

DITEST™ D-Light

Dynamic strain and temperature sensing system



Fibre optic distributed sensing for dynamic strain monitoring applications offshore

Offshore oil exploration and production is extending into deepwater locations, increasing performance requirements on subsea infrastructure. Components such as umbilical's, risers and flowlines are subject to dynamic disturbances from vessel and wave induced motion effects. Their design limits are set by fatigue accumulation. The complex nature of the induced stress makes static analysis inadequate for measuring offshore structures. Periodic ROV inspections are used to assess their structural integrity over the entire length. The method is however expensive and unreliable since visual inspection can only detect external anomalies and is unable to detect structural deterioration. By introducing in-situ real-time structural monitoring, it is possible to measure the strain and temperature profile with precision along subsea infrastructure and to use this information to detect strain events which may affect the structural integrity and eventually monitor the fatigue accumulation of the infrastructure.

DITEST D-Light Features and benefits

- Fully distributed dynamic temperature and strain monitoring
- On-line monitoring with 1 Hz acquisition rate
- 10 km distance range
- Fibre optic strain sensing system
- No active underwater component
- Based on proven technology
- Axial and bending strain measurement
- Meter spatial resolution
- High strain resolution 25 $\mu\epsilon$
- Seamless data communication



Data Sheet

Precise and dynamic measurements

DITEST D-Light harnesses the pioneering fibre optic Brillouin-based sensing technique powered by Omnisens adapted to dynamic strain monitoring applications. Unlike point sensors, fully distributed fibre optic measurement provides full information on the structure strain via measured strain profiles over the whole sensing fibre length.

The DITEST D-Light interrogator features real-time full strain profile measurement along a sensing fibre with an acquisition rate in the 1 Hertz range, while maintaining high strain resolution to meet the application requirement for dynamic strain monitoring. The spatial resolution can be adjusted from 1 to 10 meters depending on requirements and as many as 10,000 measurements can be taken along the fibre (at typically every 0.5m along the full distance). Readings can be taken dynamically, with a 1 second updating rate, giving constantly updated information on offshore structures.

“Combined with Omnisens DITEST DSM monitoring software solution and dedicated fibre optic sensors, the D-Light offers permanent real-time monitoring solution for subsea infrastructures.”

A range of applications for offshore monitoring

- Static and dynamic strain monitoring on offshore structures
- Fatigue monitoring
- Marine flexible riser strain monitoring
- Vortex induced vibration monitoring
- ROV umbilical strain monitoring
- Mooring ropes strain monitoring
- Spoolable pipe deployment
- Towed arrays

Superior monitoring performance

DITEST D- Light offers long distance measurement capabilities of up to typically 10km per channel with optimized performances in terms of spatial resolution and measurement resolution.

“The system can deliver accurate dynamic strain measurements, while its robust optical budget means it can support the most demanding of deployment conditions.”

It also includes distributed temperature measurement capabilities which can be further utilized for thermal compensation of strain sensors as well as for leak detection or heat tracing along the structure. The frequency-based sensing technique brings high accuracy and measurement immunity to optical loss or varying attenuation introduced by rotary joints and fibre-optic connectors.

Intelligent measurement control and configuration

DITEST D-Light integrates an intelligent configuration routine which automatically configures the measurement parameters and optimises each measurement according to the targeted performance, taking into account such settings as:

- Distance and sampling interval
- Measurement contrast optimisation
- Temperature and strain measurement range

The DITEST D-Light interrogator is a standalone measuring unit. It can be configured from an external computer and once configured it performs continuous on-line measurement whilst the recorded data is stored on the interrogator and transferred to a configured computer connected to the interrogator via a TCP/IP connection. The user can change the measurement parameters as and when required, adapting them to specific situations or project requirements.



Data Sheet

Measurements are made in a very simple way, as the instrument automatically controls and optimises the measurement based on the required performance parameters. Alternatively, a given acquisition time can be set and the measurement configuration is automatically adjusted to maintain an optimised measurement resolution within the specified time.

The system also includes self-performance monitoring to provide details about the quality of each measurement. This is then used to adapt the measurement settings in the case of varying sensing conditions.

Complex sensing configurations made easy

The DITEST D-Light interrogator comes with a library of pre-configured calibrated sensing elements featuring the most commonly used optical fibres and cable sensors. Multiple cable and fibre sections can be combined in a single measurement configuration, providing accurate mapping of the sensing locations even in the most complex of monitoring applications.

Powerful measurement data management

The measurement data and configurations are stored in a dedicated database format, enabling reliable data storage and easy retrieval for interpretation. The graphical user interface allows the user to visualise measurements and view measurement evolution as a function of time. The data can be exported to various format types.

“DITEST also features complete remote control capabilities, making it possible to configure instrumentation, diagnose events and carry out maintenance through a TCP/IP connection. This ensures maximum availability to the end user and makes the system a cost-effective solution for the long term.”

DITEST DSM monitoring system

The DITEST DSM monitoring system uses distributed strain and temperature measurement in order to perform permanent real-time of structural integrity. The system makes use of DITEST D-Light interrogator, dedicated fibre-optic sensing cables and the DITEST DSM monitoring software running on a dedicated DITEST server. The DITEST DSM software gathers information from single or from multiple D-Light interrogator units in a centralized database for storing, data processing and analysis for trending and alarm triggering.

The DITEST DSM graphical user interface is designed to facilitate the monitoring configuration and the identification of dedicated event by dividing the structure in various zones with specific associated warning and alarm thresholds. It can combine dynamic strain measurements with periodic temperature measurement profiles for either compensation of thermal effects on strain measurements or the detection of temperature events, such as leaks, power cable overheat, etc. Specific algorithms have been developed for the early detection of alarming conditions, based on localised strain built (trends) or abnormal strain values. Alarm events are available through TCP/IP on the DITEST-LTM™ server viewer and made available to the third party system via MODBUS TCP.

DITEST DSM features and benefits

- Fully distributed strain and temperature
- Real-time strain profile analysis
- Structure and monitoring configuration (zones, alarms etc.)
- Visualization of events and alarms
- Event logger
- Visualization of historical and real-time profiles
- Seamless data communication and storage
- Data communication with third party systems (e.g. SCADA)



Data Sheet

Powerful measurement data management

The measurement data and configurations as well as the monitoring agenda are stored in a dedicated database format, enabling reliable data storage and easy retrieval for interpretation. The graphical user interface allows the user to visualise measurements and view measurement evolution of each zone as a function of time.

DITEST also features complete remote control capabilities, making it possible to configure instrumentation, diagnose events and carry out maintenance through a TCP/IP connection. This ensures maximum availability to the end user and makes the system a cost-effective solution for the long term.

Bespoke configuration for enhanced performance

Every project involving offshore structural continuous monitoring is unique. The best performance depends on the careful selection of sensing fibre cable and its integration. Omnisens can work closely with you to ensure we define the appropriate monitoring system for your requirements and situation. Please contact us if you would like to know more.

DITEST D-Light performance and features

Performance	Number of channels	2 independent channels		
	Distance range (per channel)	10 km		
	Spatial resolution	1 to 10 m Settable by increment of 0.1 m (typically 2 m)		
	Distance resolution	0.5 m		
	Number of distance points	Up to 10,000 (typically 5,000)		
	Strain range	≤0.5%	1%	>2%
	Acquisition rate (full strain profile)	1 Hz	0.5 Hz	0.25 Hz
	Optical Loss budget	3 dB		6 dB
	Uncertainty*	40 microstrain		80 microstrain
	Features	Sensing configuration	2-fibre loop sensing configuration	
Optical Connections		E-2000/APC		
Laser wavelength		1.5 micron wavelength range		
Communication		Ethernet port (TCP/IP), USB		
Output signals		SPST relays, TCP/IP message		
Data storage		Internal Hard disc (40 GB or more)		
Data format		Database, text files, MS Excel		
Operating temperature		0 °C to 35 °C		
Humidity		< 95% non-condensing		
Power supply and consumption		100-240 VAC ; 50-60 Hz; max. 200 W		
Dimensions (W x D x H)	449 x 500 x 266 mm (6U high 19" rack mountable enclosure)			

* Copy needed here for note.

Laser safety: Omnisens DITEST products emit invisible infra-red radiation in the range 1550 nm. They are classified to EN 60825-1(2001-03) as Class 1M laser products. DITEST is a trademark of Omnisens.

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