UVM-2

Ultrasonic Velocity Meter

ULTRASONIC ENGINEERING CO., LTD.
https://www.cho-onpa.co.jp/english.html

Ultrasonic Velocity Meter UVM-2

This instrument is designed for measuring the Young's modulus and sonic velocity and the concentration by transmitting ultrasonic pulses through metals, ceramics, single crystals, plastics and other various materials by using the "sing-around" technology.
This technology enhances the measuring accuracy by means of the "sing-around" of ultrasonic pulses. This measuring instrument digitally displays the sonic velocity of testpieces quickly with high accuracy by the method of eliminating the influence of the reverberation of multiple-echoes which disturb the sing-around and the zero cross time detection circuit.

The advantages

✓ **High accuracy.**

✓ **Non-Destructive Testing.**

✓ **Designated by JIS Z 2353.**

✓ **Simple to use.**

Applications

- Fused silica
- Ceramics
- Plastics
- Metals
- Rubber materials
- Acoustic lens
- Backing material
- Acoustic matching layer

Main functions

- Longitudinal wave velocity
- Young's modulus
- Shear modulus
- Shear wave velocity
- Poisson's ratio
- Bulk modulus

Measurement principle

Measuring sequence is as follows: Ultrasonic pulse oscillation-Transmitting probe-Testpiece-Receiving probe-AGC amplifier-Zero cross time detection-Multiple delay-Synchronizing pulseoscillation-return to Ultrasonic pulse oscillation.Such repetitive sequence is taken place in the closed circuit.(The sequence is called “SING AROUND”.) Fig.1
By measuring the average periods of N-times of this sing-around loop, theN-times measuring accuracy is obtainable and thehigh-accuracy propagation time measurement is feasible,basing on the principle of the periodic measurements.
The sing-around period is digitally displayed and the sonic velocity is calculated from the period and testpiece length.

Fig. 1

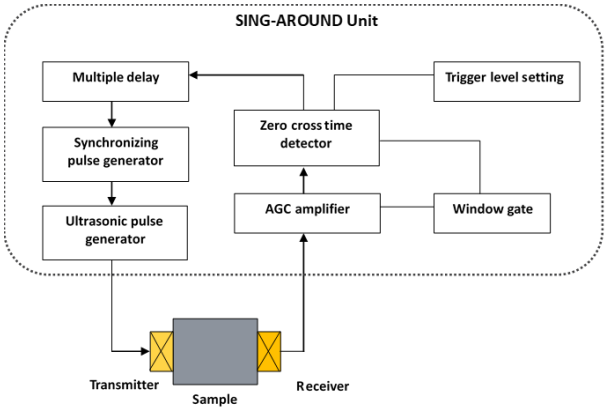
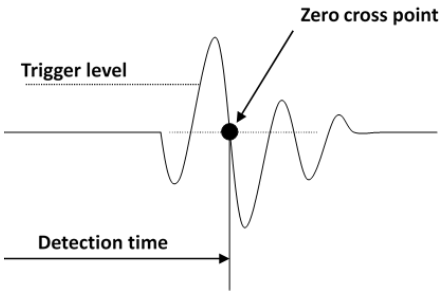


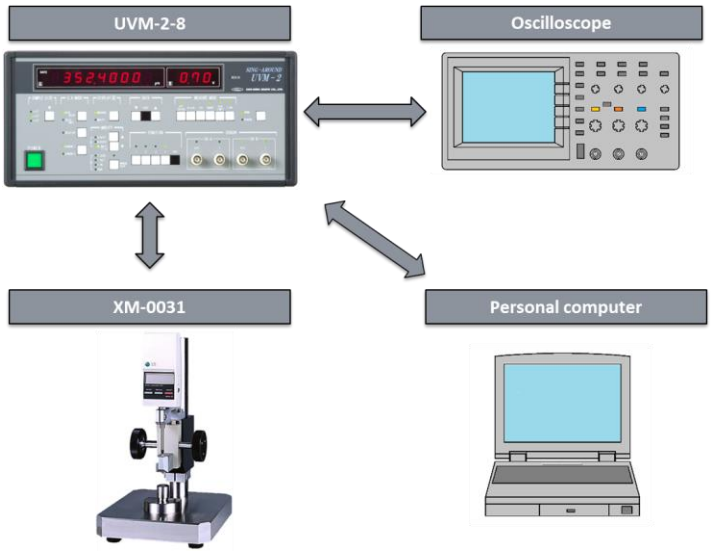
Fig. 2



Features

AGC amplifier	“AGC amplifier controls” the peak voltage of receiving signals selected by the window gate to keep constant.
Zero cross time	“Zero cross time detection circuit” initially selects a wave passing over the trigger level among amplified receiving waves, and then signals the time of the selected waveform crossing the zero voltage.
Multiple delay	“Multiple delay circuit” delays the synchronizing pulse generation until multiple-echoes in a testpiece are attenuated.
Phase inversion	“Phase inversion circuit” alternates the polarity of the receiving pulse wave.It selects the polarity that shows better build-up characteristics.

Configuration



Formulas

V_L =Longitudinal wave velocity
V_s =Shear wave velocity
ρ =Density

Shear modulus ：$G=\rho V_S$
Bulk modulus ：$K=\rho(V_L^2-4/3V_S^2)$
Young's moduls：$E=3\rho V_S^2\ (V_L^2\text{-}4/3V_S^2)(V_L^2\text{-}V_S^2)\text{-}1$
Poisson's ratio ：$\sigma=1/2\ 〔1-\ \{(V_L/V_S)^2\text{-}1\}\ \text{-}1〕$

SPECIFICATION

■Sing-Around unit

Model	UVM-2-8
Transmission frequency	1MHz to 5MHz
Measuring mode	1-Probe and 2-Probe Methods
Multiple delay time	63.5μs×N (N=1 to 16)
Delay time stability	±1ns/min at 63.5μs
Display	Minimum 0.01ns (10,000 times average)
Output	Counter output 0.5Vo-p 50Ω USB interface
Ambient temperature	0 to +40°C, 90% RH max
Power source	AC100V±10%,50Hz/60Hz,30VA
Outer dimension	320(W)×150(H)×350(D) [mm]
Weight	Approx. 7 kgs

■MEASURING CELL

Model	XM-0031
Wave mode	Longitudinal wave,Shear wave
Frequency	1MHz to 5MHz
Ambient temperature	0℃～+40℃
Thickness readout value	Minimum 0.001mm
Outer dimension	200(W)×510(H Max)×180(D) [mm]
Weight	Approx. 12kgs

■Oscilloscope

Analog band	70MHz
Sample rate	1Gs/s
Record length	20k points
Channels	2

■Personal computer

OS	Windows10 Professional（64bit）
Software	Microsoft .NET Framework4

〔General caution〕

The velocities of solids are not constant as compared with liquids. An error of about ±100m/s is normally found in metals depending on differences of purity,machining and thermal treatment of the testpieces. The errors are far greater among other solids.

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