



# INLET GAS MEASUREMENT



## Power

“Our ultrasonic FLUXUS® G706 quad beam flowmeter allows the plant operators to measure the supplied gas quantities precisely despite the difficult flow conditions. As the measurement is non-invasive, it will never impair the availability of the power plant.”



Steve Davis,  
Regional Sales Manager Central-  
West, Flexim AMERICAS.



## Measuring Task

**Non-intrusive natural gas flow measurements at the two pipelines feeding a large combined-cycle power plant**

A 1.2 GW natural gas-fired combined-cycle power plant in the United States is connected to the transport pipelines of two different operators. In order to determine the efficiency of their plant accurately, the operators must know how much gas is consumed by the two Mitsubishi M501JAC turbines. The ratio of energy used to energy generated gives the efficiency of the system. In addition, the plant operators want to have a check metering system for the custody transfer meters provided by the two supply pipelines. Without their own measurement on the two feed lines, they would have to rely only on the fiscal measurements – and the corresponding bills – of their suppliers. Therefore, the operators set about looking for an appropriate way to fit the two gas supply lines with flow measurement devices.

The supply pipe segments are large underground pipelines, 20" OD, that are exposed only for measurement purposes. In this case, the pipeline is removed from the ground at a 90° bend, and a further 90° bend results in the pipeline lying horizontally. The same thing happens on the downstream side of the meters when the pipe goes back into the ground.

As a result, a double 90° bend is the upstream disturbance in this case. This can cause some serious distortions in the flow profile. Another challenge lies in the possible enormous gas quantities of up to 22000 MCFH passing through the respective pipe, resulting in accordingly high flow velocities.

### Solution



Although the plant is not yet in operation and it would therefore been possible to install wetted devices, operators and engineers preferred a non-intrusive solution. One of the decisive advantages of gas-fired power generation is its high operational flexibility with

respect to the current demand: Gas turbines can be shut down without any problem and can be restarted quickly. Therefore, availability of the plant is crucial and must not be impaired.

For these applications, Flexim and the engineering company responsible for the construction and instrumentation of the plant identified FLUXUS® G706 to be the most suitable meter for the job. The Quad Beam meter has the best repeatability and accuracy of Flexim's clamp-on meter offering. Since the straight runs were not ideal, the G706 also offered the absolute best flow profile correction. Distortions in the flow profile can be compensated well with multi-channel measurements with signal paths offset across the pipe cross-section.

Flexim is the only manufacturer of clamp-on ultrasonic measuring instruments offering two transducer technologies: shear wave transducers with a focused signal insertion for measuring liquids and Lamb wave transducers with a broad signal insertion into the medium for measuring gas flows. Since Lamb wave transducers will be used in this application, the wall thickness of .503" had to be considered. Also, the high flow velocity had to be accounted for. The lower frequency transducers can handle more flow and the thicker wall of this application. Both measuring points are located in potentially explosive atmospheres.

Flexim's 706 Quad Beam meter was installed with all four channels in two sound paths. This gives the meter eight paths of measurement, two paths times four transducer pairs. The temperature of the gas will range between 45° and 80°F and the pressure will be between 650 and 1400 psig. The Y Channel will average the four measurement channels (A, B, C, D) into one measurement. This measurement will be in Standard Volume Flow and will be outputting a 4-20 mA signal to the customer's DCS system. The meters also have Modbus communication and will be communicating with the DCS system. This allows the customer to look at many different values such as velocity, SCNR, and flow totals.

The huge turndown of the FLUXUS® G706 allows for accurate low-flow measurements during low-load situations and start-ups. Being able to see diagnostics will let the operators know if something is amiss with the meter or if there is something different in their gas make-up. Redundancy means that the meter can operate with a bad channel because the other channels will continue to measure.

Both pipelines were not online at the same time, so multiple site visits were scheduled. The customer particularly appreciated the expertise and dedication of Flexim's instrumentation service specialists.



Quad beam measuring point on one of the supplying pipelines



The stationary FLUXUS® G706 is used as a measuring transmitter.

Transmitter diagnostics					
Physical quantity	A	B	C	D	DM
SCNR	44.21 dB	41.87 dB	44.99 dB	44.64 dB	2.10 dB
QNR	54.74 dB	55.99 dB	54.74 dB	53.74 dB	0.47 dB
Amplification	0.56 dB	0.56 dB	1.70 dB	0.56 dB	0.63 dB
Amplitude	56.85%	56.85%	55.85%	54.85%	0.43%
Quality	99.82%	100.11%	99.91%	100.00%	N/A
Var. Comp.	N/A	N/A	N/A	N/A	N/A
Var. Comp.	0.89%	0.89%	0.89%	0.89%	0.89%
Speed of sound	432.68 m/s	431.74 m/s	432.77 m/s	432.87 m/s	0.76%
Flow velocity	0.00 km/h(N)	0.00 km/h(N)	0.00 km/h(N)	0.00 km/h(N)	N/A

The diagnostic values show very good signal quality and measuring accuracy.

## Measuring Points and Instrumentation

<b>Pipes</b>	S20" carbon steel, wall thickness 0.503' There is a total of 22 feet of straight run of pipe for each application.
<b>Medium</b>	Natural gas
<b>Temperature</b>	45 °F ... 80 °F
<b>Pressure</b>	650 ... 1,400 psig
<b>Flow Rates</b>	75 ... 260 t/h
<b>Measuring Device</b>	2 stationary clamp-on ultrasonic FLUXUS® G706 quad beam gas flowmeters 8 pairs of clamp-on ultrasonic transducers type K (Lamb wave), mounted in PermaLok

## Advantages

- Cost-efficient due to easy installation without opening the pipes
- Accurate, reliable and drift-free measurement, even on short straight run pipe sections due to multi-channel set-up
- Wide measurement range - 0.3 to 80.5 fps or 0 to 31,000 MCFH
- Multiple diagnostics and measurements can be communicated through Modbus
- Channel redundancy: Multiple channels means that there is some redundancy and there can be repairs if needed without disruption of operations.
- Excellent support from Flexim sales and services

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