TTFM100B SERIES

TRANSIT TIME FLOWMETER- PORTABLE TYPE

DESCRIPTION

The Transit Time Flowmeter of TTFM100B series measures flowrate by calculating the spreading time of an ultrasonic wave in a liquid, going upstream and downstreamgo into a full pipe.

This flowmeter is mostly used to measured the flowrate of homogeneus fluids, with a very little percentage of suspended solids and possibly without gas bubbles.

Its peculiar installation makes this devices suitable for measuring aggressive fluids (acids, basic and dissolvents) or very soiling fluids(oil and fuels).

The measuring system is composed of one or more couples of ultrasonic transducers acoustically coupled to the external pipe's wall (it is also possible to use transducers in direct contact with fluid to be measured) and a portable unit elaborating the sent and received signals from the transducers. The HOST unit has a DSP microprocessor, it gives signals to interfacing with the process or the control systems.

Main Characteristics

The TTFM100B series includes a range of ultrasonic flowmeters whose electronics is composed of a single board: high precision, high fidelity, high competitivity.

The devices main characteristics are:

- Clamp-on sensors: it is not necessary to stop the flow to install them. Or Insertion sensors.
- The device could make the signals gain automatically suitable to the pipe's diameter and to the measuring conditions.
- 0.5% linearity.
- 0.2% repeteability.
- 4 flow totalizers.
- Battery supply lasting 8 hours in continuous functioning.
- The time difference during the measuring process could be 0.1 ns.
- Ultrasonic transducers with low voltage supply, patened.
- Possibility of saving up to 2000 internal measures, suitable to the selected parameters.
- Analog (4-20 ma), pulses (relays), frequence (OCT) and RS232 outputs.
- All the measures could be driven to the RS232 in order to save data into a PC or a serial printer.

Typical Use

- The TTFM100B flowmeter could be virtually used in a very huge range of measuring. The diameters could go from DN20 up to DN6000 and the application could be the following:
- Water treatment, slurry and process water pumping;
- Oil and chemical industries;
- Hydro-electric, cooling, anti-fire stations;
- Exploitation industries;
- Food, paper and pharmaceutical industries;
- Car industries;
- Flow balancing;

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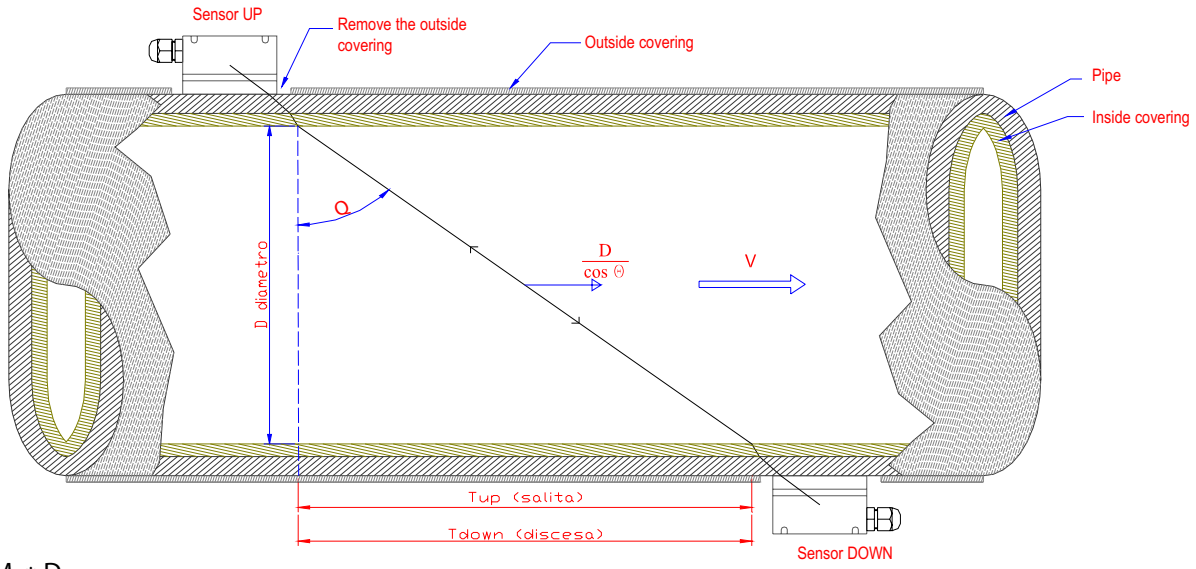
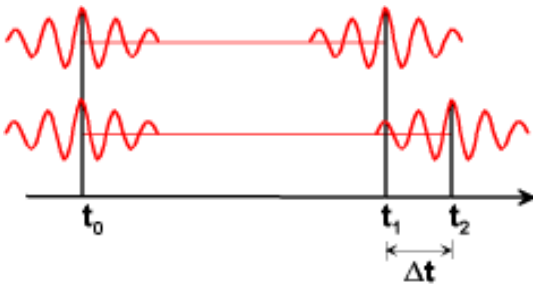
Description- Transit Time Flowmeters Working Principle

When the ultrasonic spreads in the liquid, the flow will cause a changing in the spreading time in function of downstream or upstream current.
The ultrasonic wave going towards the same directions of the flow , increases the spreading speed, while the ultrasonic wave going towards the opposite side of the flow decreases the spreading speed.
If the difference between the two spreading times is accurately measured, it would be possible to calculate the flow speed (see the following picture).
2 sensors in direct contact with the pipe's external surface are used to measure.
One sensor is placed on the upper side of the pipe's external surface, one sensor is placed on the lower side of the pipe's external surface.
The sensors positions could look like a "Z" or like a "V" or a "W", if the pipe has a small diameter (in the previous picture, the sensors are "Z" mounted).
The sensors are alternatively used to receive the ultrasonic pulses sent through the way pipe- fluid- pipe.
The difference between the transmitted and received signals upstream and downstream are calculated as follows:



$$Tup = \frac{\frac{M * D}{COS\ \theta}}{Co + VSIN\ \theta} \qquad Tdown = \frac{\frac{M * D}{COS\ \theta}}{Co - VSIN\ \theta}$$



$$V = \frac{M * D}{SIN\ 2\theta} * \frac{\Delta T}{Tup * Tdown}$$

Where:

M	Spreading time
D	Pipe's internal diameter
Θ	Transmission angle
Co	Sound spread speed through the fluid in static conditions
Tup	Positive spreading time
Tdown	Negative spreading time

DT value is the difference of spreading time into a homogenous fluid without gas bubbles.
The equation (3) for calculating the average speed "V" could be used for all the types of fluids in ideal conditions. The fluid speed measuring is in fact conditioned by different factors which make the precision decrease: for example the dumps on the pipe's internal walls: they change the measuring principle of the transit time flowmeter.
TTFM100B series has are a lot of solutions trying to solve these problems, compensating the temperature influence, the dumped internal walls and the asymmetry in the speed distribution, in order to measure in critical conditions too.
It is possible to adjust the zero point of the device: if the fluid is in static conditions, this operation makes the precision increase until reaching values near to 0.5%.

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Technical Features

FEATURE	SPECIFICATION
Linearity	0.5%
Repeatability	0.2%
Accuracy	+/- 1% of the reading value > = 0.2 m/s
Response time	From 0 to 999 seconds, set by the user.
Speed	+/- 32 m/s
Pipes diameter	From DN20 to DN 6000
Eng. Unis	Meters, Feet, Cubic meters, Cubic feet, USA Gallons, Imperial Gallons, USA Million
Totalizers	Gallons, set by the user. 7 digit for positive, negative and net
Measurable liquids	flowrate. All the liquids (virtually)
Safety	Possible to set a password for blocking the device.
Display	Graphic dislya4 lines, 16 characters.
Interface	RS232-C from 75 to 57600 BPS. Ientek protocol compatible with Fuji.
Transducers	S1, M1, L1 on customers request.
Cable lengths	From 2 x 5 m up to 2 x 500 m
Supply	3 x AAA Ni-MH batteries (included) for 8 hours working
Data logger	Internal data logger tosave up to 2000 lines of data.
Manual totalizer	7 digit totalizaer for manual acquisitions and calibrations.
Housing material	ABS
Housing dimensions	460 (L) x 400 (W) x 110 (H) mm
Weight	4.5 kg batteries included

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