

# GE Infrastructure Sensing

## Applications

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

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

## Features

- Economical nonintrusive flow measurement
- Hazardous area certification
- Simple setup and installation
- Suitable for wide range of pipe sizes and materials
- Two-channel/two-path version available
- Energy measurement option
- Large backlit LCD display
- Velocity, volumetric and energy flow rates
- Totalized flow and trend data

GE Panametrics has joined other GE high-technology sensing businesses under a new name —

**GE Infrastructure Sensing**



## DigitalFlow™ DF868 Ultrasonic Liquid Flowmeter

The 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 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 for maximum accuracy, you can

install two sets of transducers on the same pipe.

### Measure Flow from Outside the Pipe

Using clamp-on flow transducers, the 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, 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 lines.

imagination at work 

### 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 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

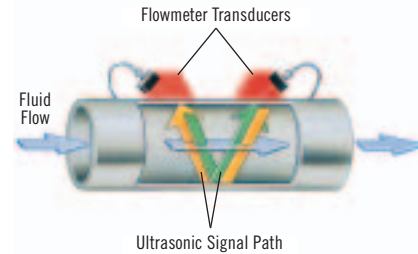
Whether single-channel or dual-channel, all DF868 meters feature two independent user-programmable graphic LCDs, giving you simultaneous access to more data. You have complete flexibility to display any parameter(s) on either LCD in a variety of numerical and graphic formats. Examples include numerical 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. You can also add 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.

### Built-In Energy Measurement Capability

Another feature that makes the DF868 meter such a powerful and versatile flowmeter is the energy measurement software included in every meter. The 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 inches (25.4 mm to 5 m) in diameter. The DF868 meter measures energy flow in water and water/glycol heating and cooling systems with temperatures from -20° to 210°C (-4° to 410°F). Consult GE Infrastructure Sensing for use with other liquid systems.

To ensure compatibility with existing or preferred temperature instrumentation, the DF868 meter is available with three analog input boards. The transmitter input board provides 24-VDC loop power and two isolated 4- to 20-mA

inputs for transmitters. For applications requiring raw RTDs, the RTD input board provides two isolated three-wire RTD inputs for temperatures from -100° to 350°C (-148° to 662°F).



Transit-time flow measurement technique

### 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 flow of velocity. The DF868 measures this time difference and uses programmed pipe parameters to determine flow rate and direction.

### Automatically Adjusts to Changing Fluid Properties

Standard in all DF868 meters, our unique Automatic Tracking Window™ (ATW™) feature ensures accurate flow measurements even when fluid properties are unknown or changing.

Like the seek mode on your car stereo, ATW dynamically sweeps the receiver window whenever the sound speed of the fluid changes. This powerful feature lets you measure flow when the fluid sound speed is unknown, is changing due to large temperature shifts, or when a new liquid starts to flow in a multiproduct pipeline.

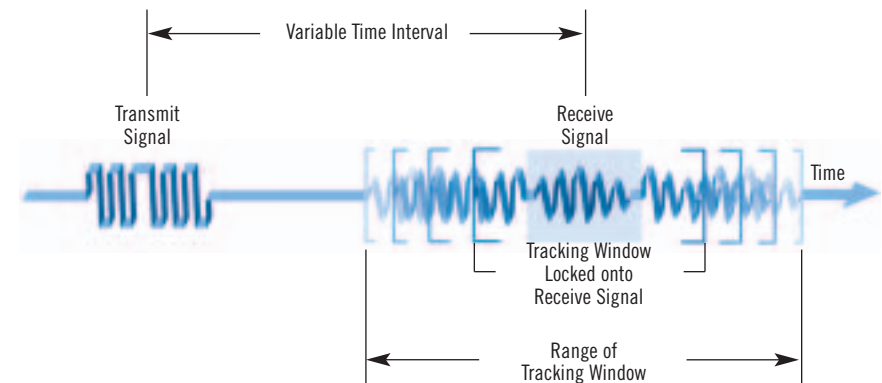
ATW works for both clamp-on and wetted transducer applications by searching for a reliable ultrasonic receive signal. It does this by varying the time between the transmit signal and the receive signal window until the receive signal is found. The tracking window automatically sweeps through a range 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.

### 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 DF868 flowmeter is built to stay in service for many years. Completely solid state, the DF868 rarely wears out or needs servicing, resulting in little downtime and low maintenance costs.

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



ATW ensures accuracy when fluid conditions change.

## 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

- Clamp-on transducers: 0.5 to 300 in. (12.7 mm to 7.6 m) and larger
- 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 GE Infrastructure Sensing for concrete, composite materials, and highly corroded or lined pipes.

#### Clamp-On Flow Accuracy (Velocity)

- Pipe ID > 6 in. (150 mm):  
±1% to 2% of reading typical
- Pipe ID ≤ 6 in. (150 mm):  
±2% to 5% of reading typical

#### Wetted Flow Accuracy (Velocity)

±1% of reading typical

*Note: Accuracy depends on pipe size and whether measurement is one-path or two-path. Accuracy to ±0.5% of reading may be achievable with process calibration.*

#### 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

*Note: 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

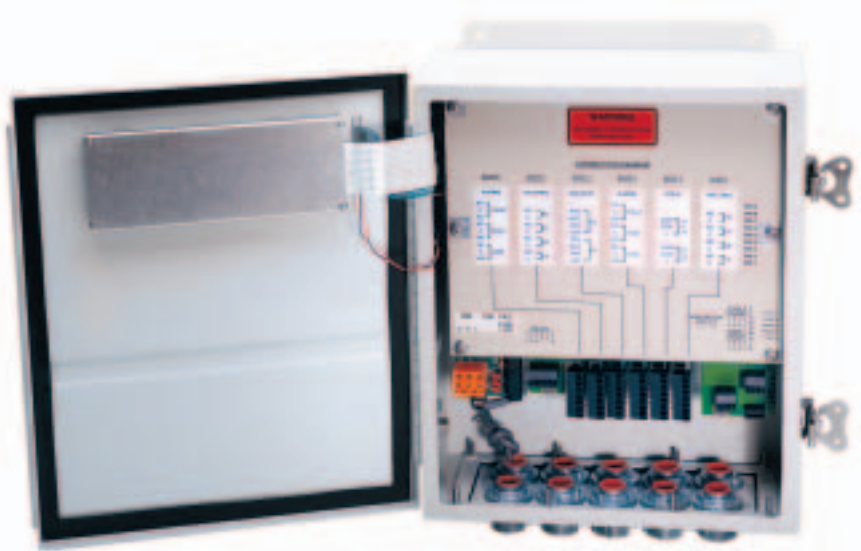
### Electronics

#### Flow Measurement

Patented Correlation Transit-Time mode

#### Enclosures

- Standard: Epoxy-coated aluminum Weatherproof NEMA 4X IP66 Class I, Div 2, Groups A,B,C,D FM J.I. 3Z9A1.AX, CSA LR 44204-12
- Optional: Stainless steel, fiberglass, explosion-proof, flameproof



An inside view of the DF868 shows the variety of input/output options available.

#### Dimensions

Standard: Weight 11 lb (5 kg), size (h × w × d) 14.24 × 11.4 × 5.1 in. (362 × 290 × 130 mm)

#### Channels

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

#### Display

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

#### Keypad

39-key tactile feedback membrane keypad

#### Power Supplies

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

#### Power Consumption

20-W maximum

#### Operating Temperature

-20° to 55°C (-4° to 131°F)

#### Storage Temperature

-55° to 75°C (-67° to 167°F)

#### Standard Inputs/Outputs

Two 0/4 to 20-mA isolated outputs, 550-Ω maximum load

#### 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-Ω 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° to 662°F (-100° to 350°C); 100-Ω Pt
- 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® protocol

#### 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

System complies with EMC Directive 89/336/EEC, 73/23/EEC LVD (Installation Category II, Pollution Degree 2) and PED 97/23/EC for DN<25

## Clamp-On Ultrasonic Flow Transducers

### Temperature Ranges

- Standard: -40° to 60°C (-40° to 140°F)
- Optional (overall range): -190° to 300°C (-310° to 572°F)

### Mountings

Stainless steel chain or strap, welded or magnetic clamping fixtures

### Area Classifications

- Standard: General purpose
- Optional: Weatherproof NEMA 4 IP65
- Optional: Explosion-proof Class I, Div 1, Groups C,D
- Optional: Flameproof  $\text{Ex}$  II 2 G EEx md IIC T6-T3
- Optional: Submersible

## Wetted Ultrasonic Flow Transducers

### Temperature Ranges

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

## Pressure Ranges

- Standard: 0 to 3,000 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, CPVC, PVDF and others

*Note: 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 NEMA 4 IP65
- Optional: Explosion-proof Class I, Div 1, Groups C,D
- Optional: Flameproof  $\text{Ex}$  II 2 G EEx d IIC T6
- Optional: Submersible

*Note: Transducers (wetted and clamp-on), flowcells and clamping fixtures for specific applications are available. Consult GE Infrastructure Sensing for details.*

## 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

### Energy Measurement

Calculates energy flow rate and totalized energy. Requires optional RTD or analog I/O board.

### Temperature Transducers

Loop-powered, three-wire, platinum RTDs; clamp-on and wetted (thermo-well) types are available

### Accuracy

±0.15°C with wetted RTDs (matched pairs)

### Range

-20° to 260°C (-4° to 500°F)

*Note: The accuracy of the energy measurement is a combination of the accuracy of the associated flow and temperature measurements. 1% to 2% of reading is typical for calibrated systems. Not all extremes of parameters can be achieved simultaneously.*

## Additional Options

### PanaView™ PC-Interface Software

The 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.