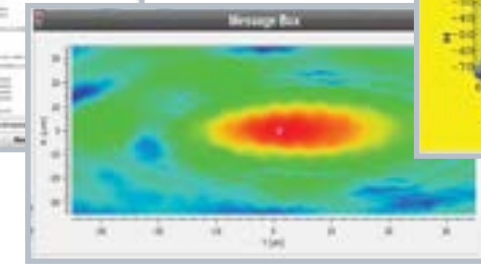
http://www.fiberpro.com

Vision Processing

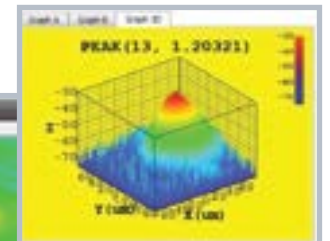
- Automatic angle alignment
- Pattern recognition for probe positioning
- Edge detection and barcode reading



GUI



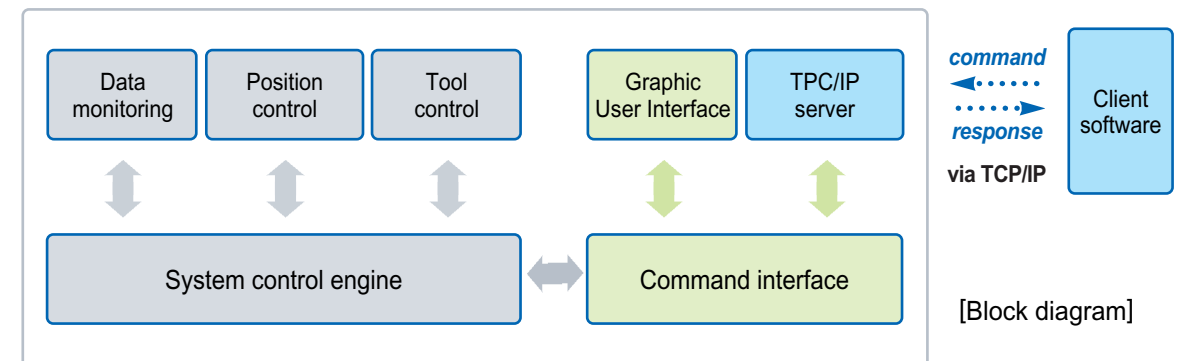
2D scanning



3D scanning

Graphic User Interface

- Capable of alignment/epoxy bonding of optic device based on vision processing and optic feedback
- User programmable sequence
- Support remote control of client's software via TCP/IP communication



Opto-Mechanical Automation System

⇒ ⇒ Optical Components Manufacturing

http://www.fiberpro.com

▶ Silicon Photonics Wafer Test System

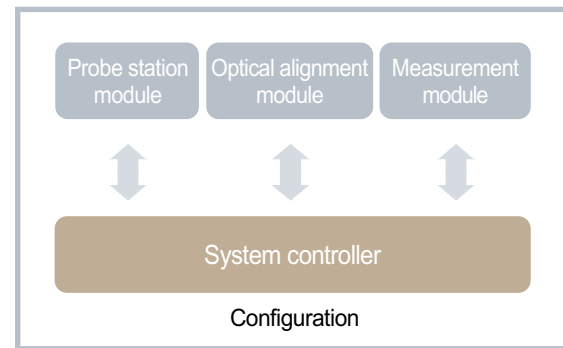


Silicon Photonics Wafer Test System : IFA-640

- Wafer level tester up to 12 inch wafer
- Automatic input/output coupling (wafer level vertical coupling)
- Coupling fiber array blocks and/or optical fiber
- Convenient Graphic User Interface (GUI) for user programmable
- Versatile alignment functions using image processing and contact sensor
- Highly customized system design



Semiconductor Wafer



Opto-Mechanical Automation System

⇒ ⇒ Optical Components Manufacturing

http://www.fiberpro.com

▶ Laser Welding System



Laser Welding System IFA-700

- Automatic alignment for TOSA/ROSA/Pigtail/BiDi
- Camera for monitoring process
- 12 automatic motor controlled stages & 3 manual stages
- 3 point laser welding process
- Automatic end-face alignment
- Highly customized sequence program

TOSA, ROSA

Pigtails

BiDi

Butterfly



Measuring Instruments



ER2200 : Singel Channel PER Meter



ER3000 : Dual Channel PER Meter

Polarization Extinction Ratio Meter

ER2200 / ER3000

High accuracy Polarization Extinction Ratio meter

- Wide dynamic range for PER measurement : up to 50dB
- Wide wavelength range : 1260 ~ 1640nm
- Minimum PER holding function
- Relative power monitoring function
- GPIB/RS232/USB 2.0 remote interface
- Channel: One or Two Channels (Optional)

Multichannel Optical Power Meter : PM2100



- Wavelength Range : 1250 ~ 1630nm
- Power Dynamic Range : -80dBm ~ +10dBm
- Resolution : 0.01 dB
- 20 channels of precision optical power measurement
- Single mode & Multimode measurement
- Fast measurement (100 kHz) with high resolution
- Varieties of interfaces (GPIB, TCP/IP, RS232)

PDL Meter : PL2000



The most accurate and fastest Polarization Dependent Loss meter in the market

- The fastest measurement speed (0.1sec.Typ.)
- All-states method - No calibration
- PDL/IL/Optical Power measurement

Lightwave Equalizer



Lightwave Equalizer : LE2000

Programmable Optical Filters

- Direct and instantaneous filter control
- Accurate tuning of center frequency, phase and attenuation level
- Multiple center frequencies can be set directly over entire band
- Programmable using supplied GUI
- Reliable all-LC design with no moving parts



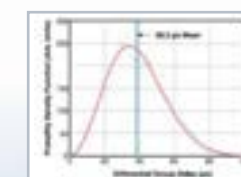
PMD Emulator



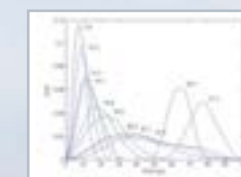
PMD Emulator Solution : PE4200

Programmable Polarization Mode Dispersion emulator solution

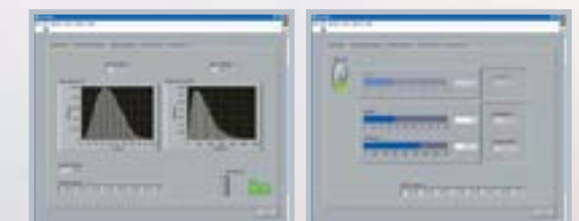
- All fiber configuration : Low loss (IL : ~1.0 dB typ. PDL : ~0.1 dB typ.)
- Customized DGD configuration and PMD range
- All order PMD emulation : 1st (DGD), 2nd (SOPMD) and Higher order PMD
- Variable mean DGD : Tunable statistics.
- Powerful GUI : Deterministic statistic emulation, Virtual (trial) DGD mode, Manual tuning.



Maxwellian distribution of probability density function of PMD.



Several output DGD distributions simulated with various average DGD.



Windows of GUI. PE4200

Optical Fiber Communication

⇒ Test & Measurement

Custom-made Products

Polarization Crosstalk Analyzer PA2000



PON-OTDR : TR3100



Optical Fiber Communication

⇒ Fiber/Cable Identifier

Acoustic Fiber Cable Identifier™

Acoustic Fiber Cable Identifier™ CI4000



- Patented Audio-Fiber Technology
- No damage on fiber cable
(Does not need bending or freezing of fiber cable)
- Non-invasive and safe method
- Dynamic range : 25 dB¹⁾

1) About 100km assuming the cable loss is 0.25dB/km

Audio Fiber Tracer

Audio Fiber Tracer CFT-810



- Output power selection (-25dBm ~ -4dBm)
- Optical power meter function
- Visual Fault Locator function
- Fiber tracing & fiber cable identification
- Audio-Visual detection of target fiber/cable
- Dynamic range : 9 dB(One pass loss)²⁾
- Battery operation

Audio Fiber Tracer FT3000



- Fiber tracing & fiber cable identification
- Audio-Visual detection of target fiber/cable
- Information of tapping position to be provided
- Visual Fault Locator function
- Dynamic range : 13 dB(One pass loss)³⁾
- Battery operation

2) About 36km assuming the cable loss is 0.25dB/km

3) About 50km assuming the cable loss is 0.25dB/km

► Polarization Scrambler



Polarization Scrambler

PS3000 series

The best polarization scrambling tool for optical communication and sensor

- High speed scrambling (~ 1MHz)
- All single mode fiber configuration : Low loss, Low PMD
- Wide operating wavelength range up to 350nm (depending on model)



Polarization Scrambler Module

PS3300 / PS3400

The best polarization scrambling tool for optical communication and sensor

- High speed scrambling (~ 1MHz)
- All single mode fiber configuration : Low loss, Low PMD

► Polarization Controllers



In-Line Polarization Controller

PC1100 series

- Super compact size
- No squeeze on fiber
- Low loss

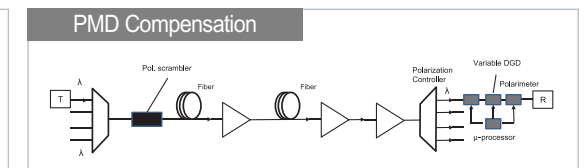
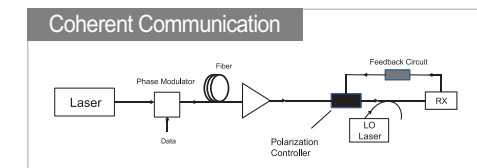
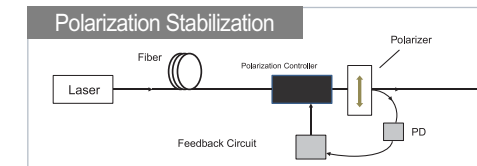
► LN Polarization Controllers



LN Polarization Controllers

PC1700

- Low Insertion Loss : < 3 dB
- Low Polarization Dependent Loss : < 0.3 dB
- Available with 3, 4, 6, 8 integrated stages
- Compact size
- PMD Compensation
- Polarization Stabilization
- Polarization Demultiplexing
- Fiber Sensor
- Fiber Laser
- Testing Equipment



► Polarization Controllers



Polarization Controller

PC1000 series

- Smooth control of polarization
- Various wavelength range

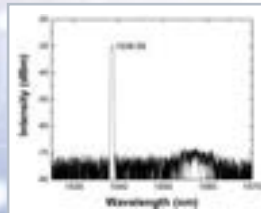
▶ Light Source Series



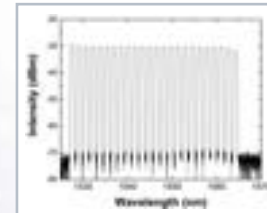
Lightwave Synthesizer : **LS5000**

Incoherent light source for Test & Measurement

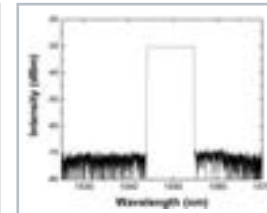
- High wavelength accuracy
- Total output power : Max. 20dBm
- Three forms of outputs
 - Single wavelength incoherent light output : 50GHz & 100GHz
 - Comb source at ITU grid with spacing 25GHz, 50GHz & 100 GHz
 - Super Flat broadband source < 0.5 dB
- Output power level control
- USB remote interface
- Simple and easy operation



Single Wavelength



Comb

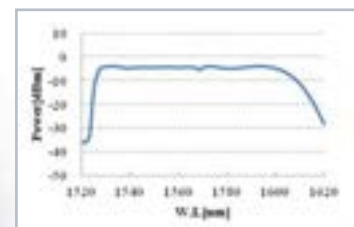


Flat Top



Broadband ASE Source : **CLS-561**

- High output power
- Stable spectral output power
- Wide wavelength range (C, L and C+ L band)
- Isolated output / Flattened output
- RS232 remote interface
- Easy operation with compact size



▶ Variable Coupler



Tunable Directional Coupler : **TC1410**

- All fiber configuration
- Low excess loss
- Smooth & easy control of coupling ratio

▶ Polarization Maintaining Splitter



PM Splitter : **FPS**

- Low crosstalk
- Low insertion loss
- Higher polarization extinction ratio than fiber coupler
- Accurate coupling ratio
- Small package size (40 x 4 x 4mm : Stainless Steel)
- Operating temperature : -40°C ~ +85°C
- Type of PM fiber : Optional (PANDA, Bow-tie)

▶ Phase Modulator



Phase Modulator : **MD1100**

- Low Insertion Loss
- C and L Bands
- High Electro-Optic Bandwidth : 10 GHz
- Compact Dimension (W x L x H) : 60 x 12.5 x 5.7 mm
- Side bands generation / Interferometric sensing
- Frequency shifting / broadening
- Optical Insertion Loss
Normal : 3.5dB, Premium : 2.0dB

Optical Metrology

⇒ Flat Panel Solution

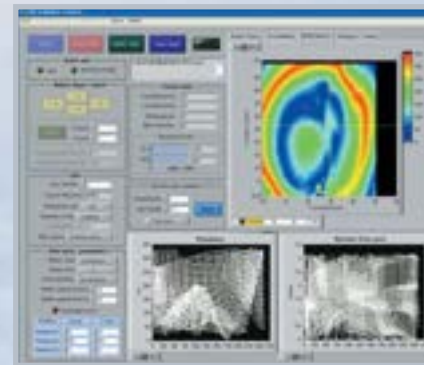
► Birefringence Analyzer



Multichannel Birefringence Analyzer : BA5100

The ultimate on-line measurement solution

- Simultaneous measurement of birefringence magnitude and angle
- High speed measurement (150Hz)
- High sensitivity in low-level birefringence measurement
- Modular design for moving head
- Versatile use -- i.e. glass, semiconductor, wave plates visible, infrared materials



Optical Metrology

⇒ Flat Panel Solution

► Thickness Monitoring System



Optical Wafer Thickness MicroGauge : TM5300-12

- Portable & Compact size
- High speed measurement (500Hz for Warp / 1kHz for Thickness)
- High accuracy & repeatability
- Up to 12 " wafer measurement
- Thickness / Warp / Bow / LTV / TTV / Stress measurement
- Si Wafer / Sa Wafer / Glass Wafer / SiO₂ / GaAS material manufacturing Process
- No calibration needed
- User-friendly operating program



Optical Thickness Measurement System : TM5000

- Portable & Compact Size
- Applicable to Silicon, Sapphire, Glass, SiO₂ and etc.
- LCD display function (Optional)
- Thickness range : 50~2,000um
- High accuracy & repeatability
- Dual channel measurement system
- User friendly operating program
- Available for OEM business & system integration

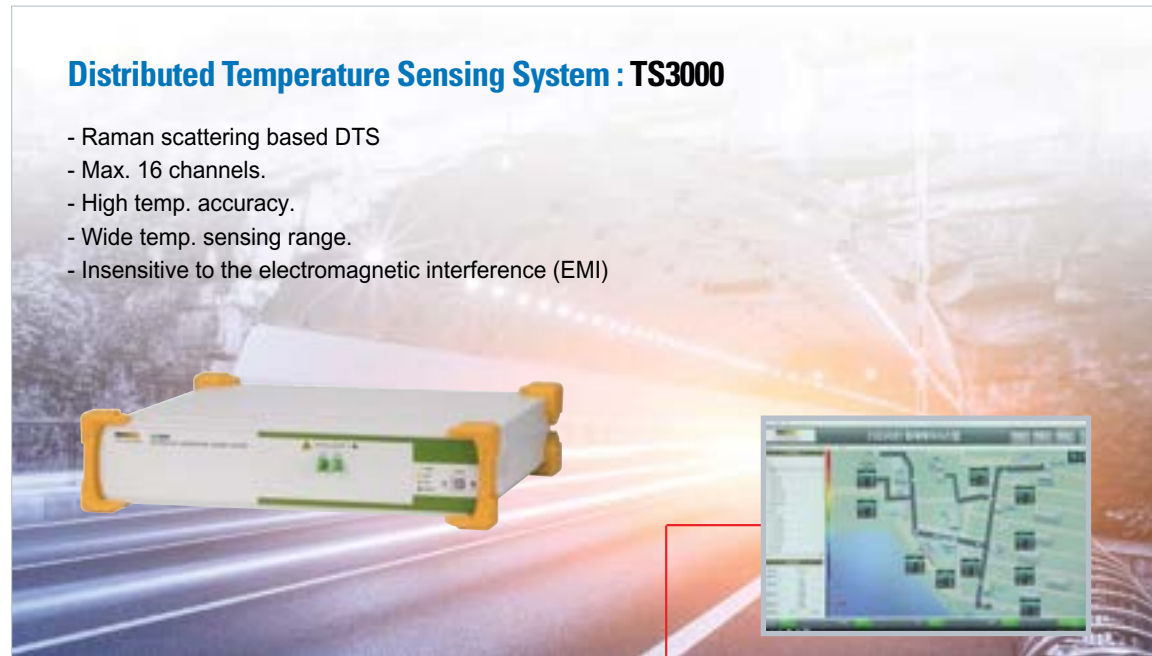
Optical Fiber Sensing System

⇒⇒ Temperature Sensors

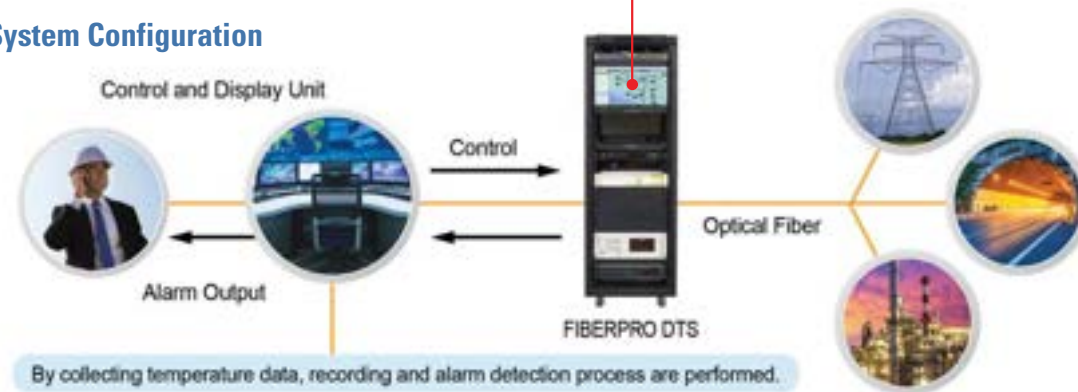
Distributed Temperature Sensing System

Distributed Temperature Sensing System : TS3000

- Raman scattering based DTS
- Max. 16 channels.
- High temp. accuracy.
- Wide temp. sensing range.
- Insensitive to the electromagnetic interference (EMI)



System Configuration



Application

- Tunnel & Large facility fire surveillance
- Power plant & Tower temperature monitoring
- Factory temperature state monitoring
- Oil & Gas pipeline surveillance of leaks
- Geothermal temperature monitoring
- Others



Optical Fiber Sensing System

⇒⇒ Temperature Sensors

Specifications

Performance

- Distance Range 5 km, 10 km
- Measurement Time : 10 ~ 600 sec
- Temperature Resolution (1σ) : < 0.5°C
- Temperature Accuracy : < ±2°C (P to P)
- Minimal Spatial Resolution : < 2 m @ 2.3 km
- Minimum Sampling Interval : 0.5 m, 1 m
- Sensing Temperature Range : -200°C ~ +700°C

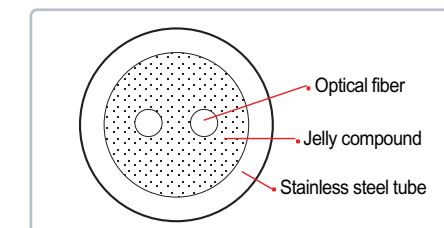
Hardware

- Number of Channel : 1, 2, 4, 8, 13, 16
- Sensing Fiber Type : MMF 50 / 125 μm (Graded index)
- Connector Type : E-2000/APC, FC/APC or SC/APC
- Operating Temperature : -20°C ~ +60°C
- Storage Temperature : -40°C ~ +85°C
- Electrical Power : AC 100 ~ 240 V, < 250W Typ.
- Dimensions (W x D x H)
600 mm x 1000 mm x 1800 mm (Rack cabinet)
445 mm x 435 mm x 177 mm (TS3000 only)
- Weight : < 10 kg
- Certification : KC (including KFI), CE
- Interfaces : LAN, RS232 (Data reading only)

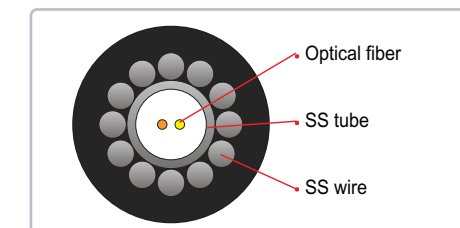
DTS Series



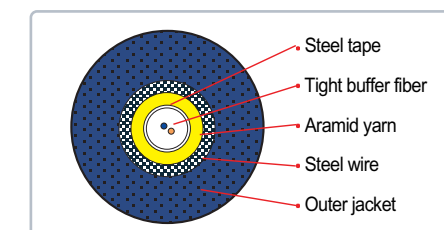
Sensing Cables



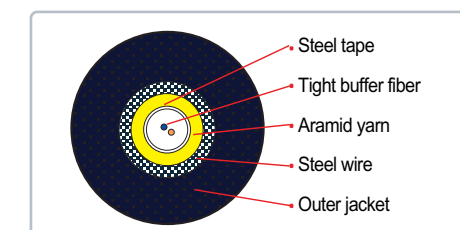
Stainless steel loose tube type



Stainless steel wire armored type



Steel tape and wire armored type



Spiral steel type

Optical Fiber Sensing System

⇒⇒ FBG Sensing

FBG Interrogation System

FBG Interrogation System : FI3300/FI3400

- Max. 16 channels.
- Max. 24 FBG sensors per channel (3 nm spacing)
- Broad wavelength range : 85 nm
- High wavelength accuracy : < 20 pm Typ.
- Fast measurement speed : Max. 10 kHz



System Configuration



Application

- **Structural monitoring**
Strain and temperature monitoring of large structures
- **Surveillance and safety systems**
Overheat detection and special temperature monitoring
- **Environmental sciences**
Temperature profile monitoring



Optical Fiber Sensing System

⇒⇒ FBG Sensing

Specifications

Optical

- Wavelength Range : 1510 ~ 1595 nm (85 nm)
- Wavelength Accuracy : < 20 pm Typ. (0 ~ 50 °C)
- Wavelength Repeatability : < 3 pm Typ.
- Dynamic Range (One way optical loss) : < 25 dB
- Source Output Power : < 10 mW (Max.)
- Number of Sensor : Up to 24 (3 nm Spacing)
- Number of Channels
FI3300 : 2, 4, 8
FI3400 : 2, 4, 8, 16
- Maximum Measurement Frequency
FI3300 : 800/N Hz (N : Selected channel No.)
FI3400 : 1600/N Hz (N : Selected channel No.)
- Optical Connector Typ. : FC/APC

Electrical

- Power Supply : AC 100 ~ 240 V
- Power Consumption : Max 15 W
- Interfaces : TCP/IP, USB

Environmental

- Operating Temperature : 0 ~ 50 °C
- Storage Temperature : -40 °C ~ +85 °C
- Humidity : 20 % to 85 % RH
- Altitude : 0 to 6,562 ft. (2000 M) above sea level

Mechanical

- Dimensions (W x D x H)
234 mm x 410 mm x 108 mm (With rubber cover)
212 mm x 380 mm x 86 mm (Without rubber cover)
- Weight : < 5 kg

FBG Sensors



Fiber Optic Gyroscope

⇒ Inertial Measurement Unit

Inertial Measurement Unit (IMU)



Inertial Measurement Unit (IMU) : FI 200C

Features

- 3 axis Fiber Optic Gyroscopes / 3 axis MEMS Accelerometers
- Bias Stability : 0.5 %/hr in full temperature range
- Angle Random Walk : 0.03 $^{\circ}$ /hr
- Power Consumption : ~ 5 W
- Operating Voltage : +5 V
- Weight : 790 g

Applications

- Autonomous vehicle
- Camera / Antenna stabilization
- Remotely-operated Vehicle
- Motion compensation
- Borehole / Pipeline measurement system
- Geo-mapping
- Mining & Agriculture



Inertial Measurement Unit (IMU) : FI 200P

Features

- 3 axis Fiber Optic Gyroscopes / 3 axis Quartz Servo Accelerometers
- Bias Repeatability : 0.5 %/hr in full temperature range
- Angle Random Walk : $\leq 0.025^{\circ}$ /hr (typ.)
- Power Consumption : ~ 5 W
- Operating Voltage : +5 V, ± 15 V
- Weight : 900 g

Applications

- Unmanned Aerial Vehicle
- Camera / Radar Stabilization
- Flight Control / Guidance System
- Motion compensation / Antenna Stabilization
- Borehole / Pipeline measurement system
- Attitude and Heading Reference System (AHRS)
- Autonomous Vehicle
- UAV/UUV Flight Controls



Fiber Optic Gyroscope

⇒ Polarizing Y-branch Phase Modulator

Inertial Navigation System



Inertial Navigation System : FN 200C

Features

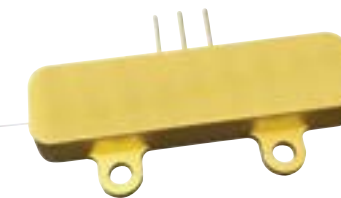
- FOG-based INS for high reliability and performance
- GPS-aided continuous navigation system with integrated GPS/IMU in a single enclosure
- Provides continuously precise position and orientation, even when its GPS is unavailable
- RS-422(UART)
- Ease of use and quick installation
- Low power consumption

Applications

- Unmanned Aerial Vehicle
- Camera / Radar Stabilization
- Motion Compensation
- Antenna Stabilization
- Attitude and Heading Reference System (AHRS)
- Autonomous Vehicle
- UAV / UUV Flight Controls



Polarizing Y-branch Phase Modulator



Polarizing Y-branch Phase Modulator : MD1000

Features

- Excellent intensity modulation : 0.05%
- High PER (polarization extinction ratio) : ≥ 60 dB
- Low Insertion Loss : ≤ 4.0 dB
- High Return Loss : ≥ 60 dB
- Low V_{π} : ≤ 4.5 V

Applications

- Fiber optic gyroscope
- Sagnac interferometer-based sensors