

DigitalFlow™ DF868

Panametrics liquid ultrasonic flowmeter

Applications

The DF868 liquid flowmeter is a complete ultrasonic flow metering system for measurement of:

- Water and wastewater
- Hot/chilled water
- Water/glycol solutions
- Refined hydrocarbons
- Petroleum products
- Crude oil
- Lubricating oils
- Diesel and fuel oils
- Solvents
- Chemicals
- Other liquids

Features

- Economical non-intrusive flow measurement
- Hazardous (classified) location certifications
- Simple set-up and installation
- Suitable for wide range of pipe sizes and materials
- Two-channel/two-path version available

Panametrics
a Baker Hughes business

Panametrics ultrasonic liquid flowmeter

The DigitalFlow DF868 is a full-featured, fixed-installation liquid flowmeter designed to meet all your flow metering and energy measurement needs. Its patented Correlation Transit-Time™ digital signal processing provides drift-free measurements in ultraclean and most "dirty" liquids. This includes fluids with gas bubbles and entrained solids that have previously required Doppler-type meters.

Dual-channel version reduces costs and improves performance

The optional dual-channel/dual-path model can be user-configured for a variety of applications. It can be set up to measure flow in two separate pipes with one meter to reduce the cost-per-measurement point. To minimize the effects of flow profile distortions, flow swirl and cross flow, and to provide maximum accuracy, two sets of transducers can be installed on the same pipe.

Measure flow from outside the pipe

Using clamp-on flow transducers, the DigitalFlow DF868 measures flow rate through metal, plastic or even concrete-lined pipes without penetrating the pipe wall. To hold clamp-on transducers in place, a variety of clamping fixtures are available to accommodate different pipe sizes, transducer types and attachment methods (e.g., chain, wire rope, Velcro® strap or a magnetic, bolt-on, or weldable steel yoke with metal band). Our universal clamping fixture includes ruled slide tracks to simplify transducer spacing for accurate flow measurements. There's even a special small-pipe clamping fixture with miniaturized transducers to simplify flow measurement on 0.5 to 2 inch (15 to 50 mm) lines.

Wetted transducers for maximum accuracy

Obstructionless wetted transducers are readily available for maximum performance. After proper installation, transit-time accuracies of better than 1 percent are achievable in most applications, matching the performance of expensive factory-calibrated meters. Measurement range is 0.1 to 40 ft/s (0.03 to 12.2 m/s) for a turndown ratio of 400 to 1 in pipes from 1 to over 200 inches in diameter. Measurement is noncontaminating, obstructionless and causes no pressure drop. The DigitalFlow DF868 is all digital so measurements don't drift, and it doesn't need regular maintenance since there are no moving parts to wear out or orifices to clog.

Dual-LCD display, datalogger and a wide variety of I/O options

Whether single-channel or dual-channel, all DF868 meters feature two independent, user-programmable, graphic LCDs, giving you simultaneous access to more data. There is complete flexibility to display any parameter on either LCD in a variety of numerical and graphic formats. Examples include numerical display of real time flow measurements, real time flow graphs and diagnostic waveforms, and numerical/graphic display of data from the meter's built-in 43,000 point datalogger. Up to 12 isolated 4 to 20 mA outputs, up to six hermetically sealed or standard alarm relays, and up to 12 frequency/totalizer outputs can be added.

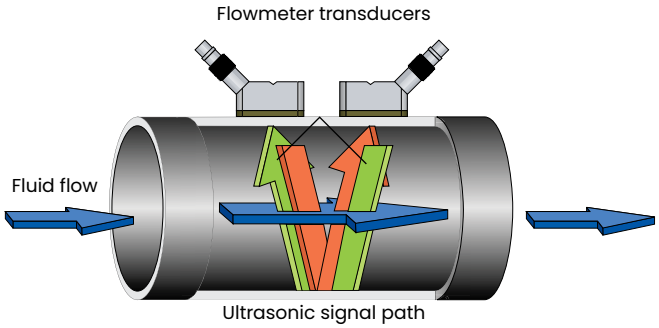
Built-in energy measurement capability

Another feature that makes the DigitalFlow DF868 meter such a powerful and versatile flowmeter, is the energy measurement software included in every meter. The DigitalFlow DF868, with optional RTDs and input boards, extends the benefits of ultrasonic flow measurement to energy measurement. Benefits include measurement of flow and temperature without pipe penetration, and compatibility with pipes from 1 to 200 in (25.4 mm to 5 m) in diameter. The DigitalFlow DF868 meter measures energy flow in water and water/glycol heating and cooling systems with temperatures from -4°F to 410°F (-20°C to 210°C). Consult Panametrics for use with other liquid systems.

To ensure compatibility with existing or preferred temperature instrumentation, the DigitalFlow DF868 meter is available with three analog input boards. The analog input board provides 24 VDC loop power and two isolated 4 to 20 mA inputs for transmitters. For applications requiring direct RTDs, the RTD input board provides two isolated, three-wire RTD inputs for temperatures from -148°F to 662°F (-100°C to 350°C).

The DF868 flowmeter uses the transit-time flow measurement technique

The transit-time technique uses a pair of transducers, with each transducer sending and receiving coded ultrasonic signals through the fluid. When the fluid is flowing, signal transit time in the downstream direction is shorter than in the upstream direction. The difference between these transit times is proportional to the velocity of the flow. The DigitalFlow DF868 measures this time difference and uses programmed pipe parameters to determine flow rate and direction.



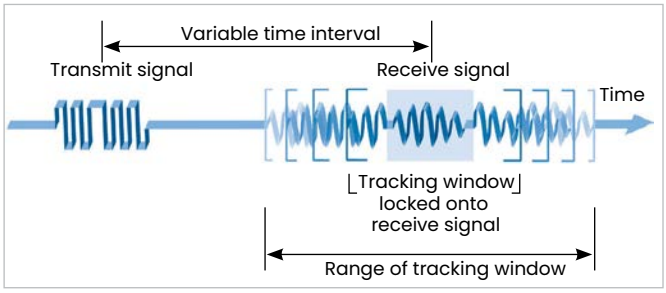
Transit-time flow measurement technique

Automatically adjusts to changing fluid properties

Our unique Automatic Tracking Window™ (ATW™) feature, standard in all DigitalFlow DF868 meters, ensures accurate flow measurements even when fluid properties are unknown or changing. Like the seek mode on a car stereo, ATW dynamically sweeps the receiver window whenever the sound speed of the fluid changes. This powerful feature enables flow measurement when the fluid sound speed is unknown, when it is changing due to large temperature shifts, or when a new liquid starts to flow in a multiproduct pipeline.

ATW works for both clamp-on and wetted transducer applications by searching for a reliable ultrasonic receive signal. It does this by varying the time between the transmit signal and the receive signal window until the receive signal is found. The tracking window automatically sweeps through a range of time intervals based on the minimum and maximum expected sound speeds programmed by the user.

The window moves (tracks) in response to changes in the fluid sound speed. Once the optimal signal is found, ATW locks onto it until another large change in sound speed occurs. When this happens, ATW returns to the seek mode until the optimal signal is found again.



ATW ensures accuracy when fluid conditions change

Is built to be economical and stay economical

To be of real value, a flowmeter must be as economical to own and operate as it is capable in the field. Using the latest microcircuit and manufacturing technologies, the DigitalFlow DF868 flowmeter is built to stay in service for many years. Completely solid state, the DigitalFlow DF868 rarely wears out or needs servicing, resulting in little downtime and low maintenance costs.

The DigitalFlow DF868 will continue to save money by streamlining the measurement process and trimming labor costs.

DF868 specifications

Operation and performance

Fluid types
Acoustically conductive fluids, including most clean liquids, and many liquids with entrained solids or gas bubbles. (Maximum void fraction depends on transducer, interrogation carrier frequency, path length and pipe configuration.)

Pipe sizes
- Using clamp-on transducers: 0.5 to 300 in (12.7 mm to 7.6 m) and larger
- Using wetted transducers: 1 to 200 in (25.4 mm to 5 m) and larger

Pipe wall thickness
Up to 3 in (76.2 mm)

Pipe materials
All metals and most plastics. Consult Panametrics for concrete, composite materials, and highly corroded or lined pipes.

Flow accuracy (velocity)
±0.5% of reading (achievable with process calibration)

Typical clamp-on flow accuracy (velocity)
- Pipe ID>6 in (150 mm): ±1% to 2% of reading
- Pipe ID<6 in (150 mm): ±2% to 5% of reading

Typical wetted flow accuracy (velocity)
±1% of reading

Accuracy depends on pipe size, installation and whether measurement is one-path or two-path.

Repeatability
±0.1% to 0.3% of reading

Range (bidirectional)
–40 to 40 ft/s (–12.2 to 12.2 m/s)

Rangeability (overall)
400:1

Specifications assume a fully developed flow profile (typically 10 diameters upstream and 5 diameters downstream of straight pipe run) and flow velocity greater than 1 ft/s (0.3 m/s).

Measurement parameters
Volumetric flow, totalized flow and flow velocity

Electronics

Flow measurement
Patented correlation transit-time mode

Enclosures
- Standard: Epoxy-coated aluminum weatherproof Type 4X/ IP66 Class I, Division 2, Groups A,B,C&D
- Optional: Stainless steel, fiberglass, explosion-proof, flameproof

Dimensions (standard)
- Weight 11 lb (5 kg),
- Size (h x w x d) 14.24 in x 11.4 in x 5.1 in (362 mm x 290 mm x 130 mm)

Channel
- Standard: One-channel
- Optional: Two channels (for two pipes or two-path averaging)

Display
Two independent software-configurable 64- x 128-pixel backlit LCD graphic displays

Keypad
39-key tactile feedback membrane keypad

Power supply
- Standard: 100 to 130 VAC, 50/60 Hz or 200 to 265 VAC, 50/60 Hz
- Optional: 12 to 28 VDC, ±5%

Note: For DC-powered meters, Class 2 rated supplies must be used for the line power

Power consumption
20 W maximum

Operating temperature
-4°F to 131°F (-20°C to 55°C)

Storage temperature
–67°F to 167°F (-55°C to 75°C)

Standard inputs/outputs
Two 0/4 to 20 mA isolated outputs, 550 W maximum load Namur NE043 compliant

Optional inputs/outputs
There are six additional slots available for any combination of the following I/O boards:
- Analog outputs: Select up to three additional output boards, each with four isolated 0/4 to 20 mA outputs, 1000 W maximum load
- Analog inputs: Select up to three boards of one of the following types:
  - Analog input board with two isolated 4 to 20 mA inputs and 24 V loop power
  - RTD input board with two isolated, three-wire, RTD inputs; span -148°F to 662°F (-100°C to 350°C); 100 W
- Totalizer/frequency outputs: Select up to three totalizer/ frequency output boards, each with four outputs per board, 10 kHz maximum. All boards allow software-selectable functioning in two modes:
  - Totalizer mode: Pulse per defined unit of parameter (e.g., 1 pulse/gal)
  - Frequency mode: Pulse frequency proportional to magnitude of parameter (e.g., 10 Hz = 1 gpm)
- Alarm relays: Select up to two boards of one of the following types:
  - General purpose: Relay board with three Form C relays; 120 VAC, 28 VDC maximum, 5 A maximum; DC 30 W maximum, AC 60 VA
  - Hermetically sealed: Relay board with three hermetically sealed Form C relays; 120 VAC, 28 VDC maximum, 2 A maximum; DC 56 W maximum, AC 60 VA

Digital interfaces
- Standard: RS232
- Optional: RS485 (multiuser)
- Optional: Modbus® RTU
- Optional: Modbus TCP
- Optional: OPC server
- Optional: Ethernet

Site parameter programming
- Menu-driven operator interface using keypad and "soft" function keys
- Storage for 10 sites

Data logging
Memory capacity (linear and/or circular type) to log over 43,000 flow data points

Display functions
- Graphic display shows flow in numerical or graphic format
- Displays logged data and diagnostics

European compliance
Complies with EMC Directive 2004/108/EC, 2006/95/EC LVD (Installation Category II, Pollution Degree 2)

Clamp-on ultrasonic flow transducers

Temperature ranges
- Standard: -40°F to 302°F (-40°C to 150°C)
- Optional: -328°F to 752°F (-200°C to 400°C)

See specific transducer for exact temperature range.

Mountings
Stainless steel chain or strap, welded or magnetic clamping fixtures

Area classifications
- Standard: General purpose
- Optional: Weatherproof type 4X/IP66
- Optional: Explosion Proof, Class I, Division 1, Groups B, C & D; Class II, Groups E, F & G; Class III
- Optional: Flameproof Ex II 2 G Ex md IIC T6–T3
- Optional: Submersible

Wetted ultrasonic flow transducers

Temperature ranges
- Standard: –40°F to 212°F (–40°C to 100°C)
- Optional (overall range): –310°F to 1112°F (–190°C to 600°C)

Pressure ranges
- Standard: 0 to 3000 psig (1 to 207 bar)
- Optional: Higher pressures on request

Materials
- Standard: Stainless steel
- Optional (for Pan-Adapta® Plugs): Titanium, Hastelloy® alloy, Monel® alloy, duplex,

Pan-Adapta plugs allow installation and removal of wetted transducers without interrupting the process or emptying the pipe.

Process connections
- Standard: 1 in or 3/8 in NPTM
- Optional: RF flanged, socket weld, fuse bond and others

Mountings
Flanged flowcell, hot tap or cold tap

Area classifications
- Standard: General purpose
- Optional: Weatherproof type 4/IP65
- Optional: Explosion-proof Class I, Division 1, Groups C&D; Class II, Groups E,F&G; Class III
- Optional: Flameproof (II 2 G Ex d IIC T6)
- Optional: Submersible

MCerts Product Conformity Certificate
Sira MC 050061/00 for continuous water monitoring (EU IPPC)

Transducer cables
- Standard: One pair of coaxial cables, type RG62 AU, or as specified for transducer type
- Optional: Lengths up to 1,000 ft (330 m) maximum

High-temperature and high-pressure ultrasonic flow transducers
- Bundle Waveguide Technology™ System transducer and holder (see BWT™ System specifications)

Energy Measurement
Calculates energy flow rate and totalized energy usage. Requires optional RTD or analog inputs to the DF868 with two temperature inputs: one for supply and one for return temperature. Typical installations use surface mount RTDs with integrated 4-20 mA transmitters, but wetted RTDs with thermowells are available if more accuracy is required and if the line can be shut down for installation.

Surface mount RTDs
Pt 1000, 4-wire, matched pair with integrated 4-20 mA transmitters

Range
- 0° to 50°C (32° to 122°F)
- 0° to 150°C (32° to 302°F)
- Field configurable to special ranges

Accuracy
±0.12°C of temperature @ 0°C

Thermowell RTDs
Pt 100, 1/10 DIN, 3 wire, matched pair

Range
- Direct RTD Input
  - Configurable in DF868. Maximum range -100° to 350°C (-148° to 662°F)
- Integrated 4-20 mA transmitter
  - 0° to 50°C (32°F to 122°F)
  - 0° to 100°C (32°F to 212°F)
  - -50° to 200°C (-58° to 392°F)

Accuracy
±0.15°C

Additional options

PanaView™ PC interface software
The DigitalFlow DF868 communicates with a PC through a serial interface and Windows® operating systems. Consult the manual for details on sites, logs and other operations with a PC.

Panametrics, a Baker Hughes business, provides solutions in the toughest applications and environments for moisture, oxygen, liquid and gas flow measurement.

Experts in flare management, Panametrics technology also reduces flare emissions and optimizes performance.

With a reach that extends across the globe, Panametrics' critical measurement solutions and flare emissions management are enabling customers to drive efficiency and achieve carbon reduction targets across critical industries including: Oil & Gas; Energy; Healthcare; Water and Wastewater; Chemical Processing; Food & Beverage and many others.

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