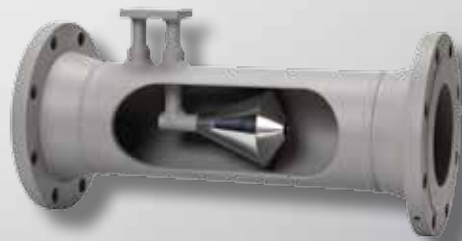


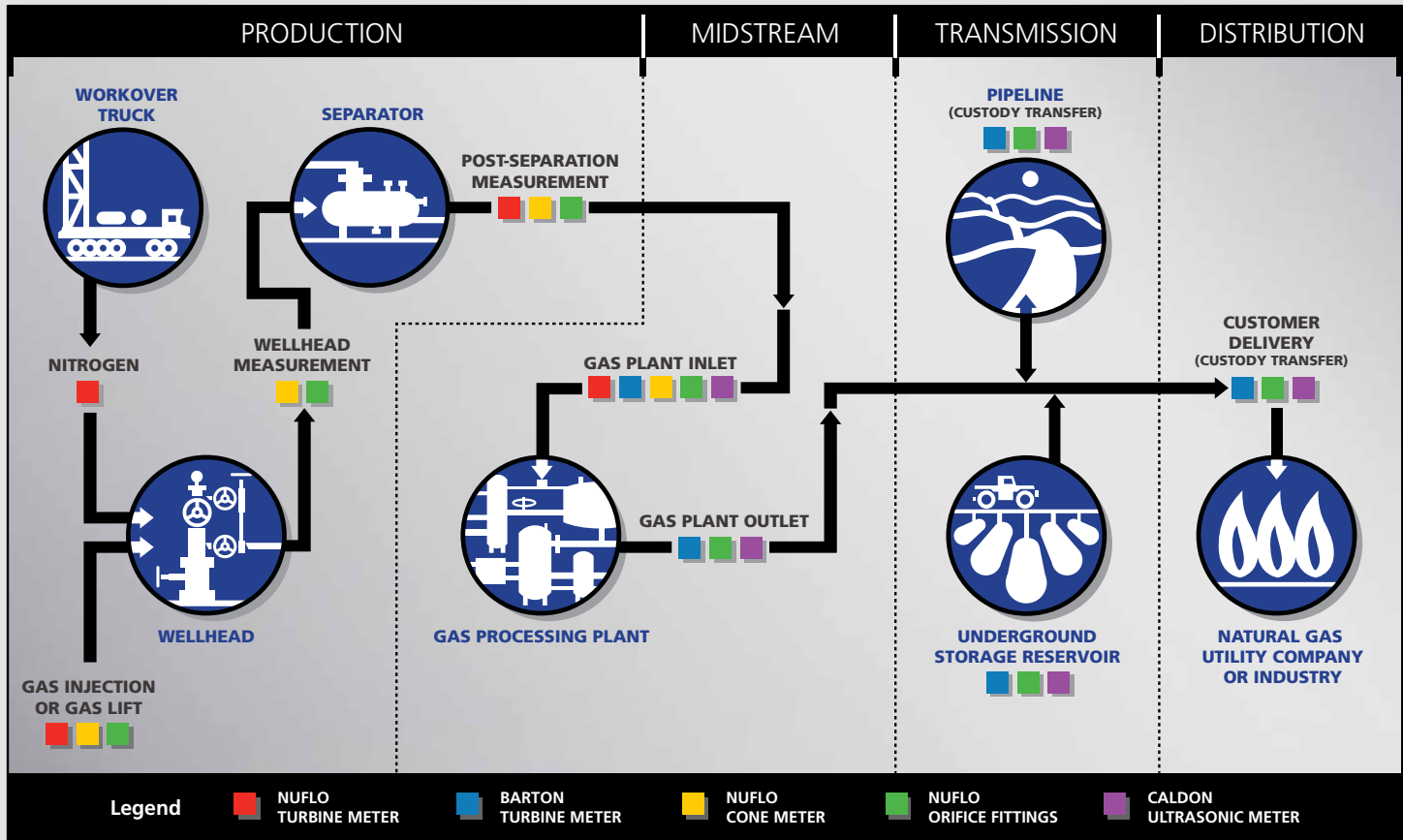
Gas Meter Solutions

Turbines, Cones, Orifice Fittings and Ultrasonic Flow Meters

TECHNOLOGY



A Meter for Every Measurement



Gas flow can be measured with several different devices, each with different primary measurement principles, applicable ranges and costs. Selecting the proper meter for a given application requires an assessment of flow rates, required accuracy and cost-to-benefit expectations.

To satisfy this broad range of needs, Cameron's gas measurement portfolio includes turbine meters, ultrasonic meters and differential pressure devices such as orifice meters and cone meters.

Take into account the following tips for selecting your next flow meter:

- Consider the accuracy and repeatability required for the application.
- Carefully estimate the required flow capacity. Consider both anticipated low and high flow conditions to better evaluate the level of rangeability (turndown) required.
- Do not assume that cost is the most important factor. Durability, power and communication requirements and maintenance may be equally as important.
- Consider the installation requirements and location. Some meters are designed to perform reliably with shorter upstream and downstream piping requirements.
- Consider how fluid composition affects your choice

of materials of construction, management of solids or liquids and computational requirements.

- Consider operational costs associated with pressure loss, user intervention and maintenance.

NUFLO Turbine Meters

NUFLO 2" twin-bladed turbine meters infer gas volume by determining the speed of the gas moving through the meter. They are specially suited for low-pressure gas measurement in 2" lines but can accommodate pressures up to 2220 psig.



- Unique cartridge design allows removal of all internal parts as one assembly. Three cartridge ranges cover the gamut of gas flow rates typically found in 1" to 3" flow line applications.
- Often used for measuring the supply of fuel gas to line heaters or small compressors.
- Between-flange design simplifies installation and makes the meter easy to remove from the line for maintenance.
- The pressure drop is negligible.
- Measurement is largely unaffected by gas density.

Cameron also offers a high-pressure turbine meter for flowing pressures between 3500 and 15,000 psi (1034 bar). This meter can measure flow rates as low as 1/10th its capacity, and with four sizes available between 1" and 3", a diverse range of flows can be metered. These rugged meters are frequently used to measure flows associated with well stimulation.



For more information see the *NUFLO gas turbine flow meters* data sheet and the *NUFLO specialty turbine flow meters* data sheet on the Cameron website.

BARTON Turbine Meters

BARTON precision gas turbine meters provide custody transfer quality measurement.

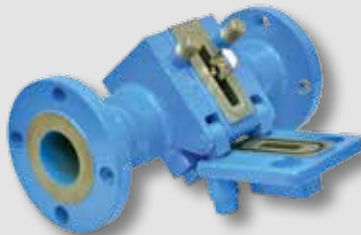
- Available in 3/4" to 12" line sizes, with threaded end connections and flanged connections up to ANSI 2500.
- With a turndown greater than 10:1, they are suitable for a wide range of flow rates.
- Permanently lubricated ball bearings provide a quick response to changes in flow rate and a long lifetime.
- Like all Cameron turbines, no power is required. They couple with other Cameron self-powered products for a complete solution.
- Measurement is largely unaffected by gas density.



For more information see the *BARTON Model 7400 precision gas turbine flow meters* data sheet on the Cameron website.

NUFLO Orifice Fittings

For economical performance under varying operating conditions and ease of service, the orifice meter is historically the preferred choice for many industrial and oilfield measurements. NUFLO orifice fittings infer the rate of gas flow by measuring the pressure difference across an orifice plate.



Operators can adapt to flow rate increases or decreases and minimize the effects of wear simply by changing an inexpensive orifice plate. The use of a fitting makes plate changing a single-person task, eliminating the need to unbolt flanges to access a plate. A self-centering receptacle in each fitting helps ensure proper alignment of the plate for accurate measurement.

Cameron can supply the fittings or manufacture the entire meter runs to a customer's specification.

- Simple trusted measurement
- No moving parts, no power required
- Measures variety of mixtures from the well with the accuracy to meet API allocation measurement standards
- Custody transfer accuracy when installed per AGA-3 or ISO-5167 standards
- Multiple fitting types are available: orifice flange union, single chamber or dual chamber
 - A single chamber fitting is ideal for lines that can be depressurized to change or inspect the orifice plate.
 - A dual chamber fitting allows the plate to be changed without depressurizing the flow line or interrupting the flow.
- Available for 2" to 6" line sizes for standard, sour and low-temperature applications with pressure ratings up to ANSI 1500
- Orifice plates available in line sizes up to 36" and in a variety of materials

For more information see the following data sheets on the Cameron website: *NUFLO single and dual chamber orifice fittings*, *NUFLO Model 5030 single-chamber orifice fitting*, and *NUFLO orifice flange unions*.

NUFLO Cone Meters

The NUFLO cone meter is a differential-based device that is well suited for gas production and similar measurement applications where space is limited.



While it is based on the same measurement principles as the orifice meter, a cone meter requires significantly less straight pipe upstream and downstream, saving valuable space and weight in cramped conditions.

- Available in sizes from 1/2" to 48" with threaded end connections or flanged connections up to ANSI 2500.
- Available in special materials
- No moving parts, low cost of ownership
- Well-suited for both unprocessed and processed gas
- Circumferential flow passage prevents the build up of liquids and is ideal for wet gas (gas plus condensate or water).
- Custody transfer quality can be obtained by calibrating the entire meter run at a qualified calibration facility.

For more information see the *NUFLO differential pressure cone meter* data sheet on the Cameron website.

CALDON Ultrasonic Flow Meters

The CALDON® LEFM® ultrasonic flow meter measures the rate of gas flow by measuring the speed at which sound travels within the pipe. It is specifically designed for measurement of natural gas where accuracy and reliability are critical. Innovative features such as sensor isolation from the process fluid and the use of a proprietary corrosion-resistant coating on internals allow safe and effective use of the meter in a variety of applications – even those prone to erosion, chemical attack or sudden pressure or temperature changes.



- Custody transfer measurement with no pressure drop
- Available in line sizes of 6" and larger
- No need for flow conditioning or long straight runs upstream, enabling a smaller footprint and low installation cost
- No moving parts and no intrusions into the pipeline, enabling pigging for cleaning or inspection
- No need to shut down flow and depressurize the pipeline for transducer replacement
- Low operating costs due to the lack of a pressure drop and reduced pumping horsepower requirements
- Local and remote diagnostic capabilities signal the onset of measurement deviation
- Savings realized in installation, maintenance and operating costs may result in a payback of up to three times the initial cost of the meter over the life of operation
- Measurement is largely unaffected by gas density

For more information see the *CALDON LEFM 380Ci gas ultrasonic flow meters* data sheet on the Cameron website.

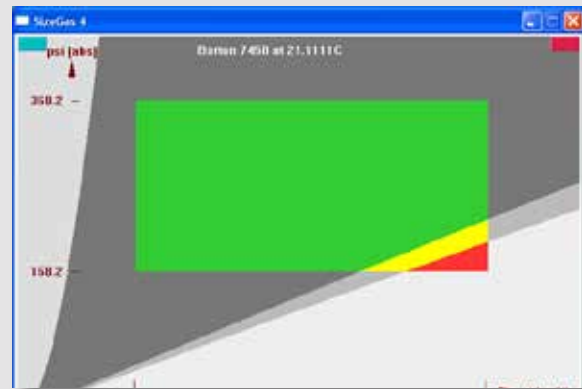
Meter Sizing Made Easy

Even when flow conditions are well defined, choosing the meter that will deliver the best performance in a specific application can be difficult. Cameron's sizing programs take the guesswork out of the process by automating the meter selection based on user-specified meter design and flow parameters.

Cameron's DP cone meter sizing program recommends the optimum cone meter size, beta ratio and full scale differential pressure to suit a required flow rate for a specified gas.

The SizeGas program provides a similar service for selection of NUFLO turbines, BARTON turbines and CALDON ultrasonic flow meters. This program not only recommends a meter type and size, but it also provides a graphical display of the meter's performance envelope so users can easily detect the boundaries of the meter's range. Users can override the automated meter selection to see the effect on performance.

Both programs are free and easy to use, and readily available for download from the Cameron website.



SizeGas graphical view of selected meter's performance

Gas Sampling Solution

Cameron's CLIF MOCK™ sampler controller is specially designed to sample gas streams in proportion to time or volume. As the solenoid supplies air pressure to the pump, the pump collects product samples from the pipeline and deposits them into a receiver which can be transported for offsite analysis. The pump can collect a sample size of 0.05 cc to 1.00 cc every five seconds.

The system can be direct-mounted to a sample probe in a pipeline or remote-mounted. It is CSA certified as intrinsically safe.

Sample count, flow total, flow rate and performance indicators are displayed on a readout and transmitted via serial communications.

Cameron offers the sampler controller as a stand-alone instrument and as the cornerstone of a complete sampling system, custom designed to meet a customer's application.

For more information see the *CLIF MOCK LGS-2000 sampling system* data sheet on the Cameron website.



Meters and More

Cameron has the products and the expertise to satisfy all of your flow measurement needs.

Choosing a gas meter is just the first step in creating a total gas measurement solution. The measurement of gas is based on standard volumes, mass or energy amounts, which requires the calculation of several flow parameters that a gas meter alone cannot provide. At a minimum, these parameters are derived from fluid composition and pressure and temperature measurements. These parameters can be computed instantaneously by a flow computer or computed separately using measurements made by a recorder.

Cameron offers a variety of electronic products to simplify this process and provide the accuracy required for a wide variety of applications.

Cameron's BARTON® gas chart recorder displays and records the measured differential pressure, static pressure and temperature.

For more exact and timely results Cameron's NUFLO™ Scanner® flow computers measure, display, record and compute flow using nearly any type of flow sensor in the industry. They may be self-contained and have onboard power as well as pressure and temperature sensors or they may be connected to peripheral devices such as radio communications systems, gas chromatographs and external power.

Where pressure and temperature is relatively constant, Cameron's turbine totalizers, differential pressure indicators and transmitters can sense, communicate and record flow.

Packaged Solutions

Cameron's expertise goes beyond the design and manufacture of measurement devices to include the design and assembly of complete measurement systems and subsystems. Our custom measurement skids can include all of measurement and automation and the networking of multiple measurement locations with software.

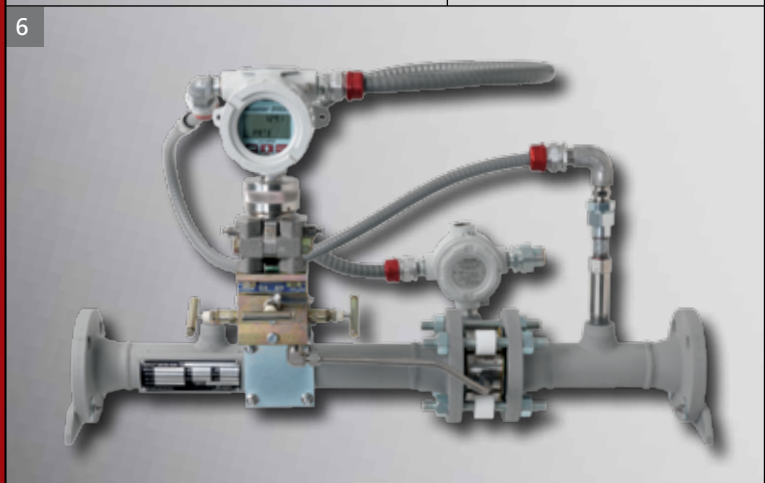
Cameron also packages essential measurement components together to create bolt-in subsystems. These ready-to-install systems typically include a turbine meter, straight run piping, a pressure sensor, a temperature sensor and a flow computer preprogrammed with site-specific and user-specified parameters.



Fabricated LINCO™ gas measurement skid.



- 1 – BARTON Model 202 chart recorder
- 2 – NUFLO Scanner 2000 flow computer and NUFLO cone meter
- 3 – Fuji transmitter and NUFLO single-chamber orifice fitting assembly
- 4 – NUFLO MC-III™ totalizer and BARTON 7400 precision turbine meter assembly
- 5 – NUFLO MC-II™ totalizer and NUFLO 2" turbine meter assembly
- 6 – Preassembled explosion-proof NUFLO Scanner 2000 bolt-in system



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Learn more about Cameron's
measurement solutions at:
www.c-a-m.com/measurement

**HSE Policy Statement**

At Cameron, we are committed ethically, financially and personally to a working environment where no one gets hurt and nothing gets harmed.