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Discover Precision



# Sine-Wave Vibro Viscometer

A closer look at A&D's SV series Viscometers and what makes them a revolution in viscometry.



# Viscometer: What is it?

A Viscometer is an instrument used to measure the viscosity of a liquid. The Viscosity of a fluid refers to the measure of its resistance to deformation. For liquids it corresponds to the informal concept known as the "thickness".





When measuring viscosity, researchers face a number of challenges when utilising commonly used viscometers such as

- **Falling-Ball Viscometer**
- **Cup Type Viscometer**
- **Capillary Viscometer**
- **Rotational Viscometer**

These obstacles can waste the users time as well as impact the ability to measure accurately.



# Challenges Faced By Researchers

## Rotational Viscometer:

Requires several kinds of rotors in order to cover a wide range of measurements.

The measurement range of a single rotor is narrow, therefore the continuity of a measurement will be disturbed and lost when exchanging rotors.

The measurement accuracy is guaranteed only for the full scale, and then errors in measurement are inevitable in the lower viscosity range.

In worst cases, accurate viscosity may not be obtained because viscosity varies accompanied by the gradually rising temperature of a sample after starting the measurement in both lower and higher viscosity ranges. This happens because, in lower viscosity ranges, a larger rotor is required to detect torque more than at a certain level, and, in higher viscosity ranges, a great quantity of kinetic energy caused by a great frictional force is exerted on the rotor.



# Challenges Faced By Researchers

## Capillary Viscometer:

You need to pay a lot of attention to the measuring operation, which requires many troublesome processes to achieve accurate measurement. For instance, special care is needed when cleaning the inside of the capillary viscometer; before measurement you need to perform ultrasonic cleansing a few times using a cleaning liquid such as benzene and then dry, followed by another ultrasonic cleansing with acetone and then dry, and finally rinse out using purified water and then dry.

Temperature control is also essential because glass is susceptible to thermal expansion/contraction under the influence of temperature, especially in lower viscosity ranges, and it may cause grave errors in measurement. Therefore, measurement requires a lot of care and quite troublesome processes. Besides that, you must measure the density of the measuring sample beforehand because viscosity will be measured by calculating from the measured result acquired from kinetic viscosity.





# Challenges Faced By Researchers

## **Falling-Ball Viscometer:**

Unlike the Vibro viscometer or the rotational viscometer, the capillary viscometer or the falling-ball viscometer cannot continuously measure viscosity. It is also impossible to continuously output digital signals of viscosity coefficient or to control data.

## **Cup Type Viscometer:**

As well as the capillary viscometer and falling-ball viscometer, the cup type viscometer is not suitable for continuous measurement of viscosity because data as an electrical signal is difficult to obtain for this measurement.



# The Vibro Viscometer

With a Vibro Viscometer two thin sensor plates are immersed in a sample. When the spring plates are vibrated with a uniform frequency the amplitude varies in response to the quantity of the frictional force produced by the viscosity between the sensor plates and the sample.

The Vibro Viscometer controls the driving electric current to vibrate the spring plates in order to develop uniform amplitude. Since the frictional force of viscosity is directly proportional to the viscosity, the driving electric current for vibrating the spring plates with a constant frequency to develop uniform amplitude is also directly proportional to the viscosity of each sample.

The machine measures the driving electric current to vibrate the sensor plates with a uniform frequency and amplitude, and then the viscosity is given by the positive correlation between the driving electric current and the viscosity.

A&D's Vibro Viscometer SC series is designed for sensitive measurement of viscosity providing a wide dynamic range and high resolution by vibrating with a frequency of about 30 Hz equivalent to the eigenfrequency (Resonance) of detection system. As a result, the SV series can determine dynamic ranges of viscosity measurement as wide as from 0.3 mPa\*s to 10,000 mPa\*s with SV-10 and from 1 Pa\*s to 100 Pa\*s with SV-100, and is capable of continuously measuring in these measurement ranges with excellent repeatability. The wide dynamic range enables the measurement of viscosity changes in thixotropic processes during which a liquid turns into sol from sol (colloidal solution), or in the curing processes of resin, adhesive or paint, which cannot be continuously measured with a conventional rotational viscometer.

*Sine-wave Vibro Viscometer*  
**SV-10/SV-100**



***Viscometry Revolution!***



**A&D** ...Clearly a Better Value  
A&D Company, Limited



# Sine-wave Vibro Viscometer

## Viscometry Revolution!

Newly developed Tuning-fork Vibration method\* promises you high accuracy and a wide measurement range without replacing the sensor plates!! (\* Patent pending)

Sine-wave Vibro Viscometer SV series measures viscosity by detecting the driving electric current necessary to resonate the two sensor plates at a constant frequency of 30Hz and amplitude of less than 1mm.

### Selectable Wide Measurement Range

Samples with very low viscosity to very high viscosity can be measured without changing the sensor plates, so a wide range of measurements can be made continuously.

(SV-10: 0.3mPa·s - 10,000mPa·s / SV-100: 1,000mPa·s - 100,000mPa·s)

### High Measurement Accuracy

The sine-wave Vibro Viscometer SV series, incorporating the innovative Tuning-fork Vibration Method, provides an excellent repeatability of 1% of reading for viscosity measurement.

### Temperature Measurement

It is very important to measure the temperature of the fluid correctly because the viscosity is very much dependent upon the temperature of the fluid. The SV series can detect accurate temperature immediately because the fluid sample and the detection unit (sensor plates) with small surface area/thermal capacity reach thermal equilibrium in only a few seconds.

### Real-time Measurement

The SV series sensor plate is very thin and small, both in area and in mass, which means that the sample is not adversely affected by temperature change. As a result, a stable viscosity measurement can be monitored in real-time.

### Non-Newtonian Sample Viscosity Measurement

Thin sensor plates allow little disturbance of sample texture and thus enable measurement of stable viscosity values.

### Sol and Gel Measurement

Sol and Gel sample fluid like starch can be measured during the change of material characteristic.

### Standard RS-232C Interface

The RS-232C comes as standard for your PC or Printer connectivity and the connection cable (25 pin – 9 pin) is also standard for your convenience.

### Flowing Sample Measurement

Even the viscosity of flowing samples can be measured, including liquid in turbulent flow, enabling field data measurement, which is as reliable as measurements in a laboratory.

### Vacuum Fluorescent Display

You can avoid unnecessary reading errors with an easy-to-read, large, clear display: 13mm height for viscosity measurement and 11mm height for temperature measurement.

### JCSS (Japan Calibration Service System)

The SV series measurement method has been recognized in Japan by JCSS as an official viscosity measurement instrument, which meets JIS Q 17025 (2005) requirements (equivalent to ISO/IEC 17025: 2005). The SV series measurement method also complies with the Guide to the expression of uncertainty in measurement (GUM) and ISO/TR 3666 (1998) – Viscosity of water.

### Continuous Measurement

The SV series Tuning-fork Vibration Method does not disturb the sample fluid and allows measurement of cloud point of samples such as surface active agents and of surface/interface changes such as wettability due to its ability to measure a wide range without the need to replace the sensor plates.

### Viscosity Calibration

Using a Viscosity Standard, viscosity calibration can be easily done. 1 point calibration or 2 point calibration is selectable in the calibration mode.

### Data Collection and Graphing Software

WinCT-Viscosity (RsVisco) software transmits viscosity and temperature measurement data to a PC and displays it on a graph in real-time.

### Small Sample Size

The standard sample cup requires just over 35ml of sample fluid so there is very little waste. (Optional 10ml/13ml sample cups are also available.)

### Easy Cleaning

Due to their simple structure, the SUS 304 stainless steel sensor plates and temperature sensor (all gold-plated) and SUS 304 stainless steel protector can be quickly and easily cleaned.

### Foaming Sample Measurement

A low drive frequency of 30Hz allows measurement of foaming samples without breaking minute foams and with less influence scattering larger foams.

### Separated Type Model

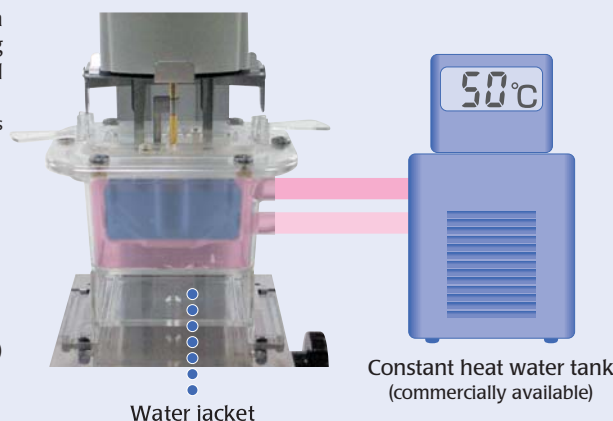
The SV-10 series is composed of a Display Unit and a Main Unit offering excellent placement flexibility.

## Sample Temperature Control

Our water jacket (AX-SV-37) (optional) used in conjunction with a commercially available constant heat water tank to heat the circulating system, ensures that the sample remains at a constant temperature and that the temperature can be changed for viscosity measurement.

(A small sample cup AX-SV-34 and a glass sample cup AX-SV-35 are available, as optional accessories.)

- AX-SV-37 Application of temperature control of sample fluid
  - Water jacket (body: polycarbonate, packing: silicon gum)
  - Small sample cup & lid (4 of each provided)
  - Can be used with the small sample cup provided, or with a glass sample cup (AX-SV-35)
  - Specifications
    - Application temperature range : 0°C – 100°C
    - Outer dimension of nozzle for circulation : 10.5mm diameter
    - Recommended hose : silicon tube, inner measurement 8mm diameter
  - Additionally, a commercially available constant heat water tank is necessary
  - A stirrer can be set at the base of the water jacket, and can stir up to a viscosity of 1,000mPa·s. (SV-10 only)
- Stirrer: VARIOMAG MICRO made by H+P Labortechnik (Germany)  
Please use a rotator with dimensions 6mm (length) x 4mm (diameter).



Water jacket

Constant heat water tank  
(commercially available)

# SV-10/SV-100

## SV-10

0.3mPa·s–10Pa·s\*  
(0.3–10,000mPa·s)

## SV-100

1–100Pa·s  
(1,000–100,000mPa·s)

Sensor Unit



Corrosive-resistant gold-plated sensor plate

Only 35ml of sample needed

Corrosive-resistant gold-plated temperature sensor

### Display Unit

Easy-to-read VFD for viscosity and temperature.  
Only 6 keys for simple operation.



### Wide range

SV-10 0.3mPa·s–10Pa·s  
SV100 1–100Pa·s

Measurement begins approx.  
15 secs after pressing the [START] key

### Separated Display Unit

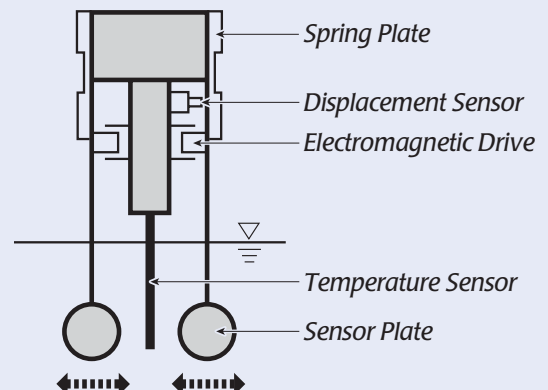
Main Unit and Display Unit for a variety of applications



## Measurement Principle for SV Series

The SV series has 2 thin sensor plates that are driven with electromagnetic force at the same frequency by vibrating at constant sine-wave vibration in reverse phase like a tuning-fork.

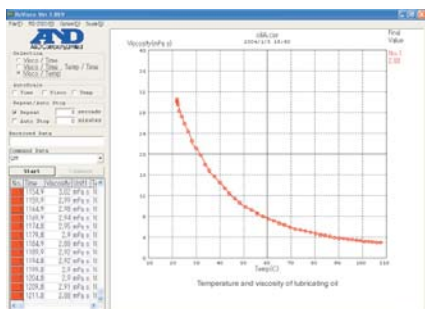
The electromagnetic drive controls the vibration of the sensor plates to maintain constant amplitude. The driving electric current, which is an exciting force, will be detected as the magnitude of viscosity produced between the sensor plates and the sample fluid. The coefficient of viscosity is obtained by the correlation between the driving electric current and the magnitude of viscosity.



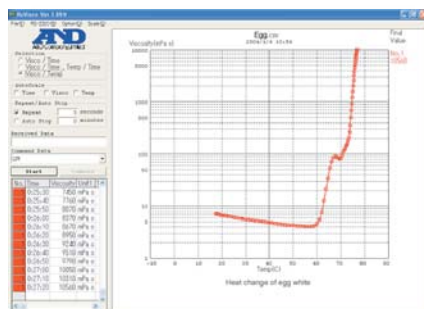
\*1,000mPa·s - 10,000mPa·s can be written also as 1Pa·s - 10Pa·s

# WinCT-Viscosity

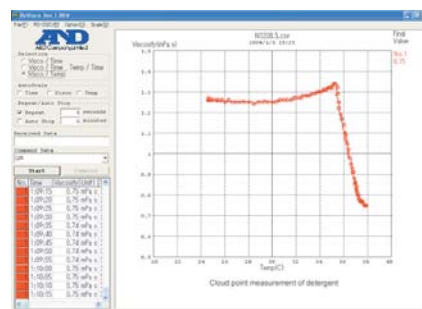
RsVisco software was developed for the transmission of real-time viscosity and temperature measurement results from the SV series to a PC. The results are displayed in a graph format with scaling conversion and logarithm display functions available. The user can save the measurement data as a "CSV" file and open it using RsVisco for future analysis of a sample.



Temperature and viscosity of lubricating oil



Heat change of egg white or Log display



Cloud point measurement of detergent

## Specifications

	SV-10	SV-100
Measurement Method	Sine-wave Vibro Viscometer using Tuning Fork Vibration Method	
Vibration Frequency	30Hz	
Viscosity Measurement Unit	mPa·s, Pa·s, cP, P	Pa·s, P
Viscosity Measurement Range	0.3mPa·s – 10Pa·s (0.3 – 10,000mPa·s)	1 – 100Pa·s (1,000 – 100,000mPa·s)
Accuracy	1% of Repeatability (S.D., 20 – 30°C, No condensation)	
Operating Temperature	10 – 40°C (50 – 104°F)	
Minimum Sample Amount	Standard Sample Cup (35ml-45ml), Optional Small Sample Cup (10ml), Optional Glass Sample Cup (13ml)	
Temperature Measurement	0 – 160°C / 0.1°C (32 – 320°F/0.1°F)	
Display	Vacuum Fluorescent Display (VFD)	
Interface	RS-232C	
Power Supply	AC Adaptor	
Power Consumption	Approx. 14VA	
Physical Dimensions	Main Unit : 332 (W) x 314 (D) x 536 (H) mm / Approx. 5.0 kg Display Unit : 238 (W) x 132 (D) x 170 (H) mm / Approx. 1.3 kg	
Connection Cable Length	1.5m ( Between the Main Unit and the Display Unit )	
Standard Accessories	Manual , AC Adaptor , CD-ROM ( WinCT-Viscosity ) Sample Cups , RS-232C Cable ( 25 pins – 9 pins )	

## Accessories



**Small sample cup (10ml)**  
Used when measuring small volume samples



**Glass sample cup (approx. 13ml)**  
Used when measuring solvents, etc.



**Water jacket**  
Used to keep the temperature of the sample constant, or to change the temperature. A constant temperature water tank is also necessary.



**Positioning stopper**  
Used to set the sensor unit and sensor plates to a uniform height when making repeated measurements.

- AX-SV-33 Sample cup (PC [polycarbonate], volume 35ml – 45ml) Same as container that comes as standard with the SV unit. Set of 10 pcs
- AX-SV-34 Small sample cup (PC [polycarbonate], volume 10 ml) Set of 10 pcs Set of 10 lids included
- AX-SV-35 Glass sample cup (volume approx. 13ml)
- AX-SV-36 Positioning stopper
- AX-SV-37 Water jacket (body: polycarbonate, packing: silicon gum), with 4 sets of small sample cup and lids
- AX-SV-38 Glass sample cup (volume approx. 60ml) Set of 10 pcs
- AX-SV-42 Analogue voltage output (0 – 1V)
- AX-SV-43 Extension cable (5m) to connect measuring unit to display unit
- AD-8121B Compact printer

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# Get In Touch

If you are interested in learning more, would like to purchase or wish to request a demonstration of the A&D Sine-Wave Vibro Viscometer

**Call us on:**

**01865 750375**

**OR**

**Email us at:**

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