

ULTRASONIC INTELLIGENT SENSORS

# ClampOn DSP Leak Monitor

DIGITAL SIGNAL PROCESSING



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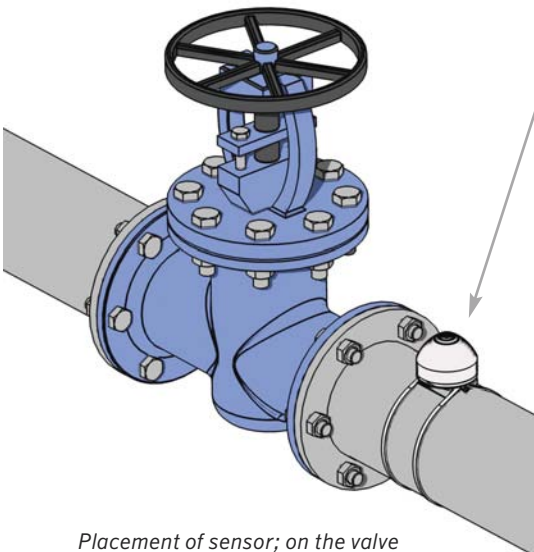
The ClampOn DSP Leak Monitor detects small and medium leaks or flow-throughs, even with low differential pressure over the measuring point on pipes and valves. The ClampOn DSP Leak Monitor has been developed with the aim of offering a product that can quantify a leak through a closed valve. The ClampOn DSP Leak Monitor is qualified as a subsea and topside monitor.

## Leaks

A leak in an oil or gas flow line is a highly dangerous situation – upstream as well as downstream, so it is extremely important for the operator to be warned about any leak immediately should it occur. A leak in a flow line, valve, flange or any other component can compromise safety and may also lead to a shutdown at the production stage or down-stream at a refinery or terminal. A product leak normally has a very low flow-rate, which is determined by the size of the defect, the properties of the fluid and the pressure differential. There are a number of advantages in using the DSP Leak Monitor to monitor valves:

- Reduced loss to flare
- Gas leak to the sea
- Reduced loss to the atmosphere
- Reduced process loss
- Maintenance planning.

The ClampOn DSP Leak Monitor helps operators identify and quantify sources of gas/liquid leakages, thus enabling them to take appropriate action. Customers have successfully used the ClampOn Leak Monitor to identify cross-flow in valves connected to the manifold.



Placement of sensor; on the valve itself or as close as possible on the pipe.



## Principle of operation

The basic theory is that a leak creates a very high-frequency noise that can be monitored by an ultrasonic sensor. In a «non-leak» situation the ultrasonic pattern will be stable, but when a leak occurs the signature will change drastically. ClampOn's DSP technology distinguishes and eliminates background noise unrelated to leakages so that the hiss from the leaks can warn the operator. The system also includes a program or database that helps to monitor and indicate the volume of the leak.

The ClampOn DSP Leak Monitor is the result of a joint venture project involving several participants in the petroleum industry.

The ClampOn DSP Leak Monitor is designed to be installed at critical points such as valves, flanges, joints, etc., and can monitor very small leakages. A pressure differential of as little as 1 bar can be monitored in gases, and 3 bar in liquids.

## The sensor

The ClampOn DSP Leak Monitor, based on our patented Ultrasonic Intelligent Sensor technology, is available in topside and subsea versions. The sensor is a compact and user-friendly unit, more so than other instruments on the market. It is easier to install in the field and easier to transfer to a new location.

The sensor is constructed of stainless steel for topside units and titanium for subsea units, and is clamped to the location (valve, flange or pipe) to be monitored. The topside units are certified to EEx ia IIB, or EEx d IIC, pipe wall temperatures from -40 to +225 °C (437 °F). An unlimited number of sensors can be connected to a single computer for real-time measurements. The sensors transmit an ASCII signal to the control computer.

### Data processing

The signal from the sensors can be interfaced directly with any type of Main Control System, and can even communicate as a ModBus Slave with any ModBus Master unit.

### ClampOn Automation Controller

Ownership is essential when implementing a monitoring system. At ClampOn we want to ensure that someone knows how your system works and is able to maintain its performance throughout its lifetime. We feel a responsibility not only to keep the equipment running smoothly, but to continue to develop new features that can increase the value of the systems we have delivered. Including a ClampOn controller in your system can help you achieve maximum system performance while keeping commissioning and maintenance costs at a minimum.

### Tiny and robust, with low power consumption

ClampOn programmable automation controllers (PAC) combine the small form factor, reliability and ruggedness of a controller with the flexible and user-friendly client interface known from our software for other platforms. A single controller can handle up to 250 ultrasonic sensors and is simple to control remotely via a network (Network interface with embedded FTP, WEB, Modbus and ClampOn servers). The controller can easily be expanded with hot-swappable IO modules (4-20 mA, relay, CANbus, Profibus etc.); it runs on 24 VDC (6W) and can be mounted on a DIN-rail. The



*Peak performers always select the very best instruments.*

PACs come with sufficient solid-state memory (up to 2GB). However, if long-term data logging is required the controller can be equipped with Compact-Flash, or an external hard drive can be connected to its USB interface.

If a dedicated computer is required, ClampOn can supply a PC equipped with our specialised software running under Microsoft Windows™. The computer is installed in a safe area and enables the operator to monitor the leak in real time, as well as generating reports from one or more sensors.

### Field lamp & reset button

Topside sensors can be supplied with an indicator lamp that lights up when a leak occurs, as well as a button to reset the sensor.

### Cabling

ClampOn sensors use twisted-pair cabling for power and signal transmission. All cables can be supplied and terminated by ClampOn.

### ClampOn subsea systems

All ClampOn systems incorporate what we call «Passive Ultrasonic Intelligent Sensors». For the user, this simply means that our technology measures, in real time, leakages in a flow line, valve, flange etc. by using acoustics. All ClampOn sensors are «intelligent» (patented), and provide digital or analogue communication with any subsea control system. Two subsea versions are available depending on required water depth. The system consists of the sensor, funnel with clamp and cable with subsea connector.

# Product Specifications

## LEAK MONITOR

Principle of operation	Passive acoustic, intelligent sensor
Minimum detectable leakage	Gas: dP>1 bar, min. leakage rate 0.1 l/min Liquid: dP>3 bar, min. leakage rate 0.1 l/min (depending on delta pressure [dP] over the leakage point)
Repeatability	1%
Method of installation	Clamped to pipe surface, non-intrusive
Sensor electronics	Intelligent DSP electronics with signal processing
Interface options	All sensors can be supplied with: Digital RS485 (ASCII, binary, ModBus RTU), 4-20mA (active/passive), Relay (Other options on request).
Options for ATEX approved sensors	local light/reset
Options for subsea sensors	CANBus, Profibus
Two-way communication	Yes
Software upgrading	Yes
Pipe Surface Temperature	-40 to 225 °C (-40 to 437 °F)
High temperature fixture	Yes – up to 500 °C
Flow regimes	Oil, gas, water, multiphase

## TOPSIDE

ATEX	⊕ II 1G EEx ia IIB T2-T5, Zone 0 ⊕ II 2G EEx de/dem IIC T5, Zone 1
CSA C&US	Ex ia IIB T5, Class I Division 1 Group C, D, Zone 0
GOST-R / GGTN	2 Ex de IIC T5, Zone 1
INMETRO	BR-Ex ia IIB T2-T5, Zone 0 BR-Ex de/dem IIC T5, Zone 1
Ingress protection	IP68
Housing material	316 Stainless Steel
Dimensions / Weight	Ex ia Model: ø80 x 105mm (ø3.1" x 4.1") / 2.6 kg (5.7 lbs) Ex d Model: ø101 x 211mm (ø4.1" x 8.7") / 7.2 kg (15.9 lbs)
Cable interface	Cable with connector / Flying lead / Gland for cable access
Power / Safety Barriers	Ex ia: ClampOn IS power barrier, IS approved signal barriers Ex de/dem: Power 12-36VDC. No IS barriers for signal or power
Power Consumption	Typical 1,5 Watt, max. 2 Watt per sensor
Cabling	Minimum 4x 0.75 mm <sup>2</sup> (pending system configuration)
Safe Area Equipment	Portable / fixed (19") power module with IS barriers
Mains power supply	12 VDC / 24 VDC / 100-240 VAC 50-60 Hz
Computer for ClampOn™ software	Minimum requirements: Pentium III, 512 MB RAM. Windows™ XP/Vista/2000-2008
Signal interface to Client system (typical)	RS232 / RS485 / Relay / ModBus / TCP I/P – Optional 4-20mA / Relay

## SUBSEA

	COMPACT	DEEPWATER
Water depth	3000m	4500m
Design pressure barA	333 (4830 psi)	675 (9790 psi)
Housing material	Titanium	Titanium
Dimensions excl. ROV handle	ø90 x 325mm (ø3.5" x 12.8")	ø150 x 360mm (ø5.9" x 14.2")
Dry weight, kg (lbs)	5.2 (11.5)	18 (39.7)
Pipe Surface Temperature	-40 to 225 °C (-40 to 437 °F)	-40 to 225 °C (-40 to 437 °F)
Hose/jumper interface	Bennex / ODI / Tronic	Bennex / ODI / Tronic
Redundant electronics	Yes	Yes
ROV installation/retrieval	Yes	Yes
Retrofit clamp/funnel	Yes	No
Power Supply	12-28VDC	12-28VDC
Current draw	Approx. 60mA @ 24VDC	Approx. 70mA @ 24VDC
Design Lifetime (MTBF)	220 000 hours (25 years)	220 000 hours





*Subsea Basket with battery and data logger.*

## Custom solutions

For many years, ClampOn's highly skilled engineering department has been developing and building custom subsea systems that have since become part of our standard product range.

### ClampOn Ultrasonic Intelligent Sensor

- Non-intrusive
- Digital Signal Processing (DSP)
- Complete digitalisation
- No analogue filters, circuits or amplifiers
- Two-way communication
- Real-time measurement
- Easy to relocate
- Contains no moving parts
- Can be mounted in hostile environments
- Incorporates sensitive, intelligent, intrinsically safe sensors
- Can be upgraded by software download
- Can store up to 60 days of measurement data within the sensor itself
- Self-testing capabilities
- Built-in temperature sensor and accelerometer (optional)
- User-friendly software for Windows™ 2000/2003/XP/NT4

*ROV operable retrofit solution for large pipe dimensions.*



Since 1995, ClampOn has supplied thousands of «Ultrasonic Intelligent Sensors» to oil and gas companies all over the world, which have benefited from the use of our systems and found them extremely satisfactory. Our systems are preferred to the alternatives because of their repeatability, accuracy and robustness, and our company's expertise in this field. Continuous technology development and personnel training have made ClampOn the winner of all field and laboratory tests in which we have participated, a position we are determined to maintain in the future.

The latest developments offer operators a future-oriented solution, in which the system can be upgraded simply by downloading new software.

# ClampOn - the leader in sand, pig and corrosion-erosion monitoring

ClampOn has since the beginning in 1995 grown to be the largest supplier of passive ultrasonic systems for sand/particle monitoring to the international oil and gas sector. All products supplied by ClampOn, particle monitor, pig detector, corrosion-erosion monitor and leak monitor are based on the same, well proven technology platform. Both the topside and the subsea instruments incorporate Digital Signal Processing (DSP), complete digitalization eliminating analogue filters, circuits and amplifiers.



The ClampOn Ultrasonic Intelligent Sensor processes all data in the sensor itself (patented principle), thus enabling the instrument to discriminate between sand-generated and flow-generated noise. This is of importance to the user since changes in flow rates and the gas/oil ratio will not affect the performance of the system.

A good signal to noise (s/n) ratio is vital for quality measurements of this sort, and ClampOn's sensors are the very best in this respect. With the new version, the external noise has been completely eliminated.

## Subsea Sensors

The subsea sensors were developed in close collaboration with Shell Deepwater Development Inc. in Houston and FMC Energy Systems in Norway. The successful outcome of the project was a sand monitoring system that combined an extremely long wor-

king life with excellent acoustic properties, offering reliability in the high pressure deepwater environment. ClampOn has since 1998 supplied approximately 1000 subsea sensors to the oil and gas industry. The subsea monitors have been under a continuous development in order to optimize quality and performance, and to meet the requirements in the market.

## ClampOn DSP Corrosion-Erosion Monitor (CEM)

The CEM is monitoring any changes in wall thickness. Two to eight transducers are mounted on the pipe surface (or other metal plate structure) and connected to a ClampOn control unit. The control unit will continuously send and receive guided waves between the transducers, resulting in a network of measurement paths that cover the selected area.

The working principle of the instrument

is based on transmitting ultrasonic signals that propagate through the pipe material. The transmitted signal is received by a sensor and is analyzed using advanced data processing schemes.

## ClampOn SandQ™ & ClampOn DSP-06 Particle Monitor

All sensors are exactly alike and interchangeable, an advantage if sensors should be moved/relocated or in case of service.

The DSP's increase in processing capacity enables the sensor to combine signals from several frequency ranges when analysing the flow. The ClampOn sensors are versatile, and are the only instruments on the market offering two-way communication between sensor and control system. This solution enables future upgrade of the sensor via a simple download of new software. When using digital output from the sensors, they can be installed in a «multi-drop» system.



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