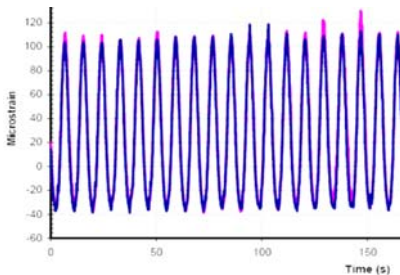


INTEGRISTICK™ Dynamic Curvature Sensor



INTEGRISTICK™ strain sensor



INTEGRISTICK™ dynamic strain
measurement – example of signal output
from the stick

The Pulse **INTEGRISTICK™** is a unique patented sensor specifically suited for riser fatigue monitoring where response is dynamic bending dominated. Typical applications include fatigue monitoring in the touch down section of an SCR and the taper joint of a top tensioned riser.

The stick sensor is 19 mm diameter and 0.5 meter in length and it is attached to the outside surface of a riser. It changes in sympathy with the riser pipe and measures the change in riser curvature in 2 planes allowing local dynamic bending stress to be determined and hence the fatigue damage rate to be calculated.

The **INTEGRISTICK™** has high accuracy, typically allowing 1 micro-strain resolution (depending on riser pipe diameter). This makes the sensor sensitive enough to capture lowest seastates. This capability is essential for measuring response under day to day current profiles and waves that contribute significantly to damage accumulation.

Uniquely the **INTEGRISTICK™** is sealed, oil-filled and pressure balanced allowing application at depths up to 3000m. It is manufactured from corrosion resistant materials. The strain measurement system is compact, ultra lightweight and can be fitted to the riser in a matter of minutes. When fitted with a compact GRP fairing the arrangement provides a highly reliable and robust method for measuring riser bending stresses.

SYSTEM CONFIGURATION

The sensor has ultra low power consumption and designed to interface directly to the **INTEGRIPOD™** (1) for battery-powered standalone or online data logging. The connection between the **INTEGRISTICK™** and **INTEGRIPOD™** can be a permanent flange connection, a dry-mate connector or an ROV connector. The connection type will depend on the project specification. The ROV retrievable **INTEGRIPOD™** using a ROV connector allows the **INTEGRIPOD™** to be removed and replaced whilst leaving the stick mounted on the riser.

LOGGER PODS

For battery-powered standalone monitoring applications, the standard **INTEGRIPOD™** has 60mm OD and 330 mm length. For a typical logging programme of 20 minutes logging every 2 hours, this data logger will last 90 days (limited by battery capacity). Bigger housings can be implemented to increase the battery capacity if required. For acoustically-linked battery-powered on-line monitoring applications, the standard **INTEGRIPOD™** has 114mm OD and 1000 mm length. For hardwired on-line monitoring application, the standard **INTEGRIPOD™** has 114 mm OD and 450 mm length. No battery will be used for this configuration.

MOUNTING METHODS

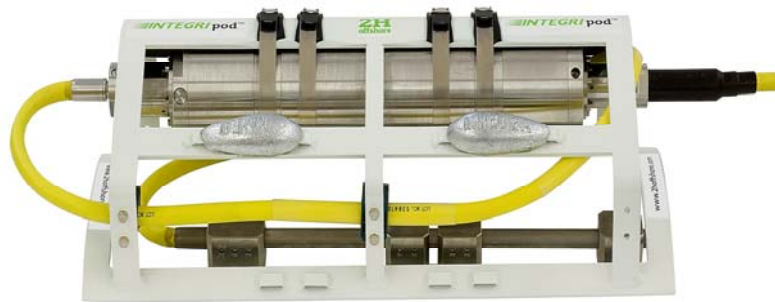
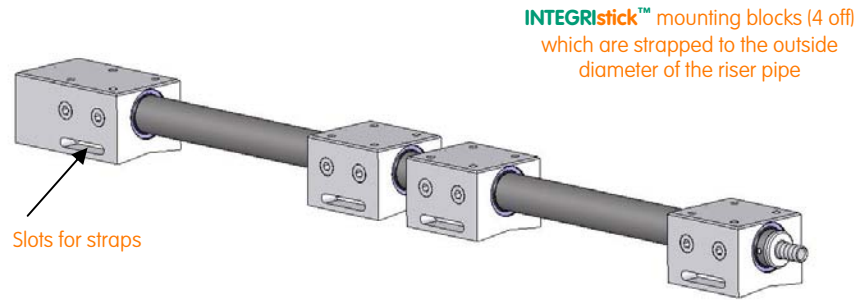
The **INTEGRISTICK™** is mounted on the outside diameter of the riser or over the outside diameter of the coating of the riser via four (4) mounting blocks. The blocks are strapped to the riser pipe using straps made from Titanium or other corrosion resistant materials. The installation can be carried above water or underwater by divers.

The logger pod (**INTEGRIPOD™**) and the **INTEGRISTICK™** are both mounted on the outside diameter of the riser using various proven mounting methods.

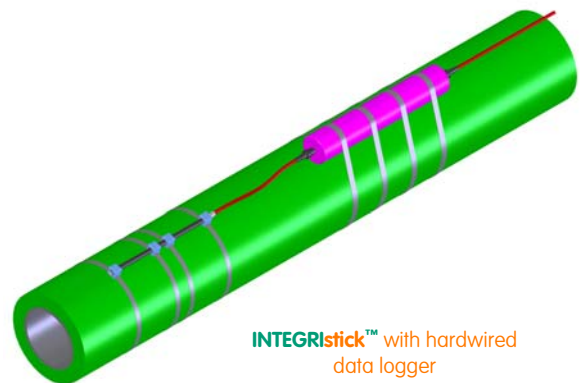
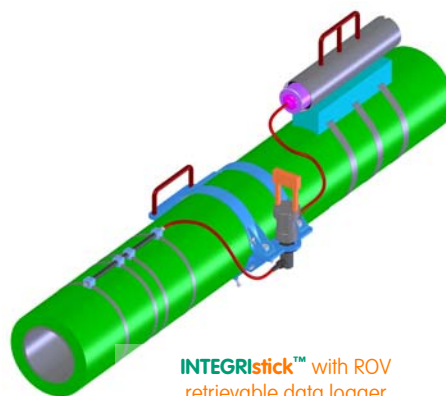
SPECIFICATIONS

Stick size	19 mm OD and 506 mm length. Hose length varies
Pod size (standalone)	Standard size: 60mm OD, 330mm long
Pod size (on-line)	Standard size: 114mm OD, 450mm long
Strain measurement noise	1 µstrain (typical value, depending on steel pipe diameter)
Temperature range	-5°C to 80°C (storage) 0°C to 65°C (operation)
Stick and pod weight	8 kg approx. in air (Standalone system)
Design pressure	3000 meters water depth (for stick and casing systems)

Note (1): **INTEGRIPOD™** is the generic name for Pulse subsea logger assembly to acquire data from sensors, to store data into memories and to transmit data in different communication schemes



An example of INTEGRstick™ and INTEGRpod™ assembly with protective cage



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