PORTABLE NON-INVASIVE FLOWMETER

Model FD10

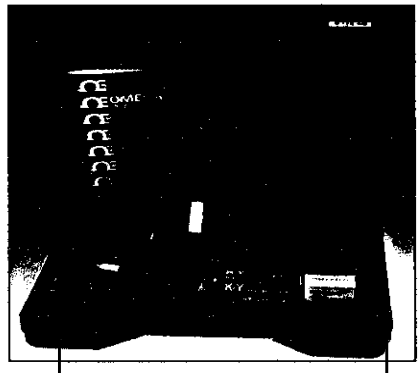
- **Battery-Powered, Portable Operation**
- **Choice of 2 Sensors Including Acoustic Couplant**

The FD10 non-invasive ultrasonic handheld flowmeter gives immediate and reliable velocity measurements with high repeatability for monitoring day-to-day performance of fluids in a pipe anywhere in a system.

The non-invasive measurement of fluid flow in a pipe is achieved using the Doppler frequency shift of ultrasonic signals reflected from contaminants in the flowing liquid. These contaminants can be suspended solids (not dissolved) or bubbles in the flow.

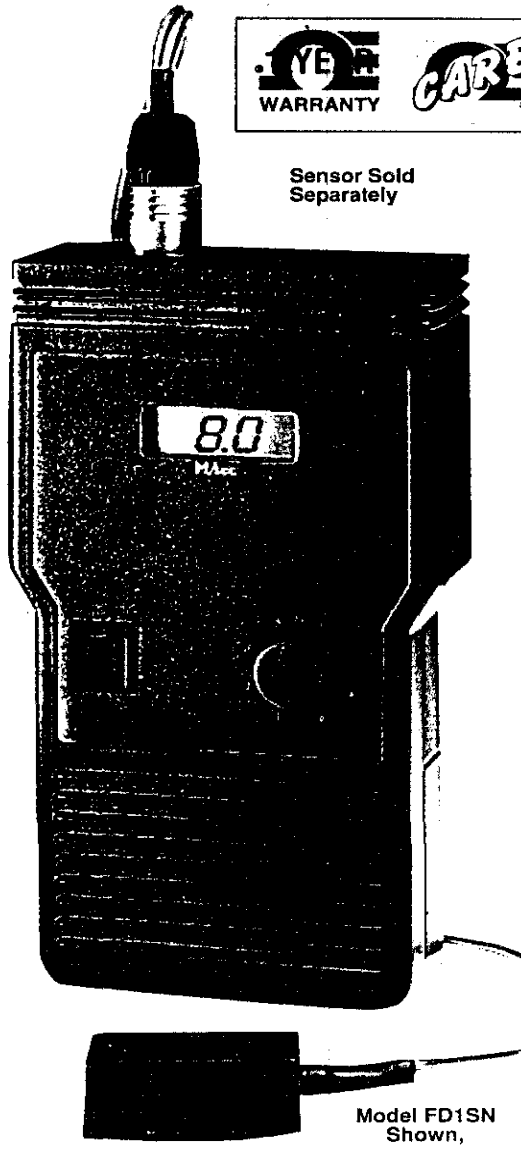
The battery-powered, portable monitor is coupled to the sensor, which in turn is positioned on the pipe using a suitable acoustic coupling jelly. With the monitor turned on, an immediate velocity reading is given. The monitor also features a "good connection" LED indicator and an adjustable calibration knob. The non-invasive sensor with 8 ft cable can be supplied for fluid temperatures up to 158°F (Model FD1SN) or for fluids up to 239°F (Model FD1SN-HT).

Model FD10 can be used effectively to monitor flow through steel, iron, hard plastic PVC and glass pipes, and by its non-invasive application can be used to measure flow of liquids such as cement, sewage, and effluent where in-line flowmetering would be difficult or impossible. Concrete, copper, and lined pipes present a barrier to the ultrasonic signal and thus the FD10 is not suitable for use with these pipes.



Model FD-10, Comes with Rugged Carrying Case and Complete Operator's Manual

Note:
Not suitable for drinking or well water, river water, typical heating or cooling water.



Sensor Sold Separately

Model FD1SN Shown,

SPECIFICATIONS

Fluid Requirements: At least 30 ppm of 30 micron or larger suspended solids (not dissolved) or bubbles
Pipe Size: 1" on up, no maximum limit
FD1SN Sensor Temp. Limits: -40 to 158°F
FD1SN-HT High Temp. Sensor: Up to 239°F
Ambient Temp. Limit: -40 to 125°F (for indicator)
Velocity Range: 1.0 to 30 ft/sec
Ultrasonic Frequency: 625 kHz
Monitor Construction: ABS plastic case, no routine maintenance required
Repeatability: ±1%
Accuracy: ±5% of a calibrated point reading
Batteries: 5 x (9V) Alkaline batteries included
Battery Life: Typically 30 hours of continuous indication, with years of storage life
Monitor Dimensions: 8.15" x 4.4" x 1.89"
Monitor Weight: 1.1 lbs
Sensor Construction: ABS plastic (FD1SN), cast iron (FD1SN-HT)
Sensor Head Dimensions: 1.97" x 0.8" x .08"
Sensor Cable: 8 ft
Acoustic Couplant (included): KY™ Jelly with low temperature sensor; silicone grease with high temperature sensor
Carrying Case Dimensions: 11.02" x 13.78" x 3.15"
Complete Kit Weight: 3.3 lbs

To Order *(Specify Model Number)*

Model No.		Description
FD10		Portable non-invasive flowmeter kit*

**Sensor required; must be purchased separately (see below). Kit includes monitor, batteries, manual, and case*

Sensors with Acoustic Couplant

Model No.		Description
FD1SN		Sensor for fluid from 41 to 158°F
FD1SN-HT		Sensor for fluid up to 239°F

ULTRASONIC DOPPLER FLOWMETERS
Flow Reference Section

INTRODUCTION

The ultrasonic Doppler flowmeter incorporates the use of a technology offering an increased range of applications. Because of its non-invasive nature, no pressure drop is created, and this type of flowmeter may be used to measure the flow of fluids and slurries which ordinarily cause damage to conventional sensors.

The basic principle of operation employs the frequency shift (Doppler Effect) of an ultrasonic signal reflected by suspended particles or gas bubbles (discontinuities). This metering technique utilizes the physical phenomenon of the sound wave changing frequency when it is reflected by moving discontinuities in a flowing liquid. Ultrasonic sound is transmitted into a pipe with flow liquids, and these discontinuities reflect the ultrasonic wave with a slightly different frequency, the frequency difference being directly proportional to the flow of liquid, Figure 1. Current technology requires at least 25 parts per million (PPM) of 30 microns or larger of suspended particles or bubbles.

A typical system incorporates a transmitter/indication/totalizer and a transducer. The transducer is mounted on the exterior of the pipe. It is driven by a high frequency oscillator in the transmitter, through an interconnecting cable. The transducer generates an ultrasonic signal which it transmits through the pipe into the flowing liquid. The transmitter measures the difference between its output and input frequency and converts this different frequency into electronic pulses which are processed for an analog indication and a voltage or current output signal. Additionally, the pulses are scaled and totalized for flow quantity.

The transmitter frequency power levels and transducer configuration are selected to accommodate a wide variety of liquids, pipe sizes, percent solids, and pipe liners.

The transmitter also incorporates a circuitry which allows adjustment of the signal threshold. This permits elimination of undesirable ambient noises (both mechanical and electrical). As a result, instrumentation is possible in a variety of locations subject to high levels of sonic, mechanical, and electrical noise.

ACCURACY

Without Field Calibration

The accuracy of a flowmeter operating on the Doppler principle is mainly a characteristic of flow velocity profile integration by the ultrasonic wave. The ability to do this is basically a function of: percent sound reflectors (solids and bubbles), their size, variation and distribution, line size, and the flowmeter design features. Therefore, it is unrealistic to state a general accuracy without full application details and transducer selection.

With Field Calibration

The accuracy with a field flow calibration may be as high as ±1% plus the accuracy of the flow calibration on the actual application at given conditions.

Clean Liquids

The basic ultrasonic Doppler flowmeter requires a minimum level of at least 25 PPM of suspended solids or bubbles at least 30 microns or larger. Transducer frequencies for these requirements would be 1 megahertz. Lower frequencies would require more PPM and a larger micron size.

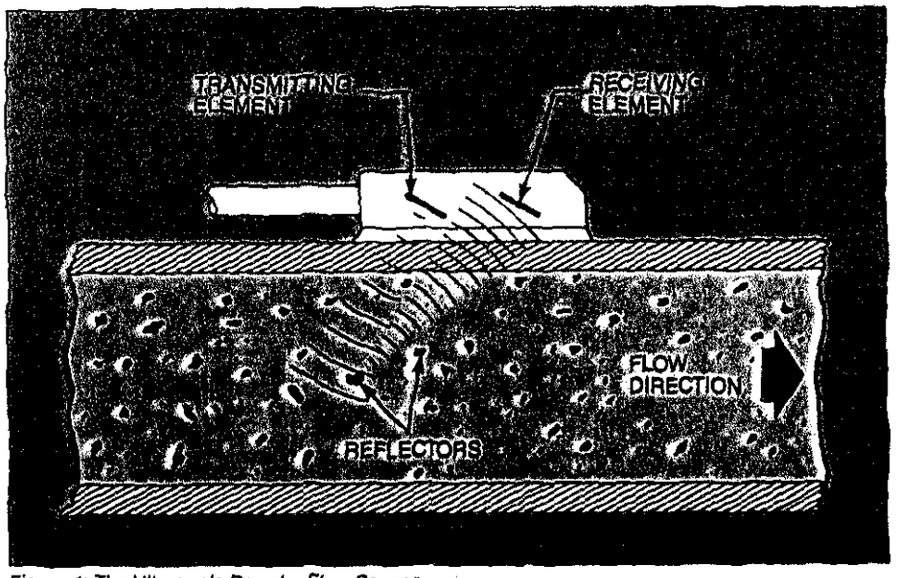


Figure 1: The Ultrasonic Doppler Flow Sensor