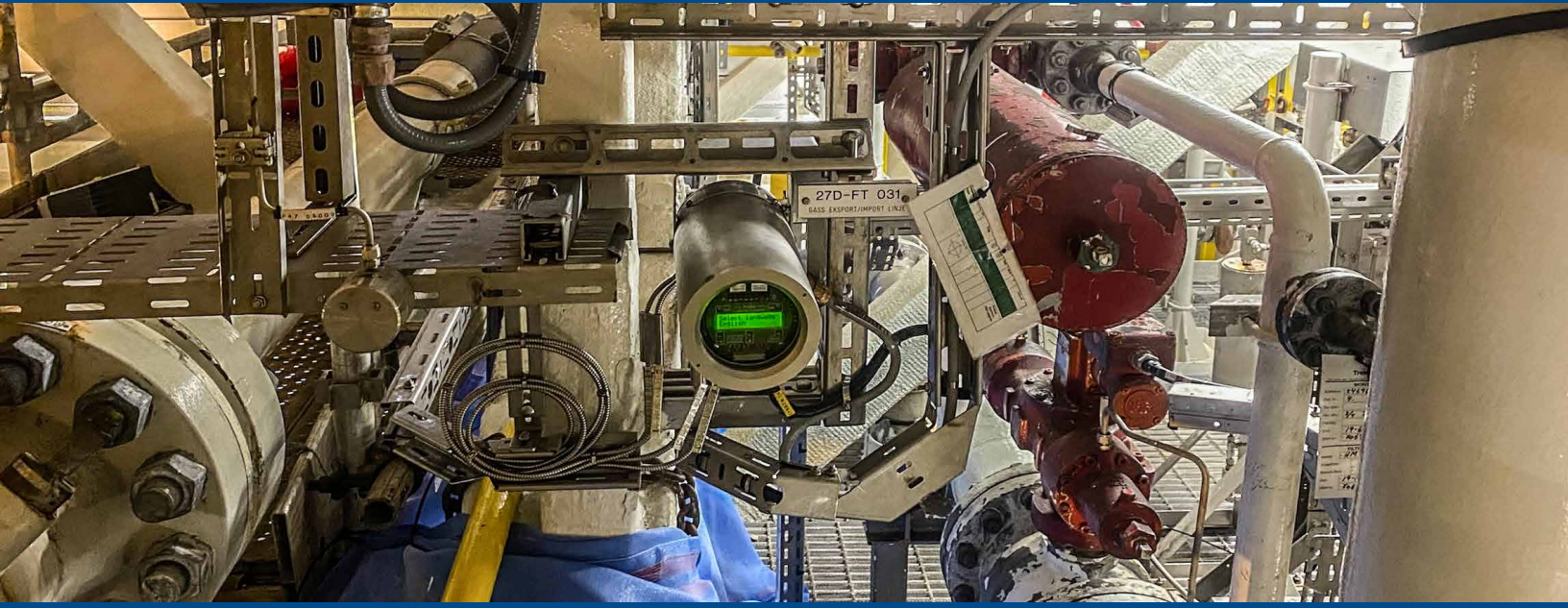




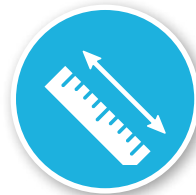
# GAS INJECTION



“For us as an experienced partner of the Norwegian oil & gas industry, Flexim’s non-invasive ultrasonic technology offers the easiest way to replace unreliable and obsolete wetted flow measurement instrumentation offshore.”



*Bjørnar Stenseth,  
Sales Engineer,  
Flow-Teknikk AS*



## Measuring Task

### Non-invasive gas flow measurement at injection wells on an offshore platform

Within the offshore oil & gas industry, once a well is opened, it is key that the extraction of crude oil is maximized to its full potential. There are various techniques employed by operators across the world to ensure that as much petroleum product is extracted as possible.

Across the lifetime of an oil well, there are in general 3 phases; primary, secondary and even tertiary production. After years of primary production, a well requires new methods to keep production at a steady level. These methods fall under the ‘Secondary Production Methods’ or ‘Enhanced recovery’ branch of Crude Oil extraction. One such method that falls under Enhanced Recovery, is Gas Injection. A second bore hole is made into the formation after which a gas injection line is then inserted.

During a Gas Injection operation, gas such as Natural Gas,  $N_2$  or  $CO_2$  is pumped down into the reservoir deep underground. This gas then spreads and increases the pressure within the oil well. This increase in pressure allows the operator to extract more oil from the reservoir. It is for this reason that Gas Injection is seen as a pressure maintenance procedure.

It is extremely important for process optimization and safety that the operators know how much gas is used during a Gas Injection procedure. Flow measurement is therefore essential.

Extreme process pressures of up to 300 bar, which come along with difficult environmental conditions, make this application challenging, in particular for wetted instrumentation. The differential pressure meters installed on a Norwegian offshore platform were exposed to wear and tear, missed the low flows and required frequent maintenance respectively repair and replacement. For dismantling and reinstallation, it is necessary to open the pipe. As a result, a shutdown is unavoidable. The plant operators of the platform were therefore looking for a way to replace the failure-prone wetted instrumentation with maintenance-free flow measurements.



## Solution

Obviously, non-invasive flow measurement with Flexim's clamp-on ultrasonic technology is the far superior solution for this kind of application. As the transducers are simply mounted onto the outside of the pipe, they are not subject to wear and tear by the medium flowing inside and by the high pressure. Installation does not require any opening of the pipe and is done during normal operation. In contrast to differential pressure measurements, the acoustic method covers an extremely large measuring range and is capable to record even the lowest flow rates.

Flow-Teknikk AS, Flexim's regional distributor, is an experienced partner of the Norwegian oil & gas industry. Their instrumentation experts are often offshore on various rigs testing and confirming the suitability of Flexim devices. This was the case on the platform multiple times over the years, not just on Gas Injection but across the entire rig.

Successful tests were undertaken with the portable FLUXUS® G608 on the Gas Injection measuring points. Utilizing the suite of diagnostics available, Flow-Teknikk created a report for the platform operator and confirmed that as expected, a fixed installation was more than feasible.

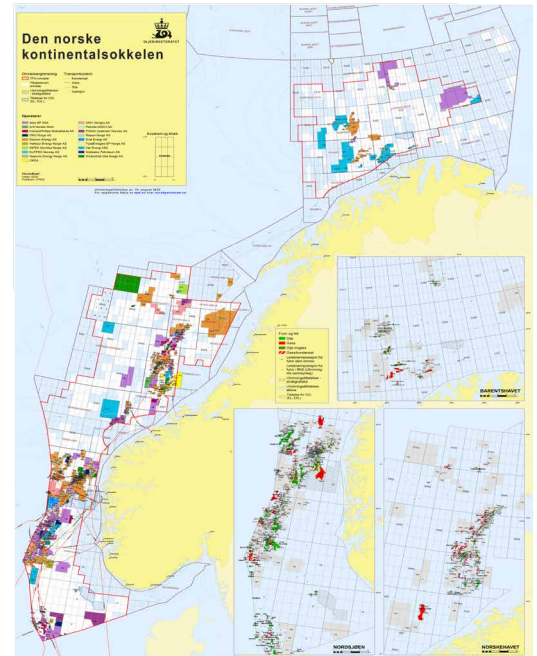
Based on the technical requirements, Flow-Teknikk identified the FLUXUS® G801 together with GSK type ultrasonic transducers as the most suitable measurement system. As with most offshore installations, the transmitter and transducers needed SS316 stainless steel housings. The FLUXUS® G801 has this as a standard option, making it the best choice for outdoor saliferous environments. To ensure the highest reliability and accuracy at all times, it was decided that all flow measuring points should be equipped with two channels.

The measuring task itself is rather basic, as it consists of a mere volume flow measurement. Also communications are standard, simply a 4 ... 20 mA output is required. The platform operator uses the FLUXUS® G801 ultrasonic systems as transducers for the operating volume flow. The calculation of the standard volume flow takes place with real-time measurement data for temperature and pressure in the process control system.

### Additional Installations

Alongside Gas Injection, there is a large base of Flexim instrumentation installed on the offshore platform:

- Fire pump testing & general check metering with FLUXUS® F/G608 ATEX Zone 2 portable meters
- Oil outlet on test separator
- Oil outlet on separator
- Gas import/export line
- Chemical & water line



Norway's petroleum era started more than 50 years ago, and a number of the early fields are still producing. Norway's first licensing round was announced on 13 April 1965, and 22 production licences were awarded, covering 78 geographically delimited areas (blocks).

At the beginning of this century, the Norwegian shelf was opened up to more types of companies as a way of ensuring sound resource management. The large international oil companies that were already established on the shelf were joined by other types of companies that could see different kinds of commercial opportunities in Norway's petroleum resources. Today, there is a great deal of diversity and competition on the Norwegian shelf, and a large number of both Norwegian and foreign companies are active.

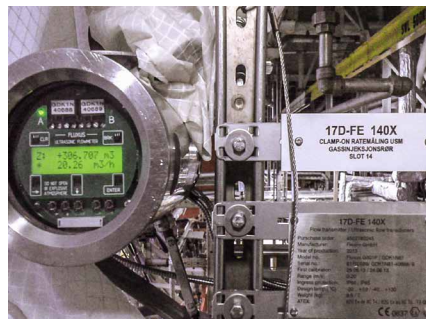
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The measuring point with two pairs of clamp-on ultrasonic transducers type GSK during installation



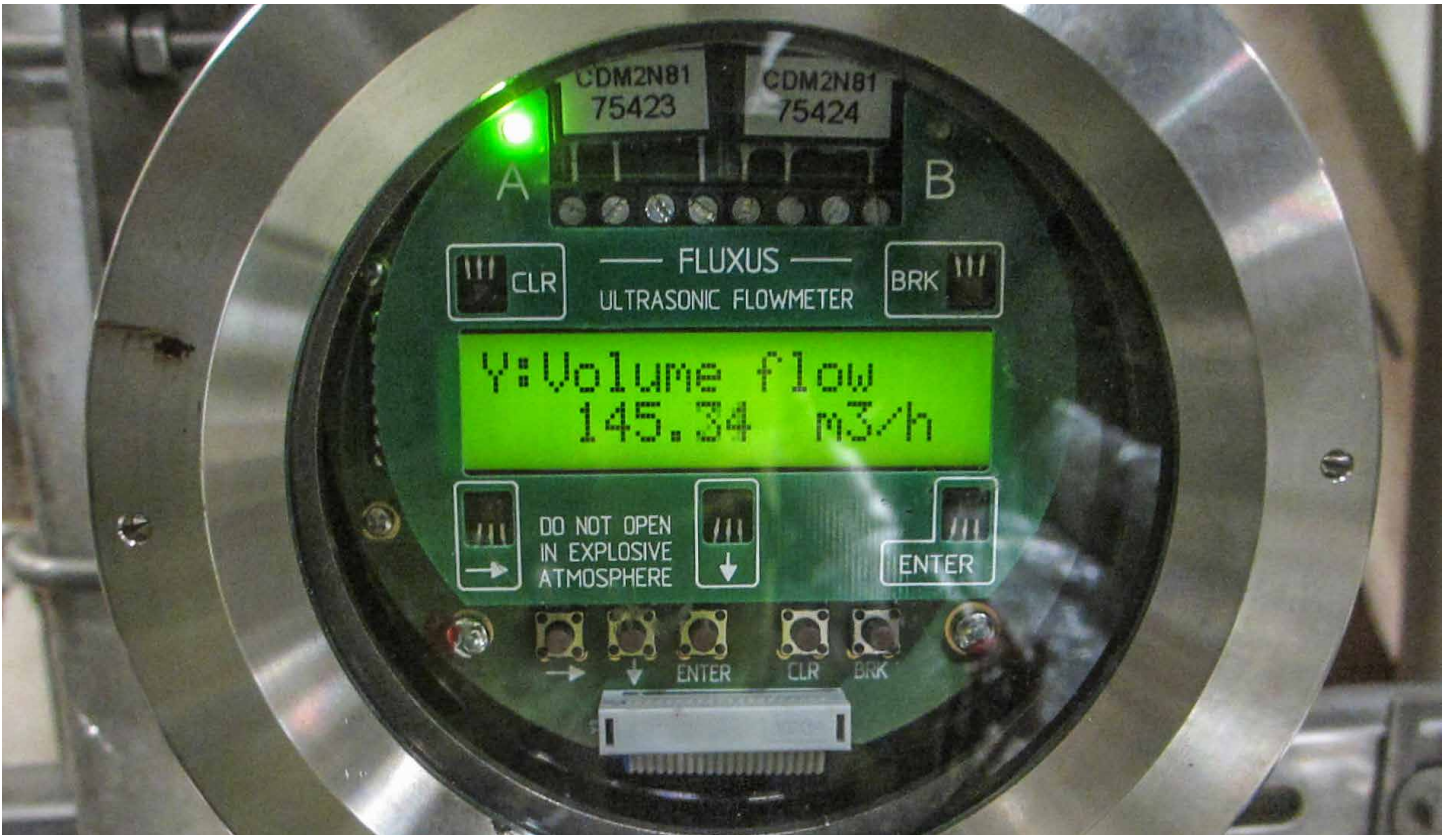
Bjørnar Stenseth during parameterization of the transmitter



The explosion-proof FLUXUS® G801 is used as a transmitter.



The final gas flow measuring point with the transducers installed in the Variofix C transducer mounting device.



## Measuring points and instrumentation

<b>Gas Injection</b>	18 x 6" pipes	18 x FLUXUS® G801 dual-channel & GSK transducers
<b>Fire pump &amp; check metering</b>	Range of pipes	2 x FLUXUS® F608 & 5 x FLUXUS® G608
<b>Oil Outlet on test separator</b>	1 x 8" pipe	1 x FLUXUS® F704 & CDM transducers
<b>Oil Outlet on separator</b>	1 x 8" pipe	1 x FLUXUS® F801 dual-channel & CDM transducers
<b>Gas import/export line</b>		1 x FLUXUS® G801 & GRG transducers
<b>Chemical &amp; water line</b>		1 x FLUXUS® F721 & FSP transducers

## Advantages

- Easy installation and replacement of existing clamp-on flowmeter
- No process shutdown required
- Reliable, accurate and robust measurement
- No wear and tear, zero maintenance
- Extreme turndown ratio, excellent low-flow reliability
- Full suite of signal diagnostics for additional process visibility
- Convincing long-term experience with Flexim and their products

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