

PPMS Ultrasonic elastic constant measurement option



Quantum Design introduces PPMS Ultrasonic option developed as co-development work with Iwate University Japan. The Ultrasonic option can measure elastic constant through special sample probe using ultrasonic sound.

System composition

- 1. Main controller:** to generate ultrasonic and to detect changed value of ultrasonic
- 2. Cartridge type sample rod with transducer:** to apply ultrasonic to sample and to detect changed value from sample (Measurement temperature: 1.9 to 300 K)
- 3. Application software:** to set parameters (selecting each parameter), to analyze detected ultrasonic and to calculate elastic constant

Features

- High accurate measurement (1 ppm acoustic velocity change) ^{*1}
- Data reading accuracy: 14 bit
- Very small foot print
- Two measurement modes for elastic constant:
 - » **Phase comparison method**
High accuracy measurement (relative accuracy 10^{-6}) for slow acoustic velocity change according to temperature and magnetic field
 - » **Orthogonal phase detection experimental method (ORPHEUS)**
High speed measurement (0.1 millisecond) ^{*2} For large acoustic velocity change according to temperature and magnetic field For transient acoustic velocity change ^{*3}
- Easy sample setting using cartridge-type sample holder
- All operation via PC with TCP/IP interface
 - » Setting frequency, repetition rate, pulse width, amplitude, gate position
 - » Remote control and monitoring possible by PC or tablet through internet ^{*4}

^{*1} Data example using the surface acoustic wave device (standard accessory enclosed)

^{*2} Suitable for repeat cycle of driving ultrasonic pulse

^{*3} Storage oscilloscope is required

^{*4} Software such as "Real VNC" is required

Specifications

Main controller

Measured physical quantity	<ul style="list-style-type: none"> ■ Relative acoustic velocity change ■ Ultrasonic attenuation coefficient
Ultrasonic oscillator	<ul style="list-style-type: none"> ■ Pulse method ■ Frequency: 10 MHz to 160 MHz ■ Pulse width: > 0.05 microsecond ■ Repeat cycle : 500 Hz to 50 kHz
Absolute velocity measurement method	<ul style="list-style-type: none"> ■ Pulse echo method ■ Phase rotation method
Velocity change measurement method	<ul style="list-style-type: none"> ■ Phase comparison method ■ orthogonal phase detection experimental method (ORPHEUS)
PC interface	TCP/IP

Cartridge type sample rod with transducer

Measurement method	Ultrasonic transmission method /reflection method
Electroacoustic transducer	LiNbO ₃
Basic frequency	<ul style="list-style-type: none"> ■ Longitudinal wave: 30 MHz ■ Transverse wave: 19 MHz ■ According to sample status, odd harmonic of the fundamental ultrasonic wave possible
Sample size	1 mm to 10 mm
Application software based on National Instruments' LabVIEW run-time version (installation of LabVIEW run-time version is required)	
Setting items	Frequency, phase, repetition rate, pulse width, amplitude, amplification, gate position