MODEL 5000

ULTRASONIC COMPOUND FLOWMETER

Features

- **Designed for Specific Applications and Ease of Installation**
- **Factory Callibrated for Each Application**
- **Factory Technician Provided for Initial Start-Up**
- **Operating Parameters are Field Changeable for Future Flow Requirements**
- **Three Separate 4-20 mA Outputs Provided for Flow, Level and Velocity**

The Eastech Badger Series 5000 ultrasonic compound flowmeter is the latest in flow measurement technology for partially filled pipes. With 30 years of experience in the design and manufacture of ultrasonic compound flowmeters, Eastech Badger understands the metering problems involved with partially filled pipes. From plant influent to plant effluent, from sewer interceptors to storm water measurement—Eastech Badger will custom design compound flowmeters each specific application.

Series 5000 flowmeters are employed for flow measurement in open channels and partially filled pipes. Series 5000 flowmeters feature wide rangeability with little or no head loss depending upon the configuration. Depth and velocity measurements are calculated in order to compute flow rates by using the Continuity Equation.

Design Parameters

TRUE CHORDAL VELOCITY MEASUREMENTS: The Series 5000 makes use of transit-time ultrasonic technology as the prime method for accurately determining instantaneous fluid velocity. This enables predictable accurate velocity measurement throughout changing flow conditions.

WIDE RANGEABILITY: Series 5000 flowmeters will accurately measure over an unusually wide range by incorporating a small flume or weir for low flow measurement.

ELIMINATES SUBMERGENCE EFFECTS: The use of the Continuity Equation negates the effects of backwater, stagnation and surcharging in a high depth flow regime.

NO HEAD LOSS: Series 5000 flowmeters require little or no head loss for operation. In most cases, the flowmeter induces no losses beyond the piping loss.

EASILY INSTALLED: Series 5000 flowmeters can be easily installed in either new or existing construction with minimum mechanical effort.

BI-DIRECTIONAL CAPABILITY: It should be noted that since chordal velocity measurements are bi-directional in a compound flow regime, each meter is capable of bi-directional operation.

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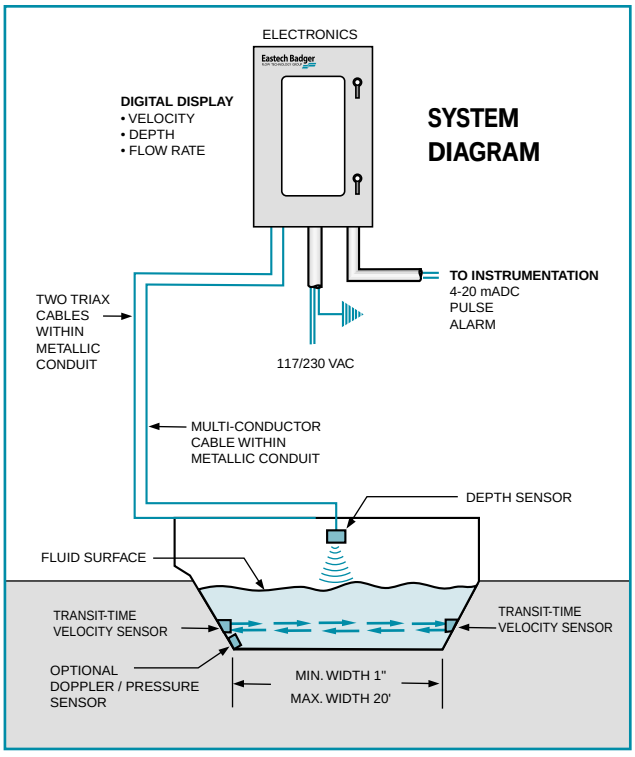
Application

Series 5000 flowmeters are designed for dependable use in the water and wastewater industry. Successful applications include sewer flow, storm water flow, irrigation, plant influents/effluents, aqueducts, and other in-plant measurements.

Eastech Badger has pioneered the use of equipment to ultrasonically measure both fluid depth and fluid velocity in open channels. In a typical application (as seen below), velocity sensors are installed on the sidewalls and a depth sensor is mounted above the channel.



Design Consideration

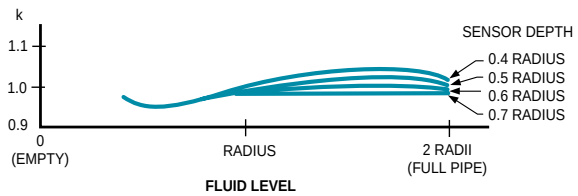
As with all flowmeters, careful consideration of the design parameters is necessary to insure proper operation.

PIPING AND CHANNEL REQUIREMENTS: Series 5000 flowmeters require a well-developed velocity profile for accurate measurement. General practice requires a sufficient straight upstream run to assure profile conditioning. A general rule is to place the metering section approximately 15 or more diameters of straight run upstream and 1 or 2 diameters downstream. Channel applications require a stable sidewall and bottom for accurate measurement.

FLOW DEPTH CONSIDERATIONS: In practice, the transit time sensors are mounted at 25% of maximum fluid depth. This allows predictable Area-Velocity measurements for depths above 30%. Below this depth, the Series 5000 automatically switches into either a depth only mode or the unit can be optionally equipped with a Doppler velocity system to compute the low end flow rate and provide redundancy in the depth only mode. The unit can automatically switch into a calibrated free flow energy method (Manning's Equation) or be programmed for a small weir, flume or non-standard H/Q relationship.

CHORDAL MEASUREMENTS: The chordal measurement method, used in Eastech Badger Series 5000 equipment, is the most viable technique for predicting average velocity. It requires detection of the chordal velocity along an entire path across the fluid. This chordal velocity more nearly represents the average area velocity over the entire flow profile. Studies with turbulent flow profiles in various channel geometries have shown that from 25% to 100% of maximum channel depth, there is a predictable correlation between chordal velocity and average velocity. This correlation permits accuracies within ± 1% to ± 3% depending on the channel geometry. This correlation factor has a slight variation, from 0.96 to 0.98, as the channel level changes from 30% full to completely full. A typical correlation plot is shown below.

TYPICAL CORRELATION PLOT



$$k = \frac{\text{Average Area Velocity}}{\text{Area Chordal Velocity}}$$

Wastewater Flow Measurement in Sewers
Using Ultrasound
USEPA Technology Series
EPA 600/2-76-243

HYDRAULIC REQUIREMENTS

Series 5000 flow meters require a well-developed velocity profile for accurate measurement. General practice required a sufficient upstream ìstraightî run to assure profile conditioning. A general rule is to place the metering section so as to secure approximately 15 or more diameters of straight run upstream and 1 or 2 diameters downstream depending on the piping arrangement. Channel application requires a stable sidewall and bottom for accurate measurement.

SPECIFICATIONS	
Enclosure	Nema 4, 4x, Fiberglass Reinforced Polyester (23.5" x 15.8" x 8.5") Weight 40 lbs.
LCD Display	Flow Rate, Total, Velocity and Fluid Depth
Mounting	500 ft. from point of measurement
Accuracy	±3% of actual flow
Depth Measurement	
Accuracy	±0.08" or ±1% of target distance (whichever is greater)
Span Range	4" to 300" (offset 12" min.)
Repeatability	±0.25%
Velocity Measurement	
Accuracy	±0.015 FPS
Repeatability	±0.25%
Sensitivity	±0.005 FPS
Rangeability	Dependant upon application
Temperature Rating	30° to 150°F (indoor unit) -40° to 180°F (outdoor unit)
Power Requirements	117/230 VAC ±10%, 50/60 Hz
Power Consumption	20 watts (150 watts w/ heater)
Output Signal Format	
Display	LCD, two (2) line
Analog	4-20 MADC isolated in 800 Ohms Up to three (3) available Flowrate (single or dual resolution) Fluid Velocity Fluid Depth
Alarms	High SPDT 100 mA @ 120 VAC Low SPDT 100 mA @ 120 VAC
Sampler	AC Triac, Adjustable
Totalizer	Open Collector, Adjustable
Programmable Features	Full Scale Flow Full Scale Velocity Current Output Meter Response Time Scaled Pulse Contact Relay Assignments Primary Element Selection 16 Point H/Q Curve

Application Checklist

Fluid Characteristics

- Type of fluid
- Temperature
- Percent solids
- Does the fluid foam?
  - Have entrained gas or air bubbles?

Hydraulic Characteristics

- Conduit energy gradient/slope
- Manning 'N' used for design
- Flow rate
  - Design Flow: Max. / Min.
  - Actual Max. Velocity / Flow / Depth
  - Actual Min. Velocity / Flow / Depth
- **Flow Conditions**
  - Gravity conditions
  - Free flow
  - Steady/turbulent/pulsating
  - Uni/Bidirectional
- **Approach Conditions**
  - Straight pipe diameters upstream
  - Straight pipe diameters downstream
  - Distance downstream from Valve/pump/elbow
- Does a freefall exist upstream/how far?

Conveyance Structure

Open Channel

- Type
- Dimensions
- Freeboard

Closed Pipe

- Pipe Material
- Inside Diameter
- Outside Diameter
- Pipe Wall Thickness
- Pipe Class Rating
- Flange Type/Rating
- Liner Material/Thickness

Flowmeter Characteristics

- Will a flume/weir be used?
- Type/Capacity
- Electronics Location/Rating
- Power Requirements
- Indicator Units
- Totalizer Units
- Output Signal Format

Ordering Guide

Please provide the following information.

Full scale flow rate for 20 mA output.

_____

Minimum flow rate.

_____

Process fluid_____

Conduit width_____

Maximum fluid depth_____

Minimum fluid depth_____

Pumped or gravity flow_____

Configuration	Open Channel	Closed Conduit	Custom Spool	End Fittings	Power Input	Enclosure NEMA 4, 4x	Primary Element
Existing **51** Spool Form **52**	Trapezoidal **1** Rectangular **2** Other **3**	Concrete Pipe **4** Ductile/ Cast Iron **5** Other **6**	304 Stainless **7** Carbon Steel **8**	Plain End **9** ANSI **10** AWWA **11**	115 VAC, 50/60 Hz **A** 230 VAC, 50/60 Hz **B**	Indoor **C** Outdoor **D** With Front Window **E** W/O Front Window **F**	Manhole Flume **M** Parshall Flume **P** Lagco Flume **L** 90° V Notch Weir **V1** 60° V Notch Weir **V2** Other **V3** Gravity Flow Equation **GF**

Eastech Badger
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