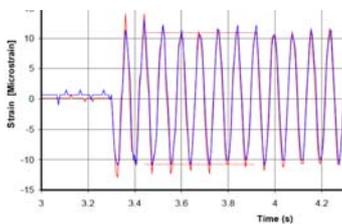


INTEGRICollar™ Subsea Strain Sensor



INTEGRICollar™ installed on a pipe



INTEGRICollar™ dynamic strain measurement – example of signal output from the sensor

The Pulse **INTEGRICollar™** is a strain sensor for measuring axial and bending stresses of a pipe structures. It uses the proven and robust displacement sensor technology widely used in the industries. The typical application for **INTEGRICollar™** includes SLOR air can up-thrust tension measurement, drilling riser tension measurement and tendon tension measurement.

This device is attached to the pipe with two rigid collars that are securely installed around the pipe. The collars are either bolted or welded to the pipe. Four linear displacement sensors are installed between the collars, allowing the pipe axial strain to be measured. The sensors require tiny force to operate, hence they will not impose heavy load to the collars.

The device relies on the high accuracy, stability and robustness of the non-contact displacement sensors, which are extensively qualified in marine applications. The sensors are hermitically sealed in corrosion resistant alloy materials and are rated to 3000 meters underwater. The robust design coupled with pressure-balanced oil-filling technologies ensures that the **INTEGRICollar™** can reliably operate for many years without intervention.

The collar design accommodates a wide range of dimensional tolerances and surface finishes typical of riser pipes. The two collars are designed either to be retrofitted or welded to the structure by operators in dry areas. The displacement sensor modules are designed to be installable by divers.

SYSTEM CONFIGURATION

The **INTEGRICollar™** can be interface permanently to the Pulse standard **INTEGRIPod™** data logging pods for standalone or online recording operations. The **INTEGRICollar™** may be also connected to an ROV retrievable **INTEGRIPod™** using a wet mate ROV connection allowing the **INTEGRIPod™** to be removed and replaced whilst leaving the **INTEGRICollar™** connected to the structure.

INTEGRIPod™ LOGGER PODS

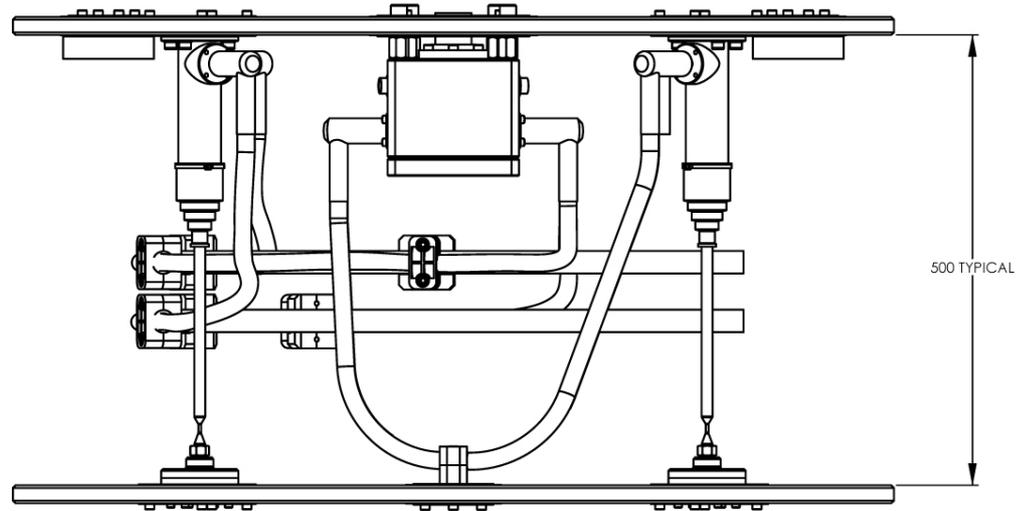
For battery-powered standalone monitoring applications, the standard **INTEGRIPod™** has 114mm OD and 600 to 900 mm length to accommodate the number of batteries required for a logger. For acoustically-linked battery-powered on-line monitoring applications, the standard **INTEGRIPod™** has 114mm OD and 1000 mm length. For hardwired on-line monitoring application, the standard **INTEGRIPod™** has 114mm OD and 450 mm length. No battery shall be used for this configuration.

MOUNTING METHODS

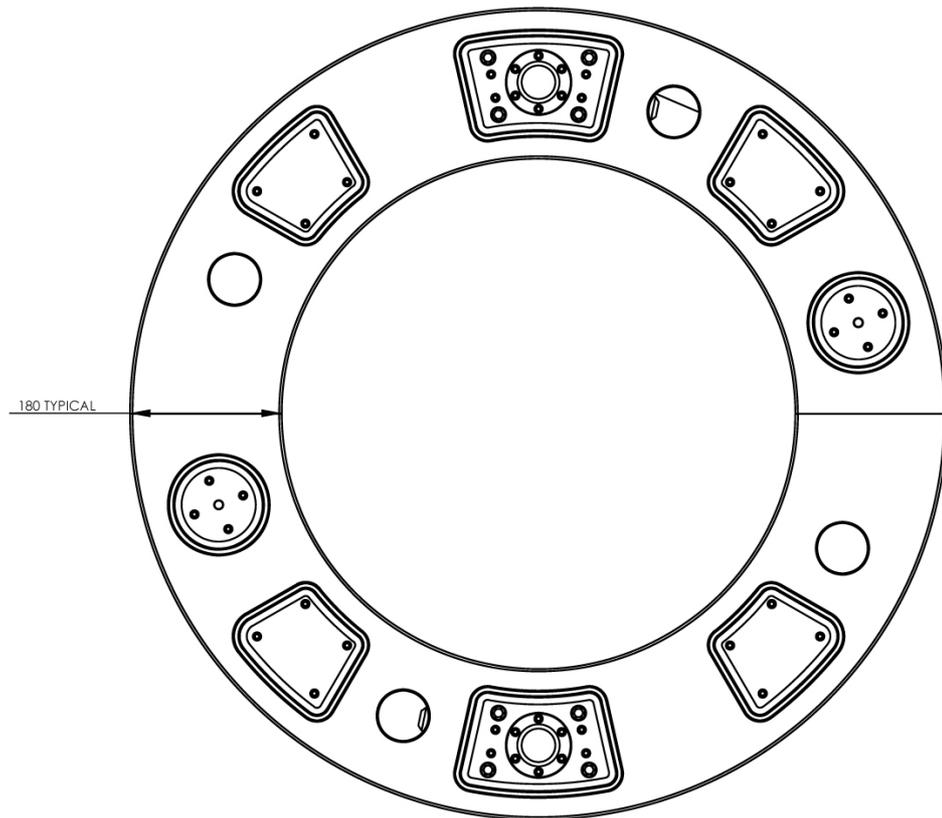
The two halves of the collars of the **INTEGRICollar™** can be clamped to the riser to anchor themselves to the structure pipe securely. The collars are made from corrosion resistant steel with cathodic protection or coating. The displacement sensor modules are fitted between the two collars. The collars may be also welded to the structure if it is allowed. Forged flanges or bossed collars may be also used if it is preferred. The data logger pods are mounted on the riser using various diver or ROV installable brackets.

SPECIFICATIONS

Collar internal diameter	To suit riser pipe outside diameters
Collar gap distance	1 m nominal
INTEGRIPod™ size	114 mm OD, various length
Strain measurement resolution	2 µstrain, typical
Strain measurement accuracy	5 µstrain, typical
Temperature range	-5°C to 70°C storage, 0°C to 35°C operation
Collar and pod weight	100 kg approx. in air
Design pressure	3000 meter water depth
Calibration certificates	Provided for calculating strain with temperature and external pressure correction



SIDE VIEW



TOP VIEW - OUT OF POSITION



London
 1-7 Cherry Street
 Surrey, GU21 6EE, UK
 Tel: +44 1483 774910

Aberdeen
 Tern Place House, Tern Place,
 Bridge of Don
 Aberdeen, AB23 8JX, UK
 Tel: +44 1224 452285

Houston
 16000 Barkers Point Lane, Suite 120,
 Houston, TX 77079, USA
 Tel: +1 713 422 2663

Kuala Lumpur
 Suite 16-3, 16th Floor, Wisma UOA II
 21 Jalan Panang 50450
 Kuala Lumpur, Malaysia
 Tel: +60 1 2328 312

Rio de Janeiro
 Praça Floriano, 19-22º andar,
 Centro, RJ, 20031-924, Brazil
 Tel: +55 21 2510 7323