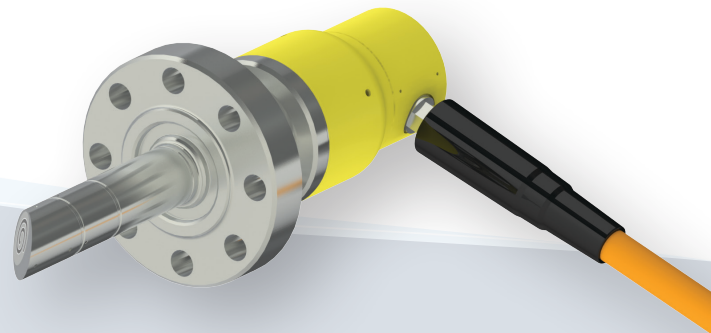


Erosion Sensor

Dependable and accurate measurement of metal loss through erosion within a high integrity mechanical package for subsea erosion monitoring – Utilizes patented CEION® technology

The sensors are rated to 15KSI at the maximum operating temperature. The design of the unit includes dual redundant penetrators between process fluid and seawater. The Erosion Sensor utilizes Teledyne Marine's proprietary CEION® technology to provide extremely high accuracy metal loss detection. This data is output in real-time in engineering units, simplifying system integration. The real-time nature of the metal loss data from this sensor provides operators with accurate information on the mechanical erosion occurring within subsea production equipment. This information will form an integral part of any Sand Management Strategy and provide more confidence to operators when running facilities at the maximum acceptable sand rate.

Information on total metal loss can also play a key part in operating risk reduction and reducing loss of containment incidents in subsea environments. In addition to the sensor hardware, Teledyne Cormon offers CFD analysis services to optimize the location of the sensor for maximum sensitivity to sand events.



*Erosion Sensor
Shown for illustration purposes only.*

PRODUCT FEATURES

- Very high resolution and fast response sensors to detect internal erosion derived from metal loss in subsea equipment
- Developed specifically for high pressure and high temperature environments in deep water applications with units deployed globally
- Optional pressure and temperature capsule can greatly increase the data available from the unit
- Real-time data available from instrument in engineering units, allowing proactive Sand Management Strategy
- Teledyne Marine can provide in-house turnkey systems including sensor, cable and interconnect, reducing procurement complexity, project risk and lead times



Erosion Sensor

Dependable and accurate measurement of metal loss through erosion within a high integrity mechanical package for subsea erosion monitoring

TECHNICAL SPECIFICATIONS

GENERAL SPECIFICATIONS	
Metal loss measurements	Erosion
Design life	>25 years
Design pressure	10KSI or 15KSI*
Hydrostatic test pressure	Design pressure x 1.5
Design temperature range**	-45 to 177°C
Ambient operating temperature	-20 to 70°C
Design depth	3000m
Hyperbaric test pressure	345bar
Paint options	Standard sensor is unpainted. Optional Norsok M-501 System 7B or 7C paint systems available.
Design codes and standards	API 6A / 17D, ASME IX, API 17F, NACE MR-0175, all metallic wetted material supplied with 3.1 traceable certification***
MECHANICAL SPECIFICATIONS	
Mechanical interface	API 6A 2 1/16
Seal groove	BX152
Approx weight in air	23kg (add 4 kg for 15K) (Probe weight only)
Flange material	10K: Duplex UNS S31803 with Inconel 625 UNS N06625 cladding in process wetted area 15K: Super Duplex UNS S32760 with Inconel 625 UNS N06625 cladding in process wetted area
Electronics Housing material	316L Stainless Steel
Jumper Interface	Omnitec Mk2
Primary & Secondary Penetrators	Glass-to-Metal, Inconel 625 (EB welded)
Probe Neck Material	Inconel 625
Termination Shell material	316L SS
Probe diameter	50mm (51.5mm With Optional PT)
Probe length	Selectable between 100 and 300mm (150 and 300mm With Optional PT)
ELECTRICAL SPECIFICATIONS	
Supply Voltage	24VDC (18V min, 30V max)
Current consumption	<50mA @24VDC
In-rush	<120% max operating current averaged over 500ms
Output signal	CANbus (CiA443, SIIIS Level 2) or Modbus (RS485)



*Erosion Sensor and Nautilus Jumper
Shown for illustration purposes only. Standard sensor
is supplied with Omnitec termination.*

CEION® MEASUREMENT	
Sensing element	Spark eroded spiral
Element material	Inconel 625
Element thickness	6mm angled; 8mm flush (Optional)****
Element life	5mm angled; 7mm flush (Optional)****
Resolution	45nm
PRESSURE MEASUREMENT (OPTIONAL)	
Sensing element	Piezoresistive silicon sensor
Measurement range	0 – 10KSI or 0 – 15KSI
Over-pressure	Max pressure x 1.5
Accuracy	+/- 0.1% CR
Drift	+/- 0.02% CR per annum @180°C
TEMPERATURE MEASUREMENT (OPTIONAL)	
Sensing element	Pt100
Calibrated temperature range	-40 to 180°C
Accuracy	+/-0.5C (-30°C to 130°C) +/-1.0° (<-30°C OR >130°C)
Drift	+/- 0.1% CR per annum

*Other non-standard options are available upon request, but may incur additional engineering charges.

** The design temperature range is limited by the penetrator qualified temperature range, the temperature de-rating of the flange material, and the ambient temperature reached by the electronics. The last two points will depend on the insulation thickness and can be assessed using computational analysis on a project-by-project basis if required.

*** Optional 3.2/3.2 intent traceable certification for process wetted and pressure retaining materials available.

**** Other custom element configurations and materials can be considered on request.

Erosion Sensor

Dependable and accurate measurement of metal loss through erosion within a high integrity mechanical package for subsea erosion monitoring

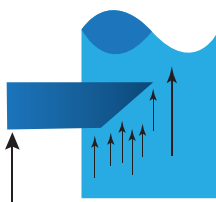
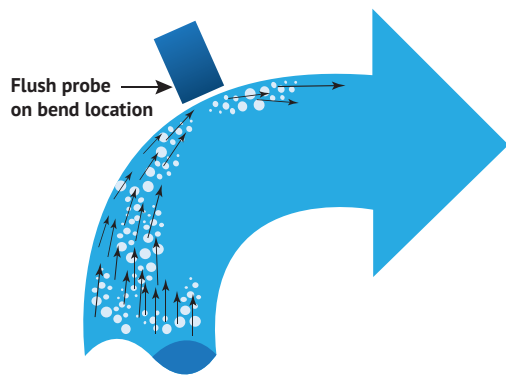
PRODUCT CONFIGURATIONS AND ORDERING DESCRIPTIONS

SAND EROSION (SE) SENSOR SERIES

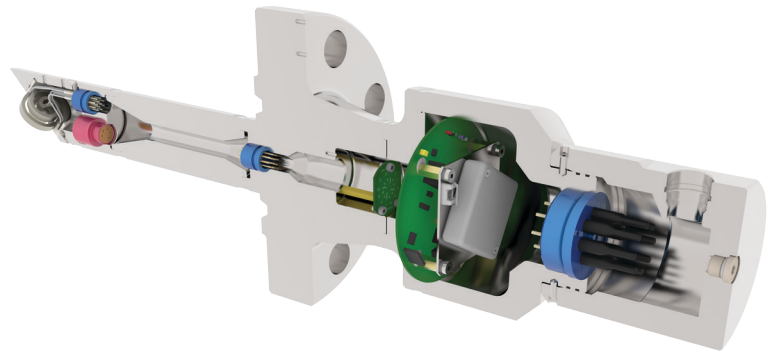
PRODUCT CODE	MAXIMUM PRESSURE RATING	OUTPUT
SE10-C	10kpsi	CANbus
SE10-M	10kpsi	Modbus
SE15-C	15kpsi	CANbus
SE15-M	15kpsi	Modbus

SAND EROSION PRESSURE WITH PRESSURE/TEMPERATURE SENSOR (SEPT) SERIES

PRODUCT CODE	MAXIMUM PRESSURE RATING	OUTPUT	PRESSURE ACCURACY
SEPT10-C1	10kpsi	CANbus	0.1% CR
SEPT10-M1	10kpsi	Modbus	0.1% CR
SEPT15-C1	15kpsi	CANbus	0.1% CR
SEPT15-M1	15kpsi	Modbus	0.1% CR



The illustration shows an angle head probe and a flush probe placement within a pipe section. Teledyne Cormon offers CFD analysis services to optimize the location of the sensor.



Erosion Sensor with optional pressure and temperature sensor pictured. For illustration only. Standard sensor is supplied with Omnitec termination.



TELEDYNE MARINE
Everywhereyoulook™

www.teledynemarine.com

1026 N. Williamson Boulevard, Daytona Beach, FL 32114 USA
Tel +1-386-236-0780 or 1-888-506-2326 • Fax +1-386-236-0906
Email: teledynemarine@teledyne.com