FEBUS optics

The reference in distributed fiber sensing

Power Cable Integrity Offshore & Onshore

Well Monitoring

Pipeline Integrity Monitoring

Seismic & Seismology

Intrusion Detection

Structural Health Monitoring

FEBUS optics

> Who we are

THE REFERENCE IN DISTRIBUTED FIBER SENSING SOLUTIONS

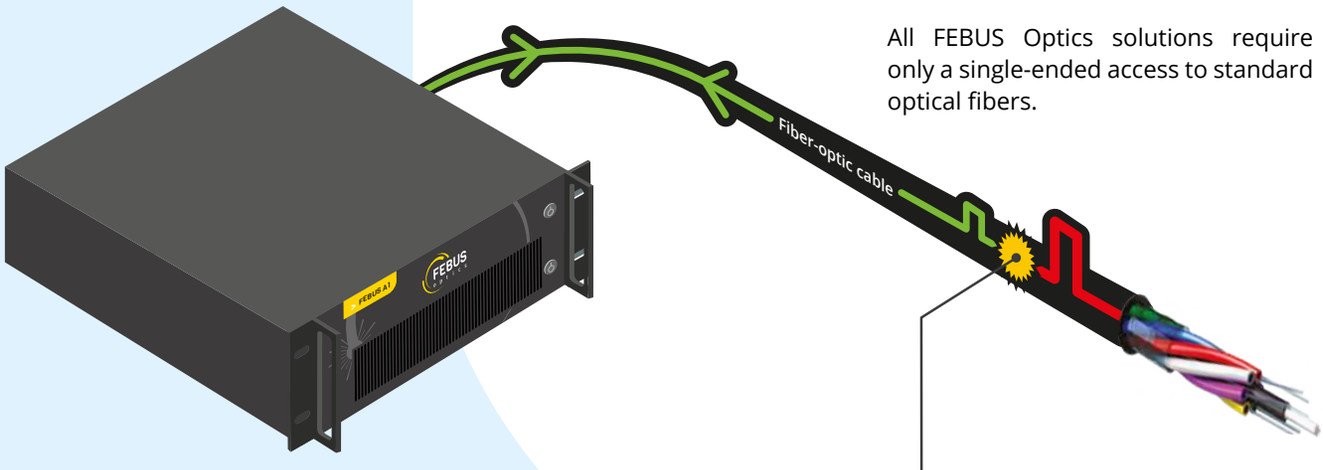
FEBUS OPTICS brings a new generation of fiber optic sensing based solutions to the market using **DAS, DTS and DSS.**

From OEM supplier to turnkey solution provider, FEBUS Optics benefits from high adaptability and many years of experience to provide on-custom, high-performance equipment and a large panel of on-site services thanks to highly skilled personnel. We offer solutions to applications such as: **Umbilical and Power Cables Integrity Monitoring, Well Monitoring, Pipeline Integrity Monitoring, Seismic and Seismology, Intrusion Detection and Structural Health Monitoring.** Our patented technologies use innovative optoelectronic architecture and unique HPC (High Performance Computing) real-time signal processing algorithm to measure accurately temperature, strain and vibrations over tens of kilometers.

FEBUS assists you from initial study to on-site implementation and long-term services. We own a **unique and versatile Test Center** to showcase our technologies and also to conduct on-demand experimental validations.

All our solutions come with a 3 years warranty (part and labor).

> What we do



All FEBUS Optics solutions require only a single-ended access to standard optical fibers.

Laser pulse propagating through the fiber

Small part of the pulse back to the equipment due to scattering effect

Hot/cold spot, Vibration, Mechanical strain,...

> **Pipeline Integrity Monitoring**

> **Intrusion Detection**

WHY & HOW

FEBUS Optics large range of products allows the delivery of a **complete and integrated solution for Pipeline Monitoring** that offers:

- **Leak Detection** with FEBUS G1-R (DSTS: Distributed Strain and Temperature Sensing) and/or FEBUS A1 (DAS: Distributed Acoustic Sensing)
- **Third Party Intrusion** (TPI) with FEBUS A1
- **Geohazard** with FEBUS G1-R

FEBUS PIDS (Perimeter Intrusion Detection System) solution using our unique DAS technology together with FOGuard Suite provides **high-performance** and **reliable** detections of intrusions on fence, wall and borders. It can be **easily integrated into a VMS (Video Management System) or used as a standalone solution** with its own algorithm for event detection and classification.

Thanks to our **many years of experience,** FEBUS provides all the associated services and can install, commission and perform long-term maintenance worldwide for Pipeline Monitoring and PIDS.

KEY ADVANTAGES

- All technologies (DAS, DTS, DSS) can be combined from a **single manufacturer.**
- **Worldwide experience** on Pipeline Monitoring and PIDS.
- Long range monitoring with optimized solution to **reduce investment and maintenance costs.**
- **Interoperability** with SCADA, Hypervisor and VMS solution.
- FEBUS owns a unique **Test Center** to demonstrate performances in customer field conditions with high fidelity.

REFERENCES

TotalEnergies, Terēga, eni, OMV, RINA, TEN Technip Energies

A1 FEBUS A1

FEBUS A1 device provides vibration and acoustic sensing typically every 2 m along several tens of kilometers with optical fiber cable deployed on or near the infrastructure.

The FEBUS A1 device can be connected to optical fiber cables already in place. It is compatible with standard single-mode or multi-mode fiber. This system is specifically designed to meet harsh environment requirements with single-ended connection to the optical fiber sensing cable.

MAIN FEATURES

- **Amplitude and Phase based sensing included**
- **Down to 0.2 m spatial sampling**
- **Up to 100 kHz measurement frequency @ 1 km fiber length**
- **Advanced Alerting and Visualization Capabilities with FOGuard Suite software**

> Power Cable/Umbilical

WHY & HOW

Power Cable related incidents account for 80% of insurance claims and around 60% relate directly to cable damage during construction of offshore windfarm. Thus, **cable monitoring is essential.**

The FEBUS G1 (DSTS: Distributed Strain and Temperature Sensing) and A1 (DAS: Distributed Acoustic Sensing) series enable the **monitoring of temperature and vibrations over very long ranges,** making both anticipation and detection of multiple potential issues possible, such as:

- **Hot Spots** (FEBUS G1)
- **Cable Overload** by RTTR (FEBUS G1)
- **Shock and Anchor Drag** (FEBUS A1)
- **Free Span/Suspension Zones** detection and localization (FEBUS A1)
- **Partial Discharge** (FEBUS A1)
- **Fatigue Monitoring** (FEBUS A1 & G1)

The FEBUS solution outputs real-time integrity monitoring during the phases of the cable life cycle:

- **Manufacturing, transpooling and deployment** using the FEBUS G1-C.
- **Operation** using the FEBUS G1-R and FEBUS A1.

KEY ADVANTAGES

- **Unique real-time integrity monitoring** during manufacturing, transpooling and deployment thanks to the portable and autonomous FEBUS G1-C.
- Very high performances with the **easiness and robustness of single-ended measurements** for all FEBUS interrogators.
- **Independent measurement of temperature and strain** using only a single optical fiber (FEBUS G2).
- Very long range, **more than 100 km.**
- Possibility to **detect and localize partial discharges** (FEBUS A1).

REFERENCES

Nexans · EDF · Van Oord Marine ingenuity · MOOG · TechnipFMC · ENEDIS · Rte

> Portable and autonomous version of the G1 series (FEBUS G1-C)

G1 G2 G-SERIES

FEBUS G-Series interrogation units provide Strain and Temperature information typically every 1 m along several tens of kilometers along an optical fiber deployed on the infrastructure.

FEBUS G-Series are ideal for performing accurate and real-time monitoring with harsh environment requirements using a portable and autonomous device (FEBUS G1-C) and single-ended configurations needing only one end of the fiber.

MAIN FEATURES

- **Up to 100 Hz measurement @ 500 m fiber length**
- **Up to 100 km range @ 10 m spatial resolution** (typ.)
- **Down to 4 µm/m** (Strain)
- **Possibility of Simultaneous Strain and Temperature measurement with unique patented G2 technology**
- **FOLog G intuitive User Interface**

> Well Monitoring

> Seismic & Seismology

WHY & HOW

FEBUS Optics unique range of products (DAS, DTS, DSS) allows for a large diversity of services for **geophysical and well applications**:

- **4D Vertical Seismic Profiling** with FEBUS A1 (DAS: Distributed Acoustic Sensing)
- **Surface Seismic** with FEBUS A1
- **Micro-seismicity Monitoring** with FEBUS A1
- **Well Integrity:** subsidence, shear, leaks with FEBUS G1-R and G1-C (DSTS: Distributed Strain and Temperature Sensing)
- **Production Monitoring** combining FEBUS T1-R (DTS: Distributed Temperature Sensing) and FEBUS A1

Thanks to the combination of Distributed Fiber Optic Sensing experts, experienced geophysicists and reservoir engineers, **FEBUS Optics can be interated to most of logging visualization softwares on the market and provide on-site services.**

The knowledge in geophysics shared with many Universities worldwide has enhanced the processing and data management tools to make FEBUS A1 the most versatile DAS system of the market.

KEY ADVANTAGES

- Our **reservoir engineers and geophysicists are closely working** with DAS, DTS and DSS.
- **Large experience on data processing** for passive and active seismic with FEBUS A1.
- **Application-related workflow,** data-quality control, data format and export.
- **Field know-how** from frequent collaborations with deployment companies.
- Several technologies (among DAS, DTS, DSS, all available in FEBUS Optics portfolio) can be combined for the **most accurate diagnosis** in all the applications.

REFERENCES

VERMILION ENERGY · TotalEnergies · OMV · ZIEBEL · brgm · TU Graz Graz University of Technology

T1 FEBUS T1-R

FEBUS T1-R (DTS: Distributed Temperature Sensing) measures points continuously and in real-time along the entire length of an infrastructure (a wellbore for instance), with repeatability **better than 0.1°C achieved in the field.** Based on analysis of Raman Stokes and Antistokes signals in an optical fiber, this DTS returns many thousands of measurement points over distances up to 30 km using a multimode fiber, addressing a large field of applications.

MAIN FEATURES

- **Intuitive FOLog T software** for acquisition control, processing and display
- **1 to 16 channels** integrated in a single box (19", 4U)
- Versatile device showing **high performance at short distances** (for wellbore application), and capable to perform hot/cold spot detection **up to 30 km (for cable monitoring)**
- **Non-proprietary** compact file format (HDF5)

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