

ULTRASONIC INTELLIGENT SENSORS

# ClampOn SandQ™ Monitor

DIGITAL SIGNAL PROCESSING



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ClampOn, the number one choice in sand monitoring systems, has added a new sensor to the ClampOn family: The patented SandQ™ sensor enables users to measure the amount of particles directly by the sensor itself. This means that no flow input from the operator is required, resulting in a dramatic reduction in field calibration costs. The sensor does not need to be calibrated after leaving ClampOn.

The SandQ™ – Quantifier – has been designed and tested over several years in collaboration with a number of industrial companies. The possibility of measuring the amount of particles without having flow data available has been requested by the market for years. Now the ClampOn SandQ™ will provide operators focusing on sand management with even more important information that was previously unavailable.

Yet again, ClampOn is in the driver's seat with this launch of a newly developed system for solving sand management issues. The SandQ™ has already been thoroughly tested in several offshore installations, with very encouraging results.

The revolutionary new patented ClampOn SandQ™ sensor is designed for installation after a bend, where the turbulent flow profile is fully developed. The ClampOn SandQ™ shares the same interfaces and communication protocols as the existing DSP Particle Monitor. This means that all existing clients who already use ClampOn instruments can fully utilize the new invention without having to reprogramme software or make hardware changes – it is simply a quick swap. The SandQ™ is intrinsically safe, and carries EEx ia IIB approval. ClampOn is well known in the upstream oil and gas sector, and the company has been the leader in providing sand, particle and pig monitoring systems to the offshore industry for many years.

## What advantages does the SandQ™ offer?

Sand production in oil and gas wells is a serious issue faced by oil and gas producers. The challenge is not merely to avoid sand production, but also to optimize well productivity, as even small quantities of particles in the well flow can cause significant damage. An operator is interested in maximum production and profit, no matter what technology is used. Operators all over the world have made ClampOn their preferred supplier of

sand monitoring systems, due to the company's patented technology for sand monitoring and sand production management. The ClampOn SandQ™ incorporates a new filtering technique combined with flow monitoring capabilities that makes the instrument an extremely useful tool for analyzing the true nature of sand production, helping to control it, and finally, maximizing the profit from the well!

## High-capacity digital signal processing – the way ahead

The SandQ™ features complete digitalization, keeping the amount of analogue filters, circuits and amplifiers to a minimum. The patented technology incorporates a powerful signal processing unit, running feature-packed, modular software. The sensor operates in several ultrasonic frequency ranges simultaneously, allowing the implementation of a host of new signal processing features. Different types of noise-generating chokes and flow conditions are analyzed and coped with via the advanced processing and filtering techniques of SandQ™. Accuracy and repeatability have been improved from earlier systems. These are important factors in quantifying sand production and makes SandQ™ a crucial tool in your daily sand management operation.

No other technology comes close to what ClampOn SandQ™ offers in terms of production optimization and profitability!

## Principle of operation

The ClampOn SandQ™ monitor is based on ClampOn's «Ultrasonic Intelligent Sensor» technology. The sensor is installed a few pipe diameters after a bend, where the flow is turbulent and particles will impact the inside wall of the pipe, generating ultrasonic pulses. Flow information is obtained from the measured acoustic spectra of the signals transmitted through the pipe wall. The signals are processed internally by a DSP

engine before results are sent to a computer or control system (no Calculating Interface Unit required). Here, the user can evaluate sand data in real time and make the decisions needed for optimized production.

The SandQ™ is delivered fully calibrated and there is no need for special calibration to operate this unit – simply clamp it on to the pipe wall.

## ClampOn Sand Management

When sand is being produced from a reservoir it lowers the production rate and increases maintenance costs; it also represents a serious hazard to its surroundings. Produced sand can never be ignored and any well producing from a sandstone reservoir needs to have some sort of sand monitoring system in place, preferably a real-time sand monitoring system.

In many cases a well is being produced in a conservative manner, at a safe distance below the blue line (ref. Figure 1) in an attempt to ensure that sand is never produced. This is a safe but expensive way of managing sand. A more active sand management plan can significantly improve your production statistics. Above the red line (ref. Figure 1) continuous sand production is likely, something that should be avoided. The potential for safe increased production and improved earnings lies in the area between the blue and red lines.

There are three main factors when performing sand management – the key words are prediction, handling and measurement!

- Prediction helps the operator to understand how to produce the well and to manage the sand issues. Sand prediction tools (based on i.e. geological and reservoir data) are also useful when designing the facility in order to ensure that it is prepared for the sand being produced and when planning the sand management strategy.

- Sand handling; produced sand will enter the process system and the operator needs to ensure that it is capable of hand-

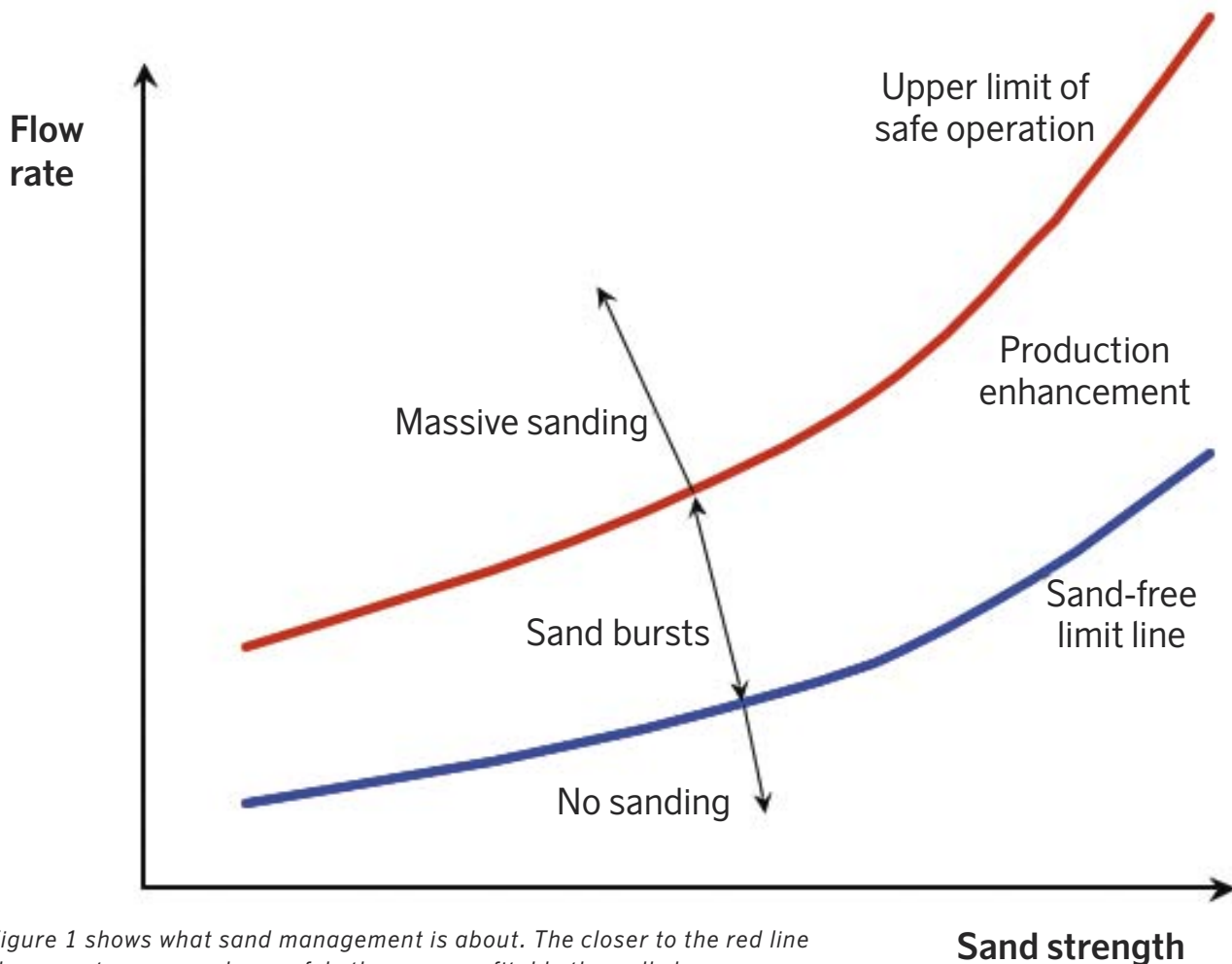


Figure 1 shows what sand management is about. The closer to the red line the operator can produce safely the more profitable the wells become.

ling the sand safely. An important aspect of sand management is reviewing erosion rates and removal issues.

- Measurement is a cornerstone of a sand management system. When the prediction and handling issues have been carefully considered, including an understanding of erosion risk and sand removal challenges, a reliable method of measurement is required to ensure that the design criteria are met and not exceeded. This is where the ClampOn Monitor comes in. The sensor's superb sensitivity, filtering mechanism and patented solutions for real-time monitoring combine to make it the best tool available to maintain a profitable and safe sand management program.

ClampOn has been working on the problem of sand production for more than a decade, helping customers all over the world to measure and predict it. Our experience of thousands of wells

has given ClampOn unique practical knowledge of how sand production will appear and how it can be measured and dealt with. Over the years ClampOn has had the pleasure of working with many of the best service and research companies involved in sand management. By combining our knowledge obtained from field experience with the ClampOn Monitor, and the high level of competence of our partners we are able to offer a unique product. Even for an organization with a high level of expertise, the opportunity to obtain assistance from the world leaders in sand management by making one phone call is invaluable.

### ClampOn - the leader in sand monitoring

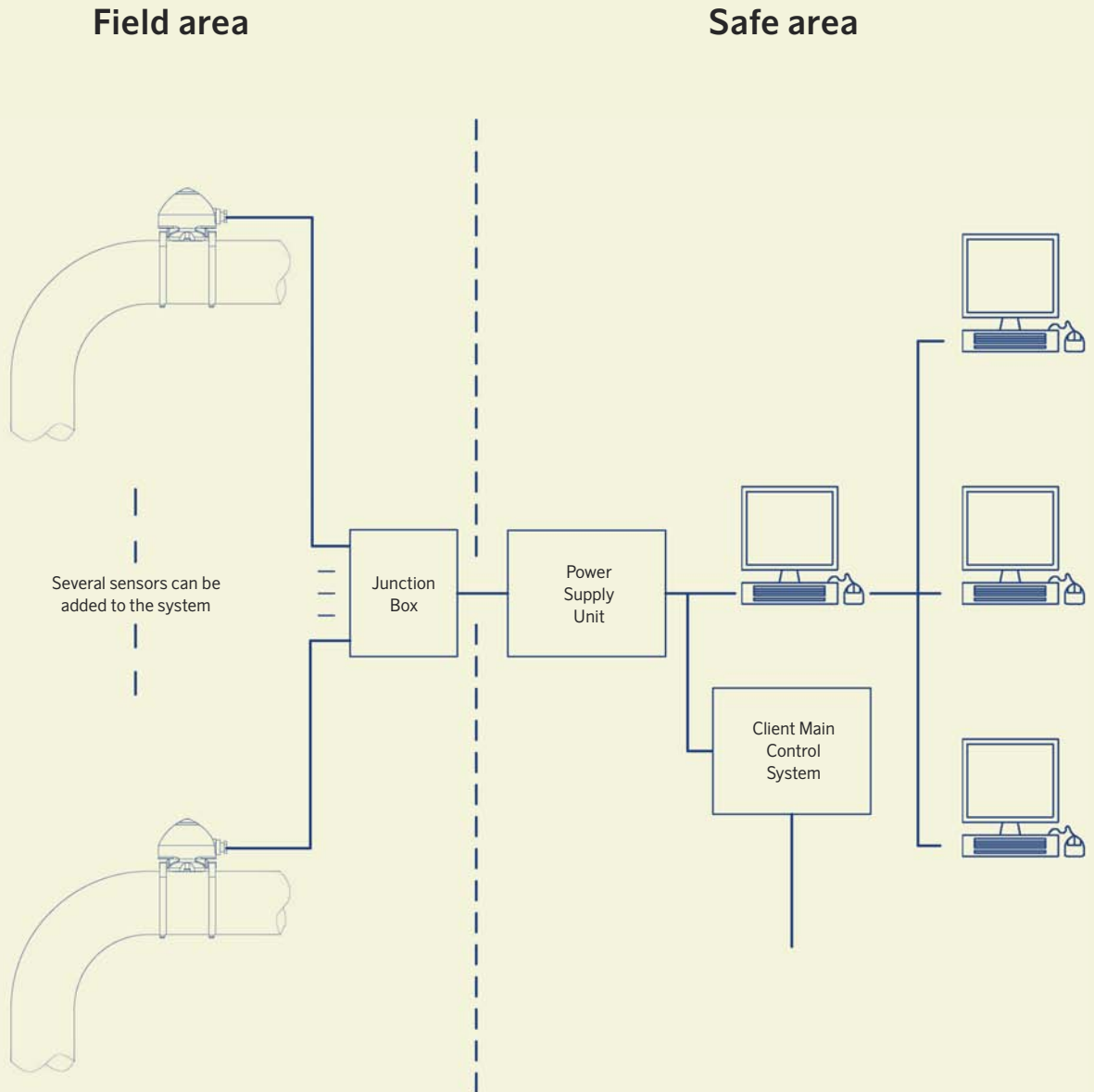
To date (September 2007), ClampOn has delivered more than 6000 topside and

subsea Particle Monitoring Systems to operators all over the world. Shell Brent, Woodside Australia and others have installed more than one hundred sensors for production optimization and elimination of erosion damage. Our system is preferred to the alternatives because of its repeatability, accuracy, s/n ratio (ability to discriminate noise), robustness and our company's expertise in this field.

Continuous technology development and personnel training have made ClampOn the winner of all the field and laboratory tests in which we have participated, a position we are determined to hold on to in the future!

The SandQ™ model offers operators a major step towards improving earnings wherever sand is a problem. If you are interested in increased profits, ClampOn's SandQ™ is your number ONE choice!

# System layout



*Typical sensor layout with sensors and junction box connected through a power supply unit to dedicated computer(s) and/or client control system.*



**SandQ™ – your sand quantifier!**

# Product specifications

## SandQ™ MONITOR

Principle of operation	Passive/active acoustics, intelligent sensor
Minimum particle size:	Depends on flow velocity and conditions. Typical sizes are: Oil/water: 25 microns / 1PPM Air/gas: 15 microns / 1 PPM
Minimum sand rate	0,01 g/s
Uncertainty:	±5% (with calibration by means of sand injections)
Repeatability	Better than 1%
Flow: Velocity	0.5 – 20 m/s
Flow: Accuracy	±15%
Flow: Min Pressure	30 BarA – Contact Manufacture for more details
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).
Two-way communication	Yes
Software upgrading	Yes
Pipe Surface Temperature	-40 to 160 °C (-40 to 320 °F)
High temperature fixture	Contact Manufacture for more detail
Flow regimes	Oil, gas, water, multiphase
Diagnostic features	Intelligent health-test of electronic hardware

## COMPUTER

Minimum hardware	Pentium III (or equivalent) with 512 MB RAM
Software requirements for ClampOn's software	Windows™ 2000/2003/XP/NT 4
Input	Serial, Modbus, ethernet, OPC
Signal output	Serial, Modbus, ethernet, 4-20mA, Relay, Client Server

## SAFE AREA EQUIPMENT

Mains power supply	12 - 48 VDC or 100-240 VAC 50-60 Hz
Power Consumption	Max 2,1 W per sensor + computer rack module Signal and power barriers and converters supplied for DIN-rail mounting, in portable enclosure or for 19" rack mounting.

## TOPSIDE PARTICLE

Ingress protection	EEx ia IP68
Housing material	316 Stainless Steel
Dimensions / Weight	ø110 x 105
Cable interface	M20 cable access
Power / Safety Barriers	ClampOn IS power barrier, IS approved signal barriers.
Power Consumption	Typical 1,5 Watt, max. 2,1 Watt per sensor
Cabling	Minimum 4x 0.75 mm <sup>2</sup> (pending system configuration)

## INTRINSICALLY SAFE (IS) APPROVAL

ATEX	EEx ia IIB T2-T5 II1G Zone 0
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