Optical Sensor Interrogator
NI PXIe-4844

- 4 optical channels
- 10 Hz full spectrum scan frequency
- 1510 to 1590 nm wavelength range
- Automatic sensor detection and configuration utility for fiber Bragg gratings

- Compatibility with extrinsic Fabry-Perot, long period grating (LPG), and other optical sensors
- Rugged carrying case with shoulder strap
- 1-year warranty

Overview
The NI PXIe-4844 optical sensor interrogator is a dual-slot 3U PXI Express data acquisition module for fiber Bragg grating (FBG) optical sensors. It has four optical channels that are simultaneously sampled at 10 Hz for measurement of FBG strain and temperature sensors. The NI PXIe-4844 features an optical core, which combines a high-power, low-noise swept wavelength laser with fiber Fabry-Perot tunable filter technology from Micron Optics. Each optical channel has an 80 nm wavelength range (1510 to 1590 nm), which can typically scan up to 20 FBG sensors per channel (more than 80 FBG sensors per module, depending on sensor range and sensitivity). You can further extend the maximum number of FBG sensors per module by connecting one or more optical channels to an external optical multiplexer or by adding more NI PXIe-4844 modules in the same PXI chassis. The NI PXIe-4844 can also be integrated into the same chassis as other PXI modules for electrical data acquisition and control.

Requirements and Compatibility

OS Information
- Real-Time OS
- Windows 7
- Windows Vista
- Windows XP

Driver Information
- NI-OSI

Software Compatibility
- LabVIEW Development System
- LabVIEW Real-Time Module

Application and Technology

Benefits of Optical Sensing
- Nonconductive, electrically passive immune to electromagnetic interference
- Measure over long distances (up to 10 km) without loss of signal accuracy
- Daisy chain dozens of sensors, including temperature, strain, and pressure, along a single optical fiber
- Simplified cable management and lightweight fiber
- No required calibration of the sensor or interrogator (onboard NIST-traceable wavelength reference)
- Potential for longer fatigue life and faster response than electrical sensors

Measurement Services Software (included)
- NI-OSI driver software for LabVIEW (32-bit)
- NI-OSI Explorer configuration utility
You configure the NI PXIe-4844 and FBG sensors in the NI-OSI Explorer, a configuration manager that scans the optical wavelength range to identify all connected FBG sensors. After you specify the range and scaling equations for each detected FBG, all scans automatically parse the channel data into individual sensor measurements and scale the data into appropriate engineering units. You can export this scaling configuration for use in the NI-OSI LabVIEW API.

The NI-OSI LabVIEW API has a similar look and feel to NI-DAQmx driver software. Data is returned as an array that you can directly wire to a LabVIEW chart to display scaled data in a value-versus-time format.

Theory of Operation

A fiber Bragg grating (FBG) is an in-fiber structure that reflects specific wavelengths of light while allowing all others to transmit (Figure 1). The reflected wavelength (Bragg wavelength) is a function of both temperature and strain, enabling FBGs to be used as sensors. Each FBG has a unique Bragg wavelength set by the vendor during manufacturing. You can daisy chain FBGs with different nominal Bragg wavelengths within a single optical fiber as long as each FBG occupies a unique wavelength range within the 80 nm optical spectrum of the NI PXIe-4844.

Benefits of FBG Technology

Electrical sensor measurements have several limitations associated with the environment in which they operate: they are prone to noise induced by electromagnetic interference (EMI), they require frequent calibration, they may require external power/excitation, and they are subject to failure when used within harsh environments. Other challenges in distributed civil and geotechnical applications involve the difficulty of installation, the permanent nature of the system, and the large amount of wiring required.

Benefits of FBG Optical Sensing

- Nonconductive, electrically passive and immune to EMI
- Measurements over long distances (up to 10 km) without loss of signal accuracy
- Ability to daisy chain dozens of sensors, including temperature, strain, and pressure, along a single optical fiber
- No required calibration of the sensor or interrogator with NIST-traceable wavelength reference

Measure Anywhere

- Ability to mix and match different measurement types on the same sensor array
- Simplified cable management and lightweight fiber
- Potential for faster response than thermocouples and longer fatigue life than foil strain gages
- Potential for immunity to lightning, high voltages, and corrosion depending on sensor packaging
- Ability to embed sensors in composite materials

Advantages of the NI Optical Sensor Interrogator

Traditional optical measurement devices provide fixed software functionality and a fixed user interface. This lack of flexibility limits the system’s ability to meet many structural test and monitoring application needs. In addition, traditional optical sensing instruments are not designed for easy integration with electrical measurements or control systems, which is often required in real-world structural and environmental measurements. The NI optical sensor interrogator (OSI) offers seamless integration with NI LabVIEW, a graphical development environment for customizable software and easy UI development. The NI PXIe-4844 is also based on the PXI platform, providing modular I/O for easy integration with a wide variety of PXI and PXI Express devices, including conventional thermocouple, strain, and vibration devices as well as analog and digital outputs for control requirements.

PXI Express

- High-performance PCI Express bus
- Advanced differential timing and triggering backplane
- Integration with electrical I/O with more than 1,500 PXI modules
- Modular I/O for easy expansion

Easy to Use

- NI-OSI Explorer utility for automatic sensor detection and simplified sensor configuration for easy scaling to physical units
- NI-OSI driver software with easy-to-use LabVIEW API including common optical measurement functions
- Tight integration with LabVIEW for data analysis, viewing, and logging

Application Examples

- Civionics – distributed measurements over long distances, including bridges, buildings, and other civil structures
- Energy – monitoring wind turbine blades, pipelines, nuclear reactors, offshore platforms, power generators
- Marine Vessel and Platforms – cargo containers, deck, mast, or any other corrosion-prone structure
- Aerospace – airframe, composite structure, fuel tank, wind tunnels
Ordering Information
For a complete list of accessories, visit the product page on ni.com.

<table>
<thead>
<tr>
<th>Products</th>
<th>Part Number</th>
<th>Recommended Accessories</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>NI PXIe-4844 4 Ch. Optical Sensor Interrogator</td>
<td>781285-01</td>
<td>No accessories required.</td>
<td></td>
</tr>
</tbody>
</table>

Software Recommendations

NI LabVIEW Full Development System for Windows
- Fully integrated graphical system design software
- Support for a wide range of measurement hardware, I/O, and buses
- Custom, event-driven user interfaces for measurement and control
- Extensive signal processing, analysis, and math functionality
- Advanced compiler to ensure high-performance execution and code optimization
- Includes SSP for professional technical support, online training, and software upgrades

NI LabVIEW Real-Time Module
- Design deterministic real-time applications with LabVIEW graphical programming
- Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O
- Take advantage of built-in PID control, signal processing, and analysis functions
- Automatically take advantage of multicore CPUs or set processor affinity manually
- Includes real-time OS, development and debugging support, and board support
- Purchase individually or as part of a LabVIEW suite

Support and Services

System Assurance Programs
NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

Calibration
NI measurement hardware is calibrated to ensure measurement accuracy and verify that the device meets its published specifications. To ensure the ongoing accuracy of your measurement hardware, NI offers basic or detailed recalibration service that provides ongoing ISO 9001 audit compliance and confidence in your measurements. To learn more about NI calibration services or to locate a qualified service center near you, contact your local sales office or visit ni.com/calibration.

Technical Support
Get answers to your technical questions using the following National Instruments resources.
- Support - Visit ni.com/support to access the NI KnowledgeBase, example programs, and tutorials or to contact our applications engineers who are located in NI sales offices around the world and speak the local language.
- Discussion Forums - Visit forums.ni.com for a diverse set of discussion boards on topics you care about.
- Online Community - Visit community.ni.com to find, contribute, or collaborate on customer-contributed technical content with users like you.

Repair
While you may never need your hardware repaired, NI understands that unexpected events may lead to necessary repairs. NI offers repair services performed by highly trained technicians who quickly return your device with the guarantee that it will perform to factory specifications. For more information, visit ni.com/repair.

Training and Certifications
The NI training and certification program delivers the fastest, most certain route to increased proficiency and productivity using NI software and hardware. Training builds the skills to more efficiently develop robust, maintainable applications, while certification validates your knowledge and ability.
Classroom training in cities worldwide - the most comprehensive hands-on training taught by engineers.

- On-site training at your facility - an excellent option to train multiple employees at the same time.
- Online instructor-led training - lower-cost, remote training if classroom or on-site courses are not possible.
- Course kits - lowest-cost, self-paced training that you can use as reference guides.
- Training memberships and training credits - to buy now and schedule training later.

Visit ni.com/training for more information.

Extended Warranty

NI offers options for extending the standard product warranty to meet the life-cycle requirements of your project. In addition, because NI understands that your requirements may change, the extended warranty is flexible in length and easily renewed. For more information, visit ni.com/warranty.

OEM

NI offers design-in consulting and product integration assistance if you need NI products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

Alliance

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, and a worldwide National Instruments Alliance Partner program of more than 700 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

Detailed Specifications

The following specifications are typical for the NI PXIe-4844 operating at 25 °C unless otherwise noted.

<table>
<thead>
<tr>
<th>Bus Interface</th>
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<tbody>
<tr>
<td>Form factor</td>
<td>x4 PXI Express, v1.0 compliant</td>
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<tr>
<th>Lasers</th>
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<tbody>
<tr>
<td>Type</td>
<td>Fiber laser</td>
</tr>
<tr>
<td>Class</td>
<td>1</td>
</tr>
<tr>
<td>Output power (continuous wave)</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td>0.06 mW</td>
</tr>
<tr>
<td>Max</td>
<td>0.25 mW</td>
</tr>
<tr>
<td>Beam diameter</td>
<td>9 mm (0.35 in.)</td>
</tr>
<tr>
<td>Number of lasers</td>
<td>4</td>
</tr>
<tr>
<td>Wavelength range</td>
<td>1510 nm to 1590 nm</td>
</tr>
<tr>
<td>Sample rate</td>
<td>10 Hz ± 0.1 Hz</td>
</tr>
<tr>
<td>Optical dynamic range</td>
<td>40 dB</td>
</tr>
<tr>
<td>Wavelength accuracy</td>
<td>1 pm</td>
</tr>
<tr>
<td>Wavelength stability (0 °C to 55 °C)</td>
<td>1 pm</td>
</tr>
<tr>
<td>Wavelength repeatability</td>
<td>1 pm</td>
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<table>
<thead>
<tr>
<th>Physical Characteristics</th>
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<tbody>
<tr>
<td>If you need to clean the NI PXIe-4844, use a soft, non-metallic brush. Make sure that the device is completely dry and free from contaminants before returning it to the PXI Express chassis.</td>
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<thead>
<tr>
<th>Note</th>
<th>For two-dimensional drawings and three-dimensional drawings of the NI PXIe-4844 module and connectors, visit ni.com/dimensions and search by module number.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13.1 cm x 21.4 cm x 4.1 cm (5.1 in. x 8.4 in. x 1.6 in.)</td>
</tr>
<tr>
<td>Dimensions (without connectors)</td>
<td>213g (7.5 oz)</td>
</tr>
<tr>
<td>Weight</td>
<td>Two side-by-side PXI Express slots, other than slot one</td>
</tr>
<tr>
<td>Slot requirements</td>
<td>x4, x8, and x16 PXI Express or PXI Express hybrid slots</td>
</tr>
</tbody>
</table>
Safety Standards

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note For UL and other safety certifications, refer to the product label or the Online Product Certification section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326 (IEC 61326): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note For EMC declarations and certifications, refer to the Online Product Certification section.

Laser Compliance

This product meets the requirements of the following laser compliance standards for electrical equipment for measurement, control, and laboratory use:

- IEC 60825-1, ED 2.0, 2007-03; US CDRH 21 CFR Subchapter J

Note For EMC declarations and certifications, refer to the Online Product Certification section.

CE Compliance

This product meets the essential requirements of applicable European Directives, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit ni.com/certification, search by module number or product line, and click the appropriate link in the Certification column.

Shock and Vibration

Mechanical shock

Operating (IEC 60068-2-7 Annex A, section A.4, Table A.1) 15 g peak, half-sine, 11 ms pulse
Non-operating (IEC 60068-2-7) 25 g peak, half-sine, 11 ms pulse

Random vibration

Operating (ETSI 300 019-2-3) 0.15 grms, 5 to 100 Hz
Non-operating (IEC 60068-2-64) 0.8 grms, 10 to 150 Hz

Environmental

This device is intended for indoor use only

Caution Do not exceed the operating temperature, even when using the module in a chassis with a higher temperature range

Operating temperature (IEC 60068-2-1, IEC 60068-2-2) 0 °C to 55 °C
Storage temperature (IEC 60068-2-1, IEC 60068-2-2) -40 °C to 70 °C
Operating humidity (IEC 60068-2-56) 10% to 90%, noncondensing
Storage humidity (IEC 60068-2-56) 5% to 95%, noncondensing
Maximum altitude 2,000 m

Environmental Management
National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the NI and the Environment Web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as

<table>
<thead>
<tr>
<th>Waste Electrical and Electronic Equipment (WEEE)</th>
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<tbody>
<tr>
<td><strong>EU Customers</strong> At the end of the product life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment, visit ni.com/environment/weee.htm.</td>
</tr>
</tbody>
</table>

**电子产品污染控制管理办法（中国 RoHS）**

中国客户 National Instruments符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。

关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohschina。 (For information about China RoHS compliance, go to ni.com/environment/rohschina.)