



# Elastic Modulus and Internal Friction Meter

Nihon Techno-Plus Corp. (Nihon=Nippon)

Main product is the Elastic Modulus and Internal Friction Meter. These systems can measure Young's modulus(E), shear modulus(G), Poisson's ratio( $\nu$ ), internal friction(Q-1) and others in wide range of sample form and temperature.

NTP is not only a maker, but also a laboratory of measurement methods for physical properties of materials. We have been studying on the materials properties, measurement methods and sensing technology at professional conferences and symposiums. NTP has developed many kind of instrument and we understand the features and characteristics of each measuring method.

Then we would recommend the high performance measuring system or assemble as customer's requirement of measurement conditions. Each device has characteristic features in precision, frequency range, sample form, sample dimension, sample handling and others. Measuring heads of each device are been able to add another device as optional attachments at the installation or later. The system-up gives you momentary measurement of many kinds of measuring conditions, material and its dimension. Using different measuring methods, researcher may get different information for material analysis and will be able to avoid mistakes to observe counterfeit wave in abnormal vibrations from complex sample.

Now, we are growing up to the "Total Measurement System Solution Provider" of Elastic Modulus and Internal Friction.

"Series" in this description means having the following types :

"-RT" : room temperature "-HT": high temperature, "-LT" low temperature "LHT": from Low temperature to high  
These specifications are limited to standard sample.

## **EG-series : Multi-function meter with easy operation for high dumping material in wide range of temperature (patented)**

This device gives you many types of measurement items at the same time and easy operation for material in high dumping states by using cantilever method.

The cantilever method has a little error by sample holding portion, but it has the great merits. This device can measure many types of items, E, G, and Q-1 by bending and shearing using cantilever method, then Poisson's ratio is calculated by E and G. And this device has probabilities as using for creep test, measurement of thermal expansion and others. They are available as options.

The other advantage is easy operation for measurement in hard vibration states of material. These states appear in high temperature range or high dumping materials in room temperature as solder, resin, brick and so on, because cantilever type has high power for driving vibration.

Otherwise hard vibration materials have many counterfeit peaks. This method can erase these peaks and only gives basic peak. Then you can easily get data in high temperature range by using EG-HT.

Principle	: Resonant Method with Cantilever Bending & torsion mechanism
Items	: E, G, Poisson's ratio and Q-1 with bending and twisting
(options)	Thermal Expansion, Creep Test and Others
Temperature	: RT~1200K (Max 100K~1500K)
Frequency	: 8Hz ~ 400Hz
Materials	: Metal, Ceramics, Polymer, resin, Glass, brick & others
Sample Form	: Plate 1~2.5mmT, 2~10mmW and 50~70mmL Bar 1~2.5mmD and 50~70mmL Above is standard. Limit is depend on sample materials
Meas. Condition	: Temperature, Strain and Time depending
Feature	: Easy operation in hard vibration states of material
Types	: EG-HT, EG-UHT, EG-LH



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### **JE-series : Young's modulus and internal friction using free vibration method (patented)**

The Free Vibration method is widely used for long time. JE-series has no contact driving and detection by setting at non-vibration node and developing wide range active electronic circuit. JE-RT gives you higher precision, higher repeatability, easier sample setting and wider range of sample form and dimensions. You can measure plate, wire, rod, cylindrical bar and others by using this device.



Standard specification range of plate sample dimension with JE-RT is 1~15mm-thickness, 1~15mm-width, 35~150mm-length. Range of rod is 1~15mm-diameter and 35~150mm-length.

Frequency is wide too. Range of standard spec. is 500Hz~20KHz, and this range is been able to shift up or down as option. The 0.2mmT\*30mmL of Si-wafer plate can be measured by standard JE-RT which thickness is out of standard spec. We have measured Young's modulus of 0.6mm thickness stainless steel plate by standard JE-RT.

Sample setting is very easy by JE-RT in especial. Sample is put only on thin wire at two vibration node points. No disturbance for vibration of sample is in this device.

BUT you have to have attention about measurement in high temperature range as if you catch and select counterfeit vibration. Using JE-LHT or JE-LHT, sample dimension is limited by reason of temperature distribution.

Principle : Resonant method using No Contact Free Vibration mechanism  
 Items : E and Q-1 with bending  
 Temperature : RT (Max 100K~1270K)  
 Frequency : 600Hz~20,000Hz

Materials : Metal, Ceramics, Polymer, resin, Glass, brick & others  
 Sample (-RT) : plate 0.8~5mmT, 1~15mmW and 35~140mmL  
 Bar 0.8~15mmD and 35~140mmL

(options) Above is standard. Limit is depend on sample materials  
 Available for Pipe, Triangle bar and other bar with uniform section  
 Features : highest precision and repeatability and easy sample setting

Wide range of sample form and dimensions  
 Attention about measurement in high temperature range  
 Types : JE-RT, JE-HT, JE-LT, JE-LHT



### **JG-series : Shear modulus and internal friction using free vibration method (patented)**

The advantages and features of JG-series are same as JE-series except sample dimensions. It can measure plate only. Minimum width is 5mm. It is the narrowest in case of using free vibration system. Sample handling of JG-RT is easier than JE-RT.

In general, JG-series is used as attachment of JE-RT and other devices and it is used for G-calibration and/or calculation of Poison's Ratio.



### **TE-series : Young's modulus and internal friction for thin plate and thin wire using cantilever type**

This cantilever type device was designed for measuring Young's modulus and internal friction of thin plate and thin wire. By free vibration method, thin plate and thin wire has many complex vibrations. Then it is difficult to determine the 1<sup>st</sup> vibration mode. This device uses cantilever type for node fixture, then you can easily get 1<sup>st</sup> mode vibration.

According to our experiments, we can measure the size of down to 0.03mm diameter Au-wire and 0.03mm thickness ribbon of metallic glass.

Our development of the high temperature driver and detector for vibration makes to be able to measure in wide temperature range.

Principle : Resonant Method with Cantilever Bending mechanism  
 Items : E, and Q-1  
 Temperature : RT~800K (Max 100K~1000K )  
 Frequency : 8Hz ~ 400Hz  
 Sample : Ribbon 0.03~0.8mmT, 2~10mmW and 30~50mmL  
 Wire 0.03~0.8mmD and 30~50mmL

Above is standard metal. Limit depends on sample materials.  
 Down to 0.5mmT in case of high polymer or resin.





Materials : Metal, Metallic glass, High polymer, Resin and so on  
 Meas. Condition: Temperature, Strain and Time depending  
 Feature : Easy operation in hard vibration states of material  
 Types : TE-RT, TE-HT, TE-LT, TE-LHT

**CC-series : Elastic moduli for single crystal using piezoelectric cube resonant method**

Single crystal has anisotropic construction. Many resonance vibrations appear from each face of single crystal. After detection of these peaks in wide range of frequency, an assemble of frequencies is determined and calculated as stiffness coefficients of each face by the computer software.

Sample is rectangular form in several mm dimensions and it's face direction and crystal direction are fit as same as possible.

Principle : Cubic Resonant Method  
 Items : E and G  
 Temperature : RT~1000K (Max 100K~1200K )  
 Frequency : 100KHz ~ 2.5MHz  
 Sample : Rectangular each 4~10mm of 3 dimensions  
 Sample edge direction and crystal mirror direction are fit in 1 degree.  
 Materials : Single Crystal  
 Meas. Condition: Temperature depending  
 Feature : single crystal  
 Types : CC-RT, CC-HT, CC-LT, CC-LHT



**MS-series: Mechanical Spectrometer by Internal Friction with forced vibration method**

The measurement principle is "Forced Vibration method", that can provide reliable date, because this measures internal friction by changing frequency at fixed temperature. Resonant vibration method is widely used for internal friction measurement, this measures it by changing temperature, and the temperature changes may cause the inner movement of material. Researchers want to get the distribution of internal friction without temperature change. The device what he want is MS-series. The researcher can analyze and calculate easily with simple theory.

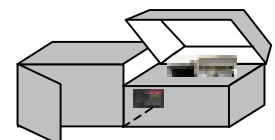
Principle : Torsion by Force Vibration method using cantilever pendulum mechanism  
 Items : Internal Friction (Q-1)  
 Frequency : 1mHz ~ 10Hz (Max 0.1mHz~10Hz)  
 Temperature : RT ~ 800K (Max 100K~1100K)  
 Meas. Condition: Frequency and Temperature depending  
 Materials : Metal, Ceramics, Polymer, resin, Glass, brick & others  
 Sample : Plate 0.2~1.5mmT, 1~5mmW, 30~60mmL  
 Bar 0.2~1.5mmD, 30~60mmL  
 Resolution : 0.0001 of Q-1  
 Output data : Raw Data Data processing is selected by user.  
 Types : MS-RT, MS-HT, MS-LT, MS-LHT



**VH-series : Ultra High viscosity Meter (patented)**

For the measurement of the viscosity higher than  $10^8$  Pa.s, the beam bending method is used commonly. However, it is thought that the viscous deformation in this method is not theoretical and it could not give correct values of viscosity. The ultra high viscosity meter "VH-series" realizes the ideal shear deformation on a cubic sample and it could give correct values of  $10^8 \sim 10^{14}$  Pa.s with high sensitivity.

Principle : Shear deformation  
 Items : High Viscosity by Shear Stress  
 Range :  $10^8$ Pa.s~ $10^{14}$ Pa.s  
 Condition : Room Temperature~100°C  
 Sample : Soft metal, Pb, Solder, Glass and others  
 Shape :  $10 \times 10 \times 10 \text{ mm}^3$   
 Types : VH-RT, VH-HT





## Portable EMAR EM0707

EMAR (Electro-Magnetic Acoustic Resonance) drives the ultra sonic in the metal and detect the signal without contact. Then, EMAR can be used to inspect and measure the materials with stain, erosion, paint and/or other materials on the surface. It means EMAR is useful for plant maintenance instead of ultra sonic devices with piezo-transducer.

But power unit of EMAR was very large and heavy. EM0707 have developed as portable EMAR for first time in the world by us. EMAR consist of EMAT (T=Transducer) as sensing head and electric power unit. There are many types of EMAT. Each EMAT has unique functions. They are developed by Hirao-Ogi lab. of Osaka University shown in following URL.

[http://www-ndc.me.es.osaka-u.ac.jp/pmwiki\\_e/index.php?n=Main.EMATs](http://www-ndc.me.es.osaka-u.ac.jp/pmwiki_e/index.php?n=Main.EMATs)

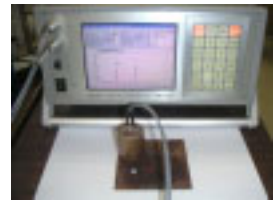
Now, we are recommending it to users for thickness and or scale measurement of pipes, tanks and others in spots of plants. We are developing the applications for inspections of fatigue, stress, abrasion, scale thickness and functions of metals.

Frequency : 500kHz~5MHz with 1kHz step in minimum

Size : EMAT=38mm diameter X 40mm

Power & Control unit with Computer= 370mmWx200mmHx280mmD 7kg

Power Supply : 0.3kVA AC



## Other PRODUCTS

### Fuel Cell → Current distribution of the flat area of Fuel Cell

In the Electric of fuel cell, it is very important to know the distribution of chemical reaction depend on conditions of gas flow and other factors. This instrument can be realized the observation by using NTP original magnetic sensors with very small size (1mmφ × 3mmL) and high sensitivity (10<sup>-3</sup> gauss). This is made on the specification of measuring mechanism by customer's requirement



### Flat Panel Display → Special ordered devices for inspection of LCD functions and optical systems

In the development of Flat display panel, many kinds of test items have to research their performance and qualities.

They are made by ordering from researchers of LCD maker.



### Imaging Pattern Detector unit for X-ray Diffraction System TRY-IPX

Imaging Plate system for Laue pattern and Debye-Scherrar pattern.



### Medical → Inspections, Alarms, Monitors and others

Alarm system are required by doctors and medical engineers. Now, we collaborate as some projects with doctors and/or medical engineers of universities and laboratories.

One example of results is the emergency call unit for hospital utility.



## Company Profile

### NTP Mind is "A wealth of Heart and Excellent Technologies"

Nihon Techno-Plus Corp. (NTP), a venture company in Japan established in 1989, has been challenging new needs from customers of the frontier science and engineering with flexibility.

To realize them and to offer good products, we study at professional conferences and symposiums, and all of our members share the information, the experimental results and discuss the developments with professional advisers. The jobs in our company are same as the studies, not labor.

At the same time, we want to make society better and to be a good corporate citizenship. We are trying to get the satisfaction of the conditions of company for our members, and we are going to get the volunteer spirits and to practice its activities for society as company minds.



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