



instrument

**2024
PRODUCT
INTRODUCTION**

Handheld Ultrasonic Flowmeter

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Company Profile

Weifang AOBO Instrument Technology Development Co., Ltd., founded in 2002, with registration capital of 10 million RMB, is a "High-Tech" and "Double-Software Certification" enterprise specialized in "flow measurement and intelligent measurement & control" industry, integrating R&D, production, sales and service.

The company has a core R&D team for computer software and technology, automatic intelligent control, HVAC engineering design and flow measurement. It has the ability to provide customers with specific solutions and complete sets of products according to their different needs, based on years of practical experience. Especially in the heating industry, by the customer's recognition, has a high reputation in the industry.

The products are mainly used in the measurement and control of "steam, liquid, gas, sewage and tap water"; and especially suitable for energy monitoring and energy-saving control in many industries, such as thermal power plants, thermal companies, residential heating, petroleum, chemical industry, papermaking, food, coating, printing & dyeing and HVAC.

Since its foundation, based on self-developed and leading technology, reliable quality, high-quality service and good reputation, our company has been warmly accepted by customers, and become a designated supplier for many central enterprises and listed companies.

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I. Product Overview

The ABDT-LCT-S series flow meter incorporates the latest ICs manufactured from the famous semiconductor manufacturers like Philips, Maxim, TI, winbond, and xilinx. The hardware features the ease of operation, high accuracy and outstanding reliability, while the software provides a very user friendly interface and much more functions. It employs a patent balanced lower voltage multi-pulse igniting circuit which increases the anti-interference ability magnificently so that the flowmeter will work properly even in demanding industrial environments such as those with power frequency transverter working nearby.



The signal receiving circuits feature self-adapting performance so as to ensure that the user can easily operate the instrument without any adjustment.

The built-in rechargeable Ni-H battery can work continuously for more than 12 hours without recharge.

The advanced circuit design, the integration of the latest semiconductors, the user-friendly software interface both in English and Chinese languages and small-sized PCB board, all these features combine to make the ABDT-LCT series ultrasonic flow meter the best and the biggest seller on the Chinese market. Moreover, it is gaining more and more recognition on the international flow meter market.

II. Operational Principle

The ABDT-LCT-S ultrasonic flow meter is designed to measure the fluid velocity of liquid within a closed conduit. The transducers are a non-contacting, clamp-on type, which will provide benefits of non-fouling operation and easy installation.

The ABDT-LCT-S transit time flow meter utilizes two transducers that function as both ultrasonic transmitters and receivers. The transducers are clamped on the outside of a closed

pipe at a specific distance from each other. The transducers can be mounted in V-method where the sound transverses the pipe twice, or w-method where the sound transverses the pipe four times, or in Z-method where the transducers are mounted on opposite sides of the pipe and the sound crosses the pipe once. This selection of the mounting method depends on pipe and liquid characteristics. The flow meter operates by alternately transmitting and receiving a frequency modulated burst of sound energy between the two transducers and measuring the transit time that it takes for sound to travel between the two transducers. The difference in the transit time measured is directly and exactly related to the velocity of the liquid in the pipe, as shown in Figure 1.

$$V = \frac{MD}{\sin 2\theta} \times \frac{\Delta T}{T_{up} + T_{down}}$$

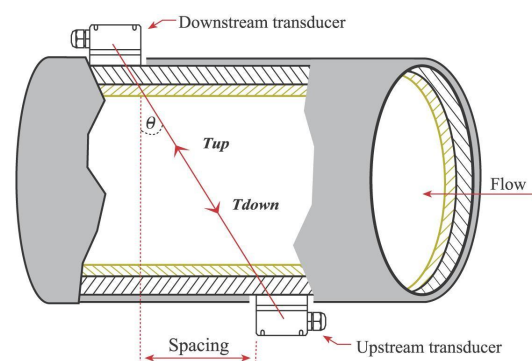


Figure 1

Where

θ is the include angle to the flow direction

M is the travel times of the ultrasonic beam

D is the pipe diameter

T_{up} is the time for the beam from upstream transducer to the downstream one

T_{down} is the time for the beam from downstream transducer to the upstream one

$$\Delta T = T_{up} - T_{down}$$

III. Product Characteristics

- * 0.5% of linearity
- * 0.2% of repeatability
- * Bilingual interface in Chinese and English
- * 4 flow totalizers
- * Patent balanced lower-voltage multi-pulse ultrasonic igniting
- * built-in date totalizers
- * work properly near transverters
- * built-in data-logger
- * 100 Pico-second resolution of time measurement
- * 0.5 second totalizing period

IV. Technical Parameter(s)

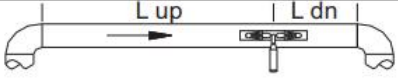
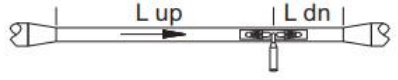
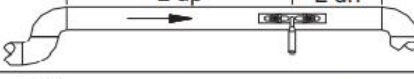
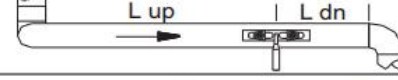
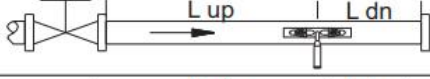
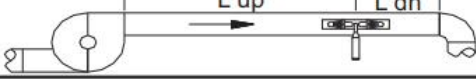
Linearity	0.5%
Repeatability	0.2%
Accuracy	± 1% of reading at rates>0.2 mps
Response Time	0.999 seconds, user-configurable
Velocity	±32 m/s
Pipe Size	20mm-6000mm
Rate Units	Meter, Feet, Cubic Meter, Liter, Cubic Feet, USA Gallon, Imperial Gallon, Oil Barrel, USA Liquid Barrel, Imperial Liquid Barrel, Million USA Gallons. User configurable.
Totalizer	7-digit totals for net, positive and negative flow respectively
Liquid Types	Virtually all liquids
Security	Setup values Modification Lockout. Access code needs unlocking
Display	4x8 Chinese characters or 4x16 English letters
Communication Interface	RS-232C, baud.rate: from 75 to 57600. Protocol made by the manufacturer and compatible with that of the FUJI ultrasonic flow meter. User protocols can be made on enquiry.
Transducers	Model M2 for standard, other 4 models for optional
Transducer Cord Length	Standard 2x5 meters, optional 2x10 meters 12x15 meters
Power Supply	3 AAA Ni-H built-in batteries. when fully recharged it will last over 10 hours of operation. 100V-240VAC for the charger
Data Logger	Built-in data logger can store over 2000 lines of data
Manual Totalizer	7-digit press-key-to-go totalizer for calibration
Housing Material	ABS
Case Size	100x66x20mm
Handset weight	514g (1.2 lbs) with batteries

V. Installation

5.1 Transducers Mounting Allocation

The first step in the installation process is the selection of an optimum location in order to obtain a more accurate measurement. For this to be completed effectively, a basic knowledge about the piping and its plumbing system would be advisable.

An optimum location would be defined as a straight pipe length full of liquid that is to be measured. The piping can be in vertical or horizontal position. The following table shows:

Piping Configuration and Transducer Position	Upstream Dimension	Downstream Dimension
	L up x Diameters	L dn x Diameters
	10D	5D
	10D	5D
	10D	5D
	12D	5D
	20D	5D
	20D	5D
	30D	5D

Examples of optimum locations.

Principles to Selection of an Optimum Location

- (1) Install the transducers on a longer length of the straight pipe. The longer the better, and make sure that the pipe is completely full of liquid.
- (2) Make sure that the temperature on the location does not exceed the range for the transducers. Generally speaking, the closer to the room temperature, the better.
- (3) Take the pipe fouling into consideration. select a straight length of a relatively newer

pipe. If the condition is not satisfying, consider the fouling thickness as part of the liner for a better result.

(4) Some pipes have a kind of plastic liner, and between the outer pipe and the liner there may be a certain thickness difference that will prevent the ultrasonic waves from direct traveling. such conditions will make the measurement very difficult. whenever possible, try to avoid this kind of pipes. If impossible, try our plug-in transducers that are installed permanently on the pipe by drilling holes on the pipe while liquid is running inside.

5.2 Transducers Installation

The transducers used by the ABDT-LCT-S series ultrasonic flow meter are made of piezoelectric crystals both for transmitting and receiving ultrasonic signals through the wall of liquid piping system. The measurement is realized by measuring the traveling time difference of the ultrasonic signals. Since the difference is very small, the spacing and the alignment of the transducers are critical factors to the accuracy of the measurement and the performance of the system. Meticulous care should be taken for the installation of the transducers.

Steps to the installation of the transducers

(1) Locate an optimum position where the straight pipe length is sufficient, and where pipes are in a favorable condition, e.g., newer pipes with no rust and ease of operation.

(2) Clean any dust and rust. For a better result, polishing the pipe with a sander is strongly recommended.

(3) Apply adequate coupling agent to the spot where the transducers are to be installed and leave no gap between the pipe surface and the transducers.

Extra care should be taken to avoid any sand or dust particles left between the pipe outer surface and the transducers.

To avoid gas bubbles inside the upper part of the pipe, the transducers should be installed horizontally by the side of the pipe.

5.2.1 Transducers spacing

The spacing value shown on menu window M25 refers to the distance of inner spacing between the two transducers. The actual transducers spacing should be as close as possible to the spacing value.

5.2.2 V-method Installation

V-method installation is the most widely used mode for daily measurement with pipe inner diameters ranging from 20 millimeter to 300 millimeter. It is also called reflective mode or method.

5.2.3 Z-method Installation

Z-method is commonly used when the pipe diameter is between 300 millimeters and 500 millimeters.

5.2.4 w-method Installation

W-method is usually used on plastic pipes with a diameter from 10 millimeters to 100 millimeters.

5.2.5 N-method InstallRarely used method.

5.3 Installation Checkup

Through the checkup of the installation, one can: check the receiving signal strength, the signal quality Q value, the traveling time difference of the signals, the estimated liquid speed, the measured traveling time of the signals and the calculated traveling time ratio. Therefore, optimum measurement result and longer running time of the instrument can be achieved.

5.3.1 Signal Strength

Signal strength indicates the amplitude of receiving ultrasonic signals by a 3-digit number. [000] means there is no signal detected, and [999] refers to the maximum signal strength that can be received.

Although the instrument works well if the signal strength ranges from 500 to 999, stronger signal strength should be pursued, because a stronger signal means a better result.

The following methods are recommended to obtain stronger signals:

- (1) Relocate a more favorable location, if the current location is not good enough for a stable and reliable flow reading, or if the signal strength is lower than 700.
- (2) Try to polish the outer surface of the pipe, and apply more coupling agent to increase the signal strength.
- (3) Adjust the transducers both vertically and horizontally while checking the varying signal strength, stop at the highest position, and then check the transducers spacing to make sure the transducers spacing is the same as what the M25 shows.

5.3.2 Signal Quality

Signal quality is indicated as the Q value in the instrument. A higher Q value would mean a higher signal and Noise Ratio (short for SNR), and accordingly a higher degree of accuracy would be achieved. Under normal pipe condition, the Q value is in the range 600-900, the higher the better. Causes for a lower Q value could be:

- (1) Interference of other instruments and devices such as a powerful transverter working nearby. Try to relocate the flow meter to a new place where the interference can be reduced.
- (2) Bad sonic coupling for the transducers with the pipe. Try to apply more coupling agent or clean the surface, etc.
- (3) Pipes are difficult to be measured. Relocation is recommended.

5.3.3 Total Transit Time and Delta Time

The numbers displayed on menu window M93 are called total transit time and delta time respectively. They are the primitive data for the instrument to calculate the flow rate inside the pipe. So the flow rate indication will vary accordingly with the total time and delta time.

The total transit time should remain stable or vary little.

If the delta time fluctuates higher than 20%, it means there are certain kinds of problems with the transducer installation.

5.3.4 Time Ratio between the Measured Total Transit Time and the Calculated

Time

This ratio would be used to check the transducer installation. If the pipe parameters are entered correctly and the transducers are installed properly, the value for this ratio should be in the range of 1003. If this range is exceeded, the user should check:

- (1) If the pipe parameters are correctly entered.
- (2) If the actual spacing of the transducers is right and the same as what the window M25 shows.
- (3) If the transducers are installed properly in the right directions.
- (4) If the mounting location is good and if the pipe has changed shape or if there is too much fouling inside the pipes
- (5) Other poor conditions.

VI. Main Accessories



- | | |
|--------------------------------------|----------------------|
| 1. Host | 2. Transducer |
| 3. Belt | 4. Special cable 5m* |
| 5. Data line | 6. Charger |
| 7. High strength protection box | 8. One roll of ruler |
| 9. Ultrasonic special coupling agent | 10. Document |

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