

ClampOn Sand Monitoring

DIGITAL SIGNAL PROCESSING

Particle Monitoring

Any owner or operator of a factory would surely like to operate it as efficiently and profitably as possible. An oil or gas well can be regarded as a factory, and the ClampOn Particle Monitor gives operators the best tool for maximizing profits. ClampOn's DSP (Digital Signal Processing) systems operate on thousands of wells every year, and the company is the world's largest supplier of sand monitoring systems. ClampOn is the natural choice for sand monitoring and sand management programs.



ClampOn Topside Particle Monitor

Ever since 1995, ClampOn has been delivering ultrasonic sand monitoring systems to the oil and gas industry, making the company the clear leader since its introduction. The high quality and superior performance of our instruments, combined with the ability to give first-class service and support to our customers has made us the supplier of choice for operators, a position we are determined to retain in the future.

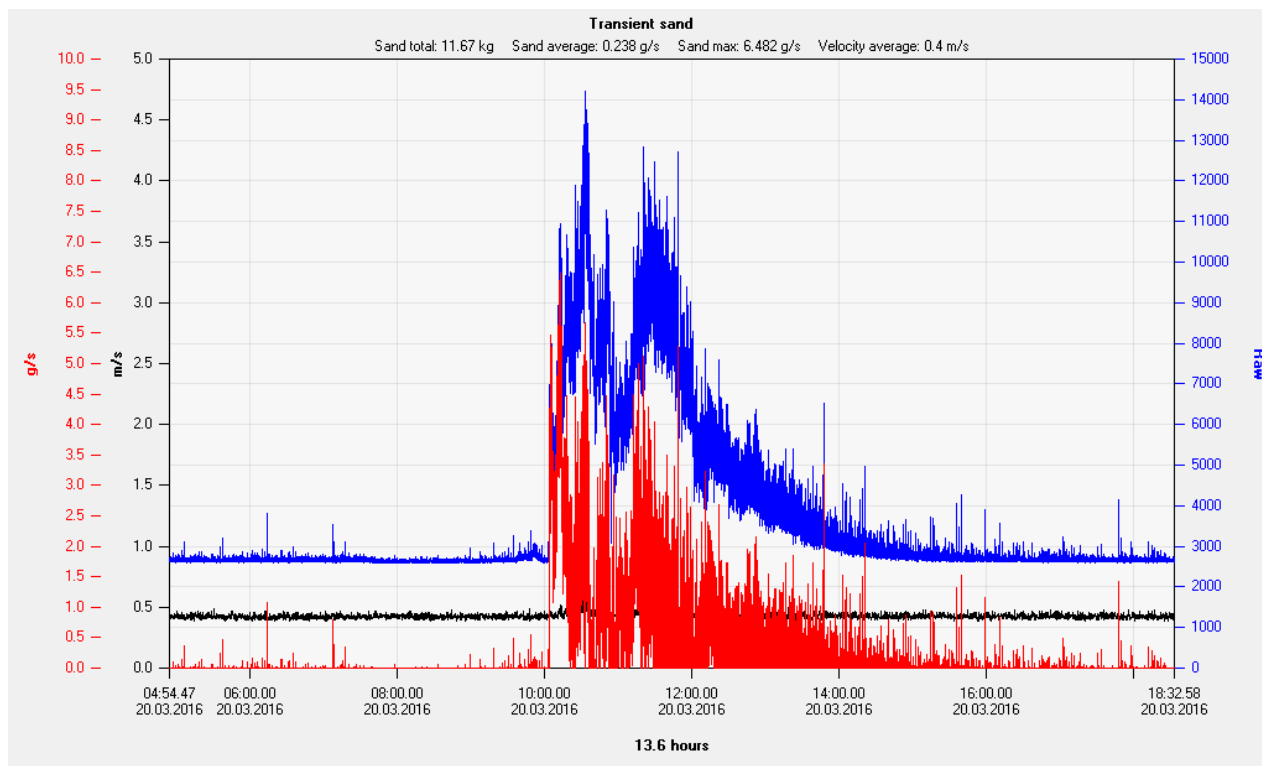
The sand monitor from ClampOn has been developed to help oil and gas producers minimize their problems with produced sand from unconsolidated formations; in other words, it is a profit generator designed to detect particles in a flowing medium inside a pipe and provide real-time sand data to the operator. The DSP instrument includes a unique sound-filtering technique that has been field-tested and proven for more than two decades, and represents a major step in optimizing oil and gas production and increasing earnings.



ClampOn Subsea Particle Monitor

Why sand monitoring?

Sand monitoring is important, not only for profitability, but also for safety. If not controlled, sand can compromise wells, fill up pipes, damage reservoirs, cause unnecessary wear on equipment, cause erosion, and there could be serious incidents. We have the capability to run 24/7 monitoring of high-risk (and low-risk) well operations, and often send service engineers out in the field for on-site monitoring if we do not have remote access to data. ClampOn's ultrasonic instruments can help operators achieve their zero emission goal.



The black plot shows velocity in metres per second, and we can see that it doesn't change. The blue plot shows the raw value, while the red shows the calculated sand rate. In the graph, we can see that an apparently sand-free well suddenly begins producing quite a lot of sand over a four-hour period. This is quite normal for many wells and shows how difficult it is to perform sand measurement using sampling or methods that are not in real time

A common problem in sand monitoring is interference from signals generated by sources other than particles, such as noise from liquid/gas mixtures, droplets in high-velocity gas wells, mechanical/structural noise and choke noise, and electrical interference.

A good signal-to-noise (s/n) ratio is vital for high-quality measurement and the ClampOn sensor provides operators with absolutely the best s/n ratio on the market. The ClampOn system's s/n ratio is also very important for an efficient field installation, due to its low calibration costs.

ClampOn's technology enables the sensor to filter background noise so that the pattern of sound made by the sand particles is illustrated clearly in the software.



How to determine the maximum sand-free production level of an oil or gas well

All too often, we meet operators who are worried because they are not fully aware of the nature of sand production, so they reduce production unnecessarily. Usually, the operator chokes back production immediately when sand is present (or when he believes sand is present). A cutback in production in the range of 20% to 75% is fairly common in oil and gas wells. To improve sand detection, it is vital to have a system that responds rapidly and accurately. The superior quality and reliability of ClampOn technology is the logical way to raise production, thanks to the essential data the instrument gives the operator. Bearing in mind the values that can be lost due to excessive sand production, investment in ClampOn sand monitoring systems soon repays itself. By using a reliable sand monitoring system, the operator can monitor the development of sand production and produce at optimised and safe levels.

To achieve effective and safe sand-free (or tolerable) production rates, the operator needs the best monitoring equipment that is available; ClampOn offers not only this, but years of experience from thousands of wells!

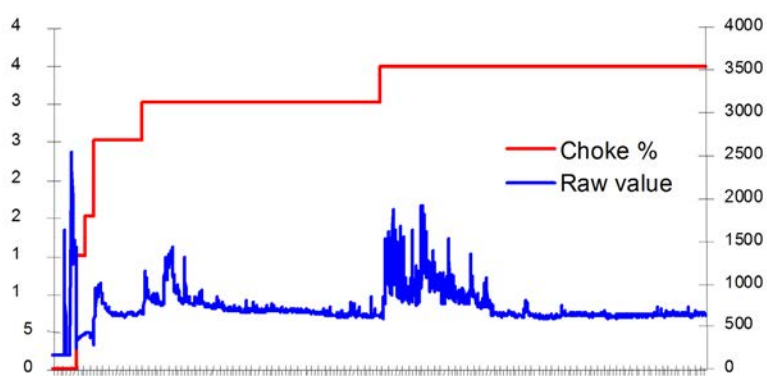


Illustration of sand production when chocking up production

Working Principle

The ClampOn DSP Particle Monitor is based on the ClampOn “Ultrasonic Intelligent Sensor” technology. The instrument is installed on or immediately after a 90 degree bend, where the particles and solids impact the inside of the pipe wall, generating an ultrasonic pulse. The ultrasonic signal is transmitted through the pipe wall and picked up by the acoustic sensor in the instrument.

The ClampOn sensor is fully calibrated and there is no need for individual site calibration, and the instrument is simply clamped to the pipe wall.

Using ClampOn’s patented technology, the signal is processed internally by a DSP engine and filtered before being sent onwards to the computer or the control system (no Calculating Interface Unit required). The user can evaluate the data in real time and make the decisions needed for profitable production.

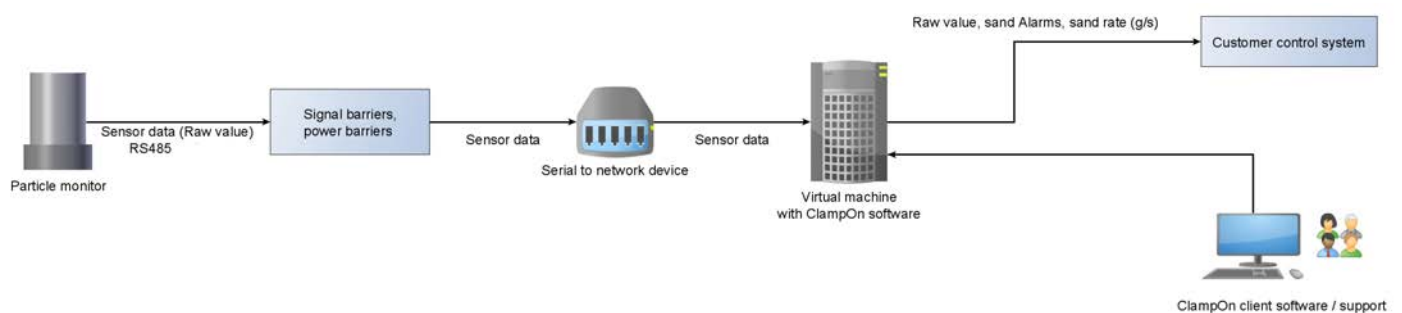
[Working Principle Video](#)



Integration

Our topside and subsea instruments can be provided with a digital or analogue interface, and comply with all common protocols. Our instruments can easily be integrated into any existing or new control system. A computer with our software is often used in parallel with our instruments and the control system. The computer uses RAW data from our sand monitors and flow data from third party systems to output calculated sand rates to the control system. All recorded data is stored for analysis and calibration purposes. We strongly recommend using the digital interface due to the following benefits:

- Two-way communication, enabling instrument software update and configuration
- Full signal range resolution
- All sensor data can be transmitted
- No signal loss



Typical system integration

Digital Signal Processing

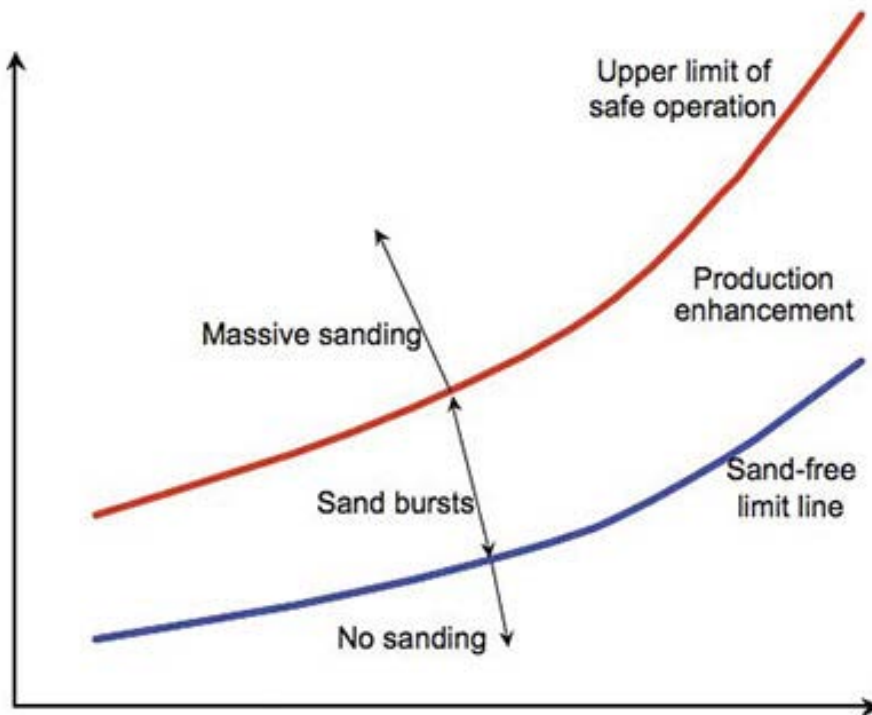
The DSP features complete digitalization, eliminating analogue filters, circuits and amplifiers. The technology incorporates a powerful DSP unit with a large amount of flash RAM, running feature packed modular software. The sensor operates simultaneously in several ultrasonic frequency ranges, allowing a whole series of new signal processing features to be implemented, including the filtering technique.

Different types of chokes or flow conditions that generate sound unrelated to sand noise are analyzed and reduced dramatically via the advanced processing and filtering technique in the instrument. This also improves accuracy and repeatability; important factors in quantifying sand production and a crucial tool in daily sand management operations.

No other technology comes close to what the ClampOn instrument offers customers who need profitable and sand-free production.

ClampOn's R&D team works tirelessly to improve the technology used in the instruments. The DSP technology we use today can not be compared to the one used 20 years ago. The technology and software has been upgraded many times over this period, and add-ons are implemented when available to make the instruments perform even better.





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

What advantages does the DSP sensor offer?

Sand production in oil and gas wells is a serious issue facing oil and gas producers. The challenge is not merely to avoid sand production, but also to increase commercial well productivity, as even small quantities of particles in the well flow can cause significant damage. As an operator you are interested in maximum production and profit from your wells, no matter what technology you use. Operators all over the world have made ClampOn their preferred supplier of sand monitoring systems, due to the patented technology that turns their wells into profit generators. The ClampOn sand monitor incorporates a unique filtering technique that makes the particle monitor an extremely useful tool for analyzing the true nature of sand production, helping to control it and finally, increasing the profit from the well. This filtering technique is the result of integrating our experience from thousands of wells, analyzing data and using the results to enhance the technology used in our equipment.

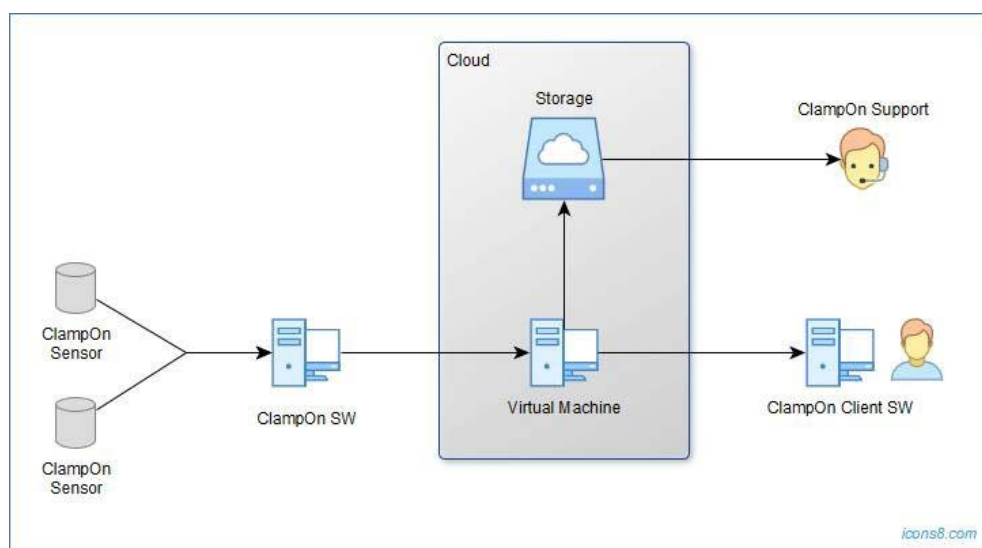
The enormous capacity of the DSP sensor makes it possible to scan through a frequency range of 1 MHz 128 times per second. This illustrates the capacity of our technology and of the filtering technique that is at the heart of acquiring and processing sand data.



ClampOn Sand Management

When sand is being produced from a reservoir, it lowers the production rate and increases maintenance costs; it can also represent a serious hazard to the 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, production rates from a well are conservative, and may be well below the maximum rate 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. The potential for safe increased production and improved earnings lies in the area between producing sand at an acceptable level and producing too much sand.



ClampOn set up for Virtual Monitoring

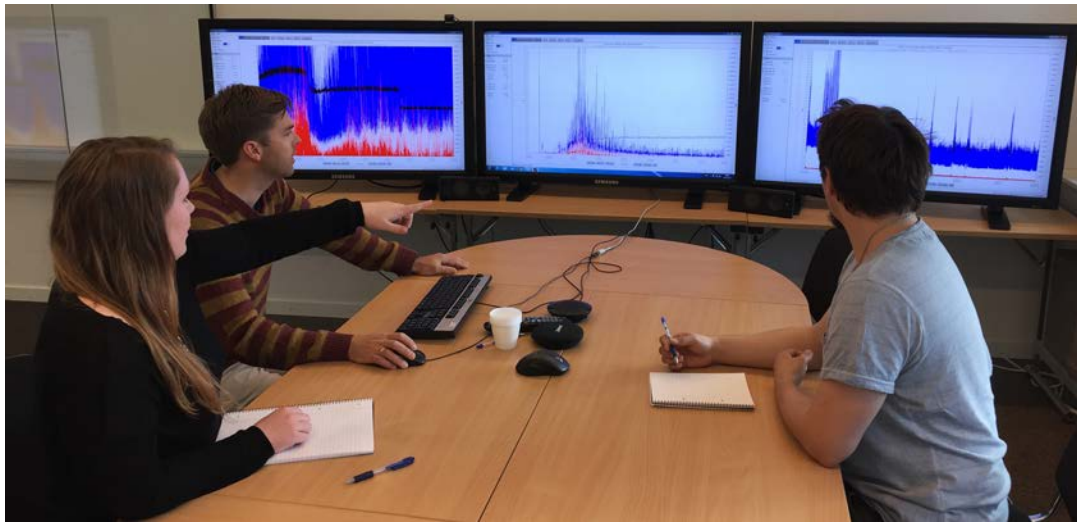
There are three main factors for effective sand management – prediction, handling and measurement:

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 sand production and when planning the sand management strategy.

Handling any sand that is produced is also important so that production can continue 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 DSP Particle Monitor comes in. The instrument's superior 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.





Sand Management & Support – analyzing data

ClampOn's experience

ClampOn has been working on the problem of sand production for more than two decades, helping customers all over the world to measure and predict it. Our experience from 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 DSP Particle 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.



Always Numero Uno!



ULTRASONIC INTELLIGENT SENSORS