



## CEION® HIGH RESOLUTION METAL LOSS TECHNOLOGY







CEION® is the state-of-the-art metal loss technology. An advanced development of the original ER ratiometric method, the technique measures changes in current density due to material loss. When applied to a Sample and Reference array in the form of a probe or sensor the instrumentation provides a signal-conditioned, calibrated output.

The principal parameters of interest are metal loss and process temperature but advanced applications may include others related to localised effects and conductivity due to surface defects, inclusions, conductive deposits or solutions in contact with the electrically conductive path through the metallic sample.

In CEION®, precision electronics, inherent noise rejection and configurable, embedded, real-time compensation algorithms combine with sensors designed for micro-structural, thermodynamic and hydrostatic balance to deliver exceptional performance.

First introduced in 1999 the technology has been used to power a wide range of devices including, corrosion probes, sand erosion detectors and pipeline corrosion monitors. Applications on surface and subsea installations, refineries, petrochemical plants and in the laboratory are in service worldwide; including the Gulf of Mexico, West Africa, UK and Norwegian Continental Shelf, Australia, Middle East, North Africa, Latin America and Asia. Cormon is continuously developing new applications for the technology, often sponsored by end-users, targeted at solving specific industry problems.



-  Corrosion & Pitting Monitors
-  Sand Erosion Monitors
-  Pipeline Flow Assurance
-  Chemical Optimisation



## Application

Features of the technique permit a wide range of sensor configurations to deliver performance appropriate to the application, including very responsive sensors for the study of short term events and long life/severe service sensors to meet the demands of deepwater HP/HT production and aggressive process applications. Some typical applications include:

### Chemical Optimisation

Corrosion Inhibitors are widely used to protect carbon steel piping in hydrocarbon service and are a major operating expense for both upstream and downstream oil & gas operators. Optimising CI dosage under actual field conditions delivers significant bottom line benefit. CEION® systems for this purpose may be permanently installed or temporarily deployed by Applications Specialists from our Services Group. The exceptional speed of response allows great operational flexibility.

### General process management

Many processes have variables that require immediate response if they are to be kept within acceptable limits. CEION® may be used as a real-time alarm indicator for applications where metal loss will result from unacceptable process changes. Where data is less-time critical, but on-line servicing is difficult, CEION® may be used in long life, lower resolution configurations.

### Sand erosion applications

When formation sand or other solids are entrained in oil & gas streams they often have damaging erosive effects on both the reservoir and the process installations resulting in enormous costs due to lost production. The effects of entrained solids in a process flow may be reliably measured using CEION® technology. Continuous on-line monitoring can be installed to provide the data to understand and control the solids production.

### PTEC intrusive subsea probes

All of the above CEION® applications, together with temperature and pressure measurement, are delivered for subsea use in the PTEC product form. Typically placed on manifolds, wellhead jumper spools or the choke bridge of HP/HT deepwater installations, they deliver the technology in long life, high resolution packages tailored and qualified for very demanding conditions and extended, maintenance free service. Custom solutions for other demanding applications can be derived from these designs.

### RPCM™ subsea and surface pipeline spools

RPCM™ (Ring Pair Corrosion Monitor) is the unique application vehicle for CEION® in pipeline monitoring for both surface and subsea. In addition to corrosion and temperature, this versatile tool can be configured to meet many flow assurance data requirements including fast response to changes in pipeline parameters. The piggable sensor gives 360° coverage and permits a range of materials and response speeds in one device.



## Understanding CEION® performance

The 'performance' of a measurement system is dependent upon three variables: the metal loss rate\*, the thickness of the sensor element and the raw resolution\*\* of the measuring electronics. CEION® has market leading raw resolution and will provide superior performance for any combination of the other two variables.

For any given metal loss rate a considerably shorter time is needed for a CEION® sensor to detect a change than for standard ER measurements. The value of this faster detection lies in the ability to respond more quickly to increases in the metal loss rate which can reduce the total metal lost and thereby extend asset life. It is also highly likely that the fast resolution will reveal a level of detail that is not evident in data from less responsive equipment. This extra insight is of special value in activities like sand erosion monitoring and corrosion inhibitor evaluation.

There are applications where it is not possible or useful to act quickly when the metal loss rate changes. In such cases the value of CEION® lies in the extended life of the sensor. For example, a 320 mil (8mm) thick CEION® probe will last at least 15 times longer than a 20 mil (0.1mm) thick ER probe at the same metal loss rate and still give a much better response time in hours. Taking the life time cost of the extra replacements and the added costs of the purchase and installation process, which may far exceed to sensor price, it is easy to see the value CEION®.

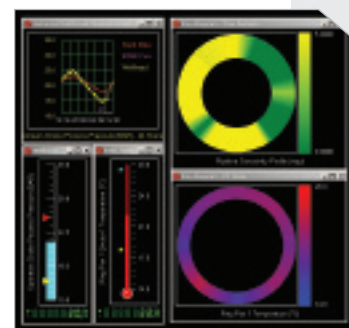
There are also applications where extended service life is essential; probes in subsea or nuclear installations for example. Conventional ER sensors do not give useable results when element configurations exceed 2mm. When target service life exceeds of 20 to 50 years CEION® is the only viable technology because it provides useable resolution with thick element sensors.

In order to make a basic comparison we have selected a metal loss rate of 4 mils per year (0.1 mm per year) for the table below. This is a level commonly found in carbon steel hydrocarbon systems under normal operating conditions. Higher metal loss rates mean faster responses but it is important to measure quickly and accurately at normal operating metal loss rates so that process changes are detected immediately.

Element Thickness	CEION®		ER	
	Raw resolution as % of element thickness	Time to detect change at 4 mils per year (0.1 mmpy)	Raw resolution as % of element thickness	Time to detect change at 4 mils per year (0.1 mmpy)
20 mils (0.5mm)	0.0006%	0.26 hours	0.1%	43.8 hours
40 mils (1mm)	0.0004%	0.35 hours	0.1%	87.6 hours
80 mils (2mm)	0.00025%	0.44 hours	0.1%	175 hours
160 mils (4 mm)	0.00045%	1.58 hours	n/a	Not in range
320 mils (8mm)	0.00056%	3.04 hours	n/a	Not in range

\*may be caused by corrosion, erosion or combined effect.

\*\*It is important to recognise the difference between raw (single measurement) resolution and apparent (processed multiple measurement) resolution. The above figures are based on raw resolution. Apparent resolution, sometimes used by other manufacturers, may appear to be 5 to 10 times better but the same technique could equally be applied to CEION® data with the same apparent improvement in performance.



## Application support for CEION®

CEION® is both extremely capable and relevant to a very wide range of applications. In order to assist clients to obtain the full value of the technology Cormon offers project relevant support through its group structure. The Flow Assurance and Optimisation Group (FAO) provide a high-level, turnkey service for optimised implementation of CEION® solutions. Field Services Group provides applications specialists and related operational support for CEION® on system installations and optimisation campaigns. Products Group delivers CEION® equipment packages and related accessories to end-users. All three groups service clients world-wide through a Regional Office network.

## Products

Basic CEION® packages comprise an intrusive sensor, an instrument, a means of access to the process, often under pressure, and some data handling software. PTEC probes and some other specialised designs integrate the sensor and electronics into a single unit, while RPCM™ units are project specific spool and instrument pod combinations. More detailed product data can be found in the following datasheets:

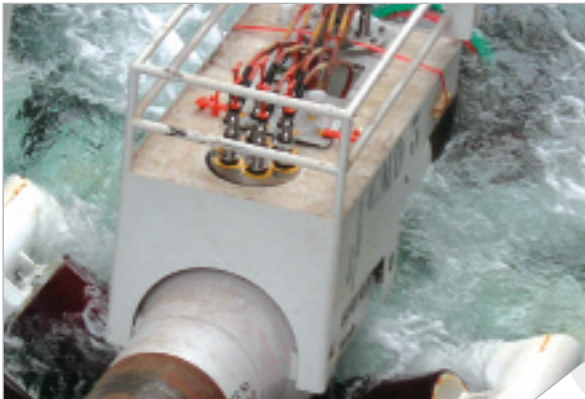
CMEI 021 – CEION® Instrumentation

CMEP 023 – CEION® Probes

CMEP 026 - Sand Erosion Measurement

CMEP 024 – PTEC subsea probes

GL 016 – Subsea flow assurance monitoring tools (RPCM™).



Cormon Ltd  
Unit 3, Robell Building  
Chartwell Road, Lancing Business Park  
Lancing, West Sussex BN15 8TU  
United Kingdom

Tel: +44 (0) 1903 854800  
Fax: +44 (0) 1903 854854  
Email: [sales@cormon.com](mailto:sales@cormon.com)

[www.cormon.com](http://www.cormon.com)

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