SV-10
SV-100

Vibro Viscometer

INSTRUCTION MANUAL

A&D Company, Ltd.

1WMPD4000646G

The contents of this manual and the specifications of the instrument covered by this manual are subject to change for improvement without notice.

CONTENTS

1. INTRODUCTION

This manual describes how the SV series viscometer works and how to get the most out of it in terms of performance.

Read this manual thoroughly before using the viscometer and keep it at hand for future reference.

1-1 Compliance

Compliance with FCC Rules

Please note that this equipment generates, uses and can radiate radio frequency energy. This equipment has been tested and has been found to comply with the limits of Class A digital devices pursuant to Part 15 of FCC rules. These rules are designed to provide reasonable protection against interference when equipment is operated in a commercial environment. If this unit is operated in a residential area, it may cause some interference and under these circumstances the user would be required to take, at his own expense, whatever measures are necessary to eliminate the interference. (FCC = Federal Communications Commission in the U.S.A.)

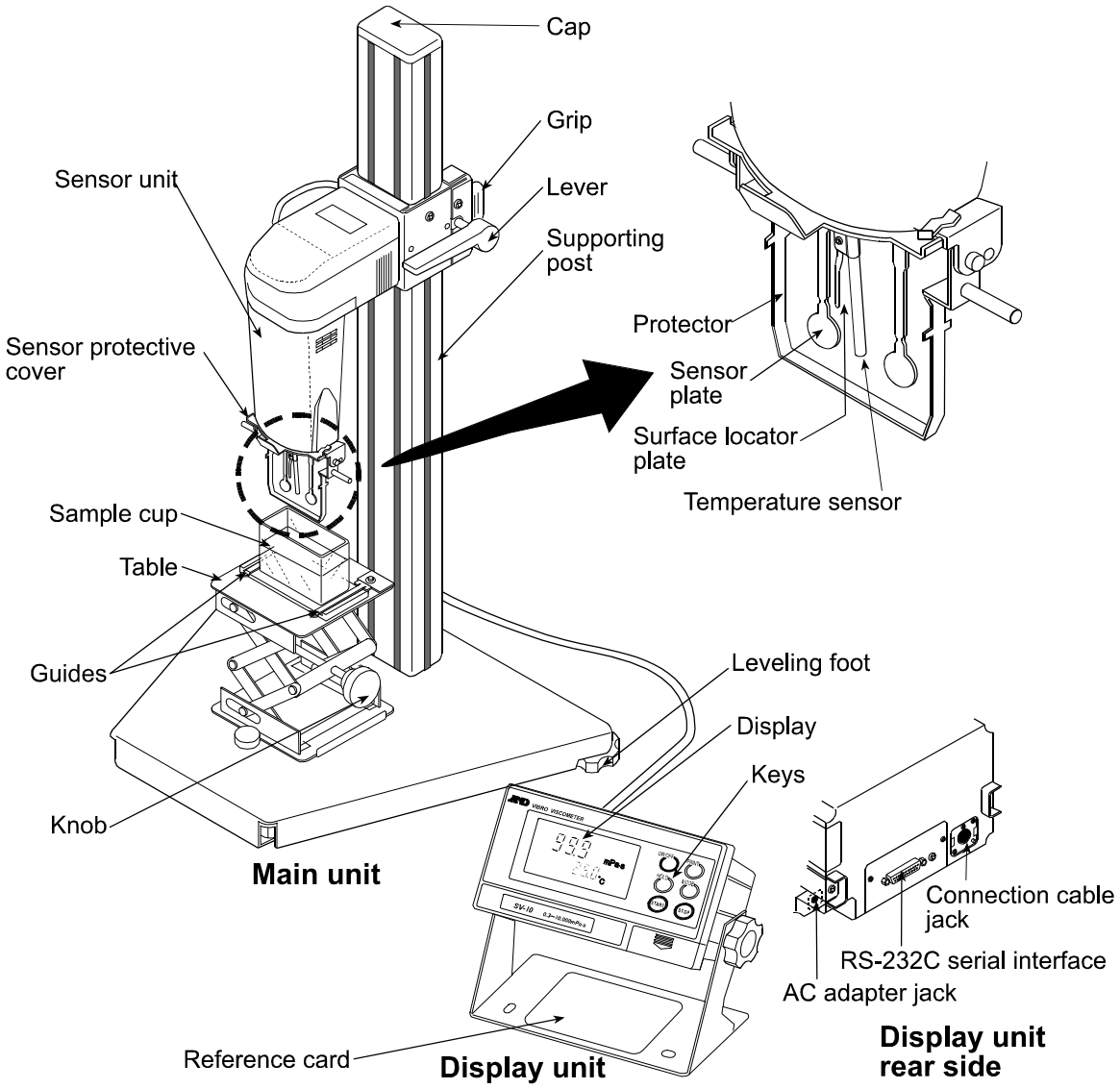
1-2 Features

- High accuracy
  The Sine-wave Vibro Viscometer achieves a high measurement accuracy of 1%*1 (repeatability) over the full range.
  *1 Refer to "15. SPECIFICATIONS" on page 61.
- Wide range continuous measurement
  Continuous measurement over the whole measuring range is possible, without replacing the viscosity detection sensor plates.
- Standard temperature sensor
  The temperature sensor to measure the sample temperature is installed as standard. The temperature sensor is located between the two sensor plates. So, the accurate detection of the relation between temperature and viscosity is possible.
- Accurate measurement
  Due to the low heat capacity of the viscosity detection unit (sensor plates and temperature sensor), the time required for temperature equilibrium is short. Thus, the sample viscosity can be measured accurately in a short time.
- Long continuous measurement time
  The sensor plates, with a low frequency of 30 Hz and an amplitude of less than 1 mm, apply very little load to the sample. So, the viscometer can continuously obtain stable viscosity values without causing a temperature rise or damaging the sample.
- Measurement of a non-Newtonian fluid/foaming sample
  The thin sensor plates allow little deformation of the sample texture. Thus, non-Newtonian fluid can be measured in a stable way. And, foaming samples can be measured without breaking minute foam particles and with less influence scattering large foam particles.
  When measuring tap water, bubbles may accumulate on the sensor plates, increasing the viscosity.
- Measurement of a flowing sample
  The two sensor plates oscillate in the opposite direction. So, even when a sample is in motion, errors are eliminated. This allows measurement of a sample while being stirred. The viscometer can be used for a flowing product line, which enables field management with identical data used at the laboratories.
- Calibration
  The viscometer can be calibrated using a standard viscosity fluid or a sample of a known viscosity. Calibration allows the viscometer to maintain the accuracy constantly.
  By calibrating an actual sample, using the viscosity value obtained by another type of viscometer as a correction value, the measurement data obtained by the SV series viscometer can be combined into those obtained by the other type of viscometer.
- Simplified calibration when measuring the viscosity near 1 mPa·s, (SV-10 only)
  Simplified calibration using purified water is a one-key operation. The SV-10 has a built-in function to measure the temperature of the purified water using the temperature sensor and calculates the viscosity value of the purified water at that temperature.
  At this time, be careful not to influence the viscosity value by generating bubbles.
- Standard windows communication tools WinCT-Viscosity
  Windows communication tools WinCT-Viscosity (CD-ROM) is provided as standard. The CD-ROM contains the graphing program RsVisco, which imports the data to a personal computer and displays the results as a graph in real time. With RsVisco, changes in viscosity over time and temperature dependency of viscosity can be observed easily and the obtained data can be saved in files.

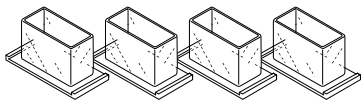
2. UNPACKING THE VISCOMETER

2-1 Unpacking

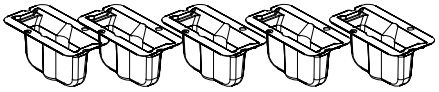
- The viscometer is a precision instrument. Unpack the viscometer carefully. Keep the packing material to be used for transporting the viscometer in the future.



Accessories



Sample cup
(Polycarbonate
Capacity: 45 mL, 4 pcs)



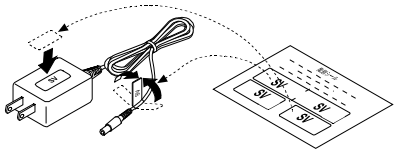
Disposable cup
(Polyethylene terephthalate
Capacity: 10 mL, 5 pcs)

Windows communication tools
WinCT-Viscosity (1 pc)

Note:
Affix the AC adapter labels to the AC adapter, as illustrated here.

Connection cable
(1 pc)

RS-232C cable (1 pc)
25P-9P for modem



AC adapter (1 pc)

AC adapter labels

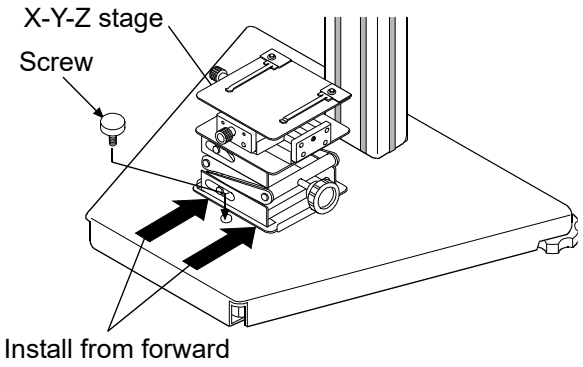
Note

- **Confirm that the adapter type is correct for the local voltage and power receptacle type.**
- **Use the dedicated AC adapter specified for the viscometer.**
- **Do not use the AC adapter provided with the viscometer for equipment with which the AC adapter may not be compatible.**
- **If you use the wrong AC adapter, the viscometer and other equipment may not operate properly.**

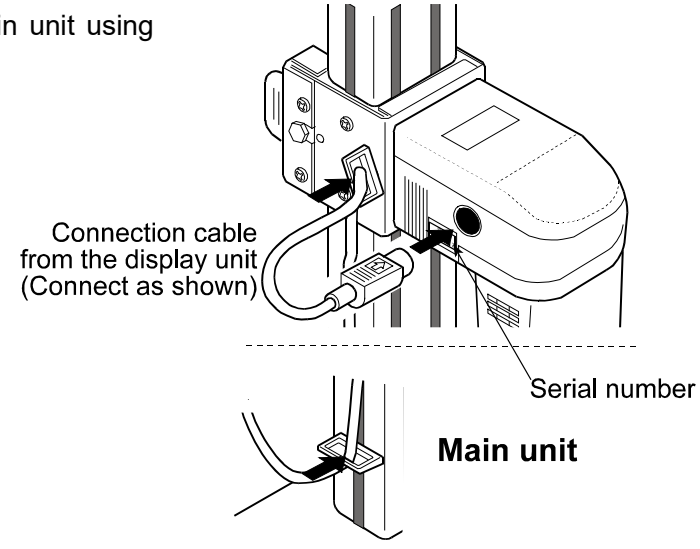
2-2 Installing the Viscometer

Note: When assembling, handle the sensor plates with care.

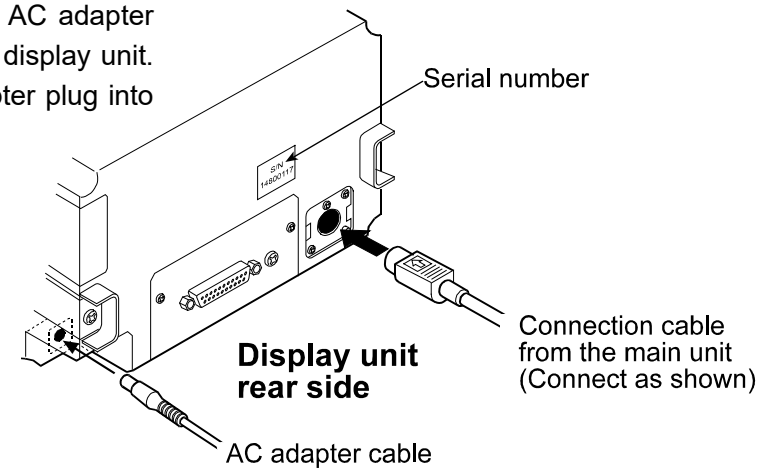
1 Remove the attachment screw from the base. Install the X-Y-Z stage along the guide ribs from forward of the base. Secure the X-Y-Z stage using the screw removed. (Confirm the direction of the X-Y-Z stage's knobs.)



2 Connect the display unit to the main unit using the connection cable.



3 Insert the AC adapter plug into the AC adapter jack located on the rear side of the display unit. Insert the other end of the AC adapter plug into an electrical outlet.

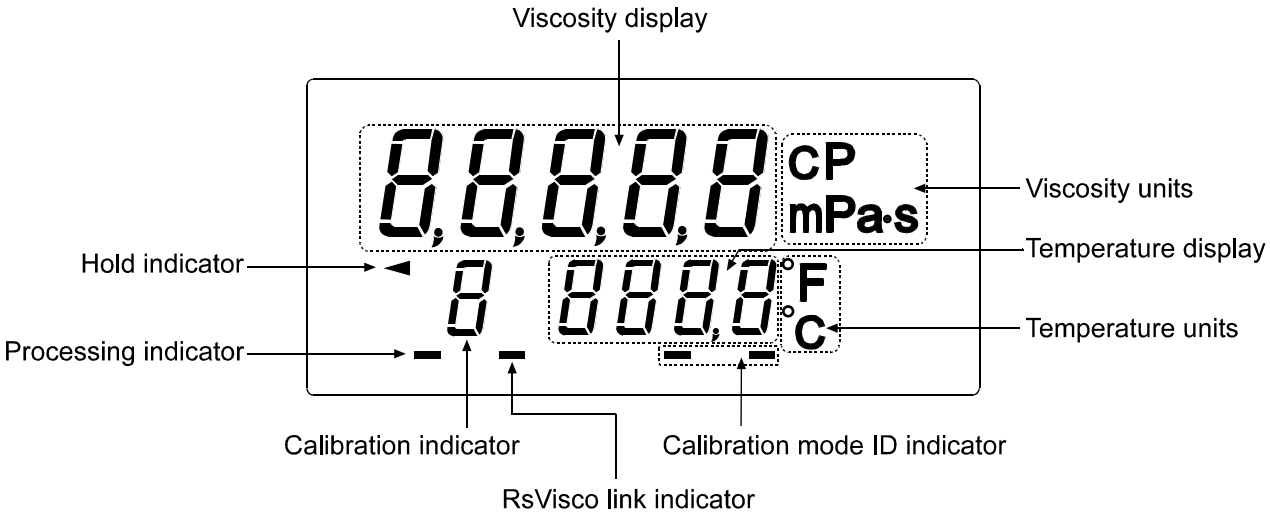


Note

- **Confirm that the adapter type is correct for the local voltage and power receptacle type.**
- **The main unit and the display unit have been adjusted in pairs. For accurate viscosity measurement, before use, confirm that the main unit and the display unit have the same serial number.**

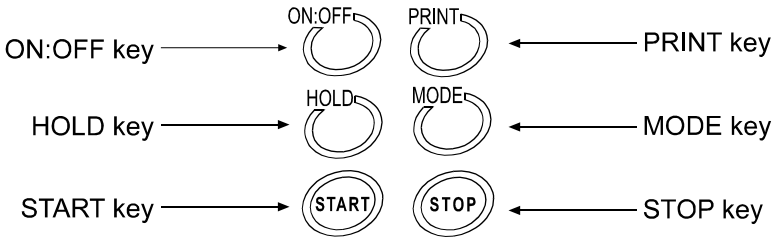
3. DISPLAY AND KEYS

3-1 Display



Name	Description		
Viscosity display	Standby mode	Displays [- - - - -].	
	Measurement mode	Displays the viscosity value in real time.	
	Data hold mode	Freezes the display of the viscosity value.	
Viscosity units	Displays the unit of viscosity.		
Temperature display	Standby mode	Displays the temperature value in real time.	
	Measurement mode		
	Data hold mode	Freezes the display of the temperature value.	
Temperature units	Displays the unit of temperature.		
Processing indicator	Blinks while the measurement is being performed. (While the sensor plates are in vibrating motion)		
Hold indicator	Illuminates while the viscometer is in the data hold mode.		
RsVisco link indicator	Illuminates while measurement is performed using RsVisco, the graphing program contained in the WinCT-Viscosity (CD-ROM).		
Calibration indicator	Displays " [" in the calibration mode.		
Calibration mode ID indicator	At one-point calibration		Blank display [ ]
	At two-point calibration	Inputting first point	Displays [-].
		Inputting second point	Displays [- -].

3-2 Keys



Key	Description
ON:OFF Power	Turns the power on and off. When the power is turned on, the viscometer enters the standby mode ([- - - - -] is displayed.)
START Start measurement	Start a measurement. (The processing indicator blinks.) Displays the viscosity and temperature values in real time during measurement.
STOP Stop measurement	Stops the measurement (The processing indicator is off) and freezes the display of the viscosity and temperature values at the time the STOP key is pressed during measurement. When the STOP key is pressed again, the viscometer enters the standby mode.
HOLD Data hold	Freezes temporarily the display of the measurement data (viscosity and temperature) at the time the HOLD key is pressed during measurement. (The hold indicator is on.) In the above condition, the measurement is continued. (The processing indicator blinks.) Pressing the HOLD key again releases the data hold mode. ∗1
MODE Change units	Changes viscosity units. ∗1 (By the function setting "Fnc 1", the measurement elapsed time can be displayed.)
PRINT Output data	Outputs the measurement data.

∗1 While the measurement is being performed using the graphing program RsVisco, the data hold mode using the HOLD key and unit changes using the MODE key are not available. RsVisco is contained in the accessory Windows communication tools, WinCT-Viscosity.

While data are being output continuously (function setting "Prt 2" or SIR command), the data hold mode using the HOLD key is not available.

3-3 Displaying the Viscosity Values

The viscosity values are displayed as below, depending on the unit selected and the viscosity range.

The correlation of the units are as follows: 1 mPa·s = 0.001 Pa·s = 1 cP =0.01 P

3-3-1 SV-10

Use the MODE key to switch between mPa·s (Millipascal second) and Pa·s (Pascal second), or between cP (Centipoise) and P (Poise).

The unit selected at the factory before shipment is mPa·s.

When the viscosity unit is mPa·s or Pa·s:

Viscosity measured	Unit selected							
	mPa·s				Pa·s			
mPa·s	Display	Minimum display	Unit	Remarks	Display	Minimum display	Unit	Remarks
1	0.30 | 1.00 | 9.99	0.01	mPa·s		0.0003 | 0.0010 | 0.0099	0.0001	Pa·s	Digit indicating 0.01 mPa·s is not displayed
10	10.0 | 99.9	0.1			0.0100 | 0.0999	0.0001		
100	100 | 999	1			0.100 | 0.999	0.001		
1000 | 10000	1.00 | 10.00	0.01	Pa·s	Switches to Pa·s	1.00 | 10.00	0.01		

When the viscosity unit is cP or P:

Viscosity measured	Unit selected							
	cP				P			
mPa·s	Display	Minimum display	Unit	Remarks	Display	Minimum display	Unit	Remarks
1	0.30 | 1.00 | 9.99	0.01	cP		0.0030 | 0.0100 | 0.0999	0.0001	P	
10	10.0 | 99.9	0.1			0.100 | 0.999	0.001		
100	100 | 999	1			1.00 | 9.99	0.01		
1000 | 10000	1 0.0 | 100.0	0.1	P	Switches to P	10.0 | 100.0	0.1		

3-3-2 SV-100

Use the MODE key to switch between Pa·s (Pascal second) and P (Poise).

The unit selected at the factory before shipment is Pa·s.

Viscosity measured	Unit selected			
	Pa·s		P	
Pa·s	Display	Minimum display	Display	Minimum display
1	1.00	0.01	10.0	0.1
	⏐		⏐	
	9.99		99.9	
10	10.0	0.1	100	1
	⏐		⏐	
	99.9		999	
100	100.0		1000	

4. PRECAUTIONS

To get the optimum performance from the viscometer and acquire accurate measurement data, note the following:

4-1 General Precautions

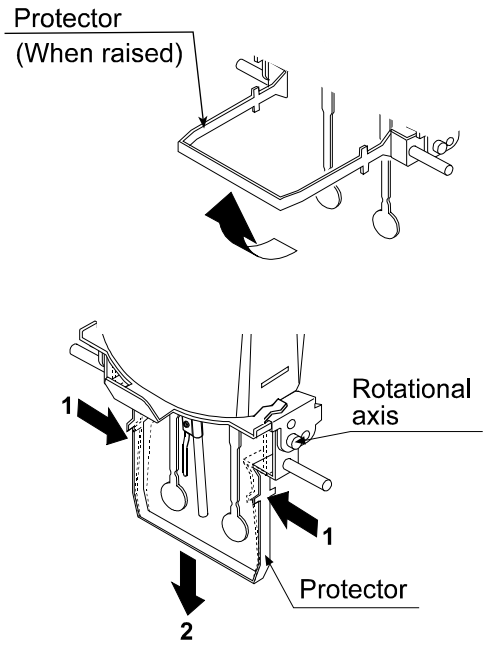
- Install the viscometer in an environment where the temperature and humidity are not excessive. The best operating temperature is 25°C±2°C at 45-60% relative humidity.
- For precise measurement, install the viscometer where there are no great changes in temperature and humidity.
- Install the viscometer where it is not exposed to direct sunlight and it is not affected by heaters or air conditioners.
- Install the viscometer where it is free of dust.
- Install the viscometer away from equipment which produces magnetic fields.
- The viscometer uses the Tuning-fork Vibration Method. So, use much care to avoid external vibration, especially when measuring low viscosity.
  Places where the viscometer is prone to vibration are:
  Second or higher floor, soft ground, near busy highways or rail lines.
  Avoid these places as a measuring site. If measurement is to be performed in such a place, use an anti-vibration table that is available as an option (AD-1671A).
- Protect the internal parts from liquid spills and excessive dust.
- Do not disassemble the viscometer.
- When precise measurement is required, acclimatize the viscometer to the measuring environment. After installation, plug in the AC adapter and warm up the viscometer for one hour or more.

4-2 During Use

- To level the surface of the sample; adjust the leveling feet so that the center of the narrow part of the right and left sensor plates is on the liquid surface.
- The viscosity of a liquid is temperature dependent and changes in accordance with the temperature change. In general, if the temperature rises, the viscosity value decreases about 2 to 10 percent per degree Celsius. Take changes in the liquid temperature into consideration for an accurate measurement.
- Be sure to calibrate using the standard viscosity fluid or purified water before measurement. In a measurement that takes a long time, perform calibration periodically, as necessary.
- Placing the sensor plates and the temperature sensor in the sample may change the sample temperature. For precise measurement, leave the sample as is for a while, after placing the sensor plates and the temperature sensor, to ensure no changes to the sample temperature. And then, start a measurement.
- Ensure a stable power source when using the AC adapter.
- Use only your finger to press the keys. Using a sharp instrument such as a pen may damage keys.
- The sample cup is made of polycarbonate (PC) and is not appropriate for organic solvents. When organic solvents are used as a sample fluid, use the glass sample cup (AX-SV-35) that is sold separately or a commercially available glass beaker.
- The protector can be raised or removed. So, even when a beaker is used, the viscosity can be measured with a small amount of sample.

How to remove the protector:

Press the left and right side frames lightly in the direction indicated as 1 to release the rotational axes. Pull the protector in the direction indicated as 2 to remove.



4-3 After Use

- Remove any residual sample material from the sensor plates, temperature sensor and protector using alcohol. Using the sensor plates, temperature sensor and protector with residue of an old sample left on will cause a measurement error.
  Clean the sensor plates carefully to avoid bending them.
  The sensor plates and the temperature sensor are made of stainless steel (SUS304). The surface is plated with 24K gold.

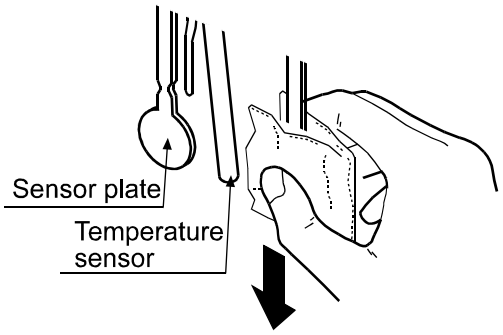
  Note

  Liquids with strong acidity may remove the gold plating and corrode the sensor plates and the temperature sensor.

  How to clean the sensor plates and temperature sensor

  Hold the sensor plate or temperature sensor with tissue paper. Move the tissue paper downward to remove the sample.

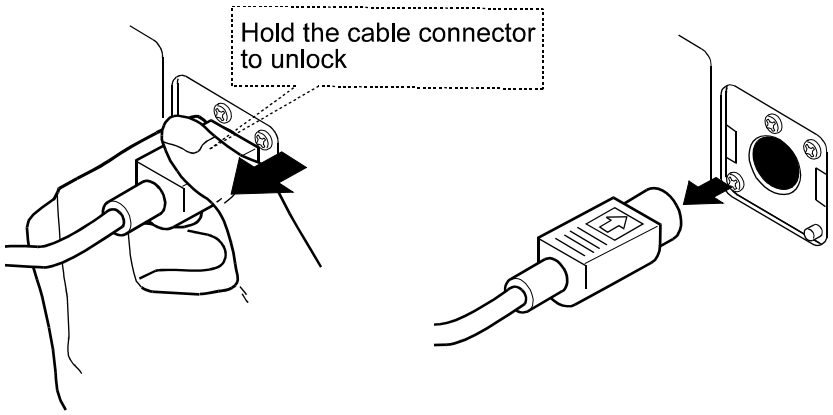
  Then, use tissue paper moistened with alcohol, to remove any residual sample material.



- Clean the sample cup as necessary.

- Unlock the cable connector before disconnecting the connection cable.

  How to unlock the cable connector



4-4 Measuring the Absolute Value of Viscosity

The SV Series Sine-wave Vibro Viscometer, as a measuring principle, detects the product of viscosity and density.

$$\text{Displayed viscosity value} = \text{Viscosity} \times \text{Density} \cdots\cdots [1]$$

While the displayed value has a unit of mPa·s, it indicates the product of viscosity and density.

Example (1) When a sample has an absolute value of viscosity of 2.00 mPa·s and density of 1.000:
Displayed value = 2.00 [mPa·s] × 1.000
= 2.00 [mPa·s]

(2) When a sample has an absolute value of viscosity of 2.00 mPa·s and density of 0.800:
Displayed value = 2.00 [mPa·s] × 0.800
= 1.60 [mPa·s]

Note

The density can be measured, using the density determination kit, AD-1653 in combination with a balance.

To obtain the absolute viscosity value precisely, do as follows:

4-4-1 At Measurement

Divide the displayed viscosity value by the sample density to obtain the absolute value of viscosity.

Example (1) Measure the sample and confirm the displayed viscosity value.

Here, 736 mPa·s as an example.

(2) Check the sample density at the temperature when the sample is measured.

Here, 0.856 as an example.

(3) Divide the displayed viscosity value by the sample density to obtain the absolute value of viscosity.

Here, 860 mPa·s is obtained as the absolute viscosity value.

$$\text{Absolute value of viscosity} = \frac{\text{Displayed viscosity value}}{\text{Sample density}}$$

$$= \frac{736}{0.856} \cong 860 \text{ mPa·s}$$

4-4-2 At Calibration

When calibrating, enter the product of the absolute viscosity value and the density of the standard viscosity fluid used for calibration, as a correction value.

The standard viscosity fluid has the calculation sheet of kinetic viscosity and viscosity at various temperatures attached. To obtain the correction value using this sheet, do as follows:

$$\text{Kinetic viscosity} = \frac{\text{Viscosity}}{\text{Density}} \qquad \text{From this, Density} = \frac{\text{Viscosity}}{\text{Kinetic viscosity}} \cdots [2]$$

$$\text{Correction value} = \text{Viscosity} \times \text{Density} \cdots\cdots [3]$$

When substituting [2] for the density in [3], the following equation is obtained.

$$\text{Correction value} = \frac{\text{Viscosity}^2}{\text{Kinetic viscosity}} \cdots\cdots [4]$$

Example 1: To calibrate the viscometer using a standard viscosity fluid:
Using the calculation sheet, calculate the value used for calibration.

(1) Check the kinetic viscosity and the viscosity at the temperature when the calibration is performed.

Here, 1011 mm^2/s for the kinetic viscosity and 889 mPa·s for the viscosity at 20°C as an example.

(2) Substitute the values above into equation [4].

$$\frac{889^2}{1011} \cong 781$$

781 mPa·s is obtained as a correction value used for calibration.

(3) After calibration, measure the viscosity of the standard viscosity fluid used and confirm that the viscometer displays the similar value as the correction value, 781 mPa·s in this example. This completes the calibration procedure.

Example 2: To calibrate using a standard viscosity fluid with known values of viscosity and density.
In this example, a standard viscosity fluid with a viscosity of 889 mPa·s at 20°C is used.

(1) Check the viscosity value and the density of the standard viscosity fluid at the temperature when the calibration is performed..

Here, 889 mPa·s for the viscosity and 0.878 for the density at 20°C as an example.

(2) Substitute the values above into equation [3].

$889 \times 0.878 \cong 781$

781 mPa·s is obtained as a correction value used for calibration.

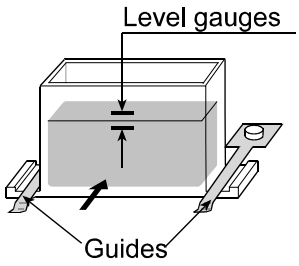
(3) After calibration, measure the viscosity of the standard viscosity fluid used and confirm that the viscometer displays the similar value as the correction value, 781 mPa·s in this example. This completes the calibration procedure.

5. MEASUREMENT

5-1 Preparing the Sample

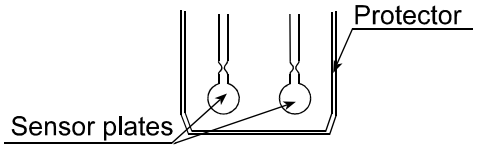
1 Pour the sample into the cup until its surface reaches between the level gauges. The level gauges indicate 35 and 45 mL.

2 Attach the cup on the table along the guides.



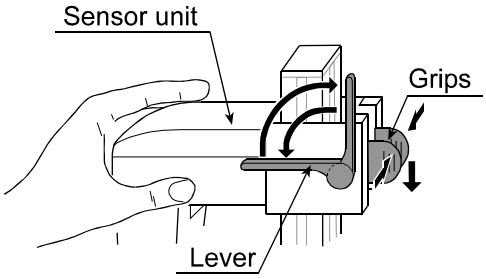
3 Confirm that the protector is in the position as shown in the figure.

Raise the lever to release the sensor unit.

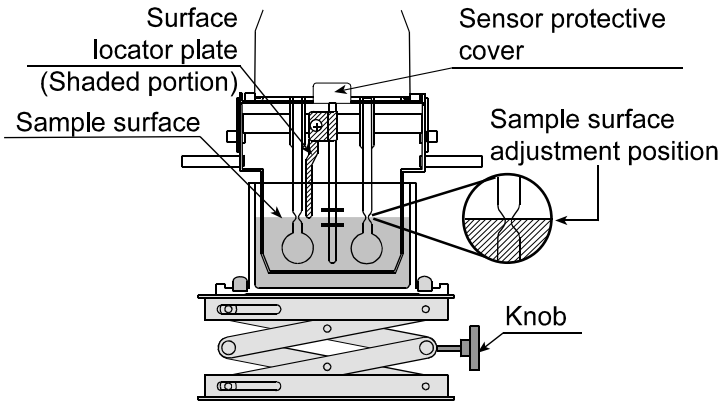


4 Pinch the grips, support the front side of the sensor unit and gently lower the sensor plates above the sample surface.

5 Lower the lever to secure the sensor unit.



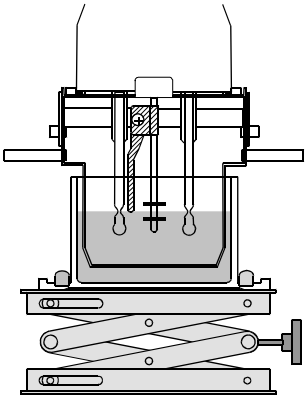
6 Turn the knob on the table so as to adjust the sample surface to the center of the narrow part of the sensor plates. At this time, use the surface locator plate as a guide. The surface locator plate has been secured in position so that the tip of the surface locator plate comes into contact with the sample surface.



SV-10

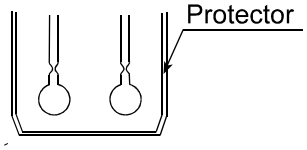
Note

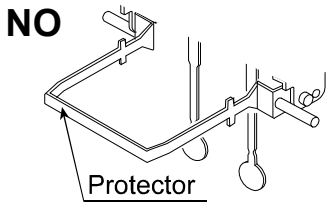
- **Be sure to adjust the sample surface to the center of the narrow part of the sensor plates. Otherwise, a measurement error may occur.**
- **The surface locator plate can be attached or removed by loosening the screw.**
- **Before removing the sensor protective cover, remove the surface locator plate.**
- **When the surface locator plate is removed and attached again, it is recommended that calibration be performed using the standard viscosity fluid before measurement.**


SV-100

Note

Use the protector in the position as shown on the left below. If the protector is not used with the SV-10, a measurement error may occur, especially in measuring a viscosity over 5000 mPa·s.





When the position of the sensor plates in the liquid is not at the same level, level the viscometer using the leveling feet so that the liquid surface will be leveled.

5-2 Basic Measurement Procedure

The below is an example of the SV-10 at shipment.
For the SV-100, the unit at shipment is Pa·s

1 With the power turned off, press the ON:OFF key.

2 When the display is in the standby mode, press the START key. *1

After about 15 seconds, the measurement values are displayed.

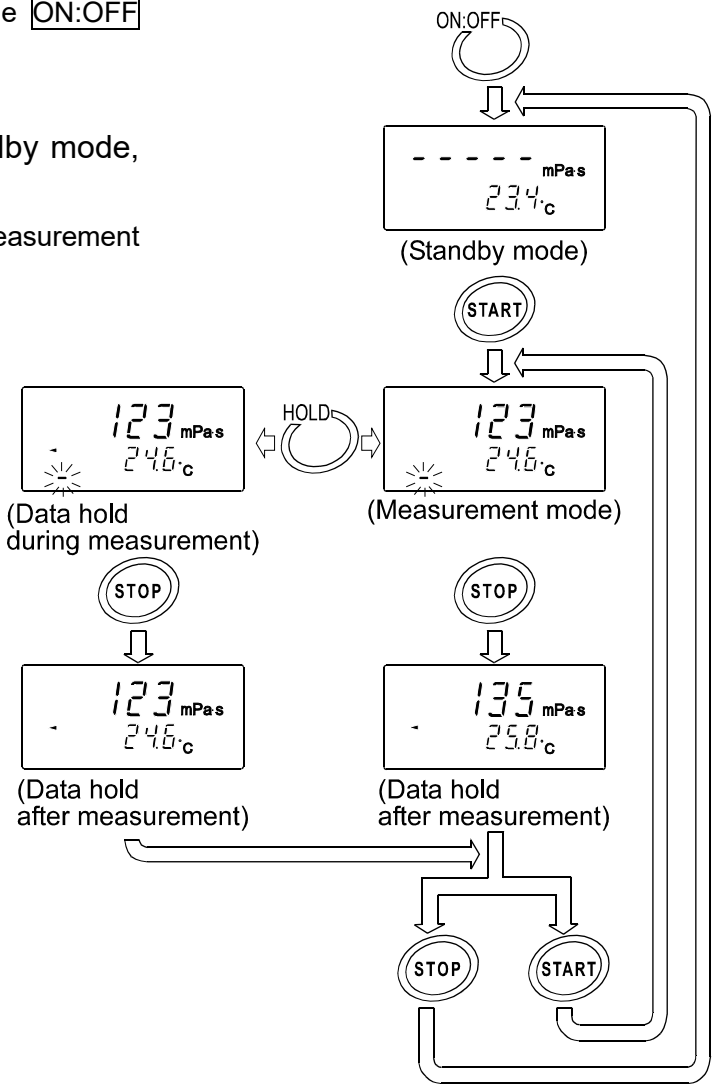
3 During measurement, press the HOLD key as necessary, to freeze the display temporarily.

To release the data hold mode, press the HOLD key again. *2

4 Press the STOP key to stop the measurement. The measurement results freeze and are displayed.

5 To stop the measurement, press the STOP key.

To go on to the next measurement, set the sample and press the START key.



When the viscosity value is below the measuring range, L is displayed.

When the viscosity value exceeds the measuring range, H is displayed.

If the sensor plates are not in vibrating motion for about 20 seconds, for example, when the sample coagulates, the measurement will stop automatically.

∗1 When the graphing program RsVisco is used, press the START button on the RsVisco to start a measurement.

∗2 While the measurement is being performed using the graphing program RsVisco or data are being output continuously (function setting "Prt 2" or SIR command), the data hold mode using the HOLD key is not available.

5-3 Changing Units

The units of viscosity available are: mPa·s (millipascal second),

Pa·s (Pascal second),

cP (Centipoise),

P (Poise).

The correlation of the units are as follows: 1 mPa·s = 0.001 Pa·s = 1 cP =0.01 P

The units of temperature available are: °C (Celsius) and °F (Fahrenheit).

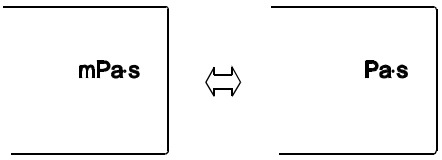
The unit selected upon power-on depends on the function setting. The unit selected at the factory before shipment is as shown below.

Model	Viscosity	Temperature
SV-10	mPa·s	°C
SV-100	Pa·s	

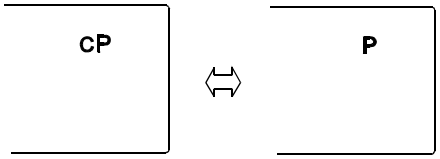
Use the MODE key to change units. Each time the MODE key is pressed, units are switched as below:
Note that the unit of temperature is fixed in the function setting.

SV-10

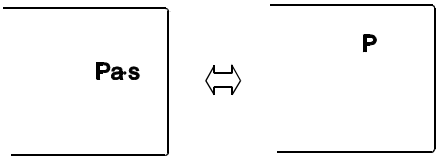
- In the function setting, mPa·s or Pa·s is selected:



- In the function setting, cP or P is selected:



SV-100



Note

While the measurement is being performed using the graphing program RsVisco, unit changes using the MODE key is not available.

With the function setting "Fnc 1", pressing the MODE key during measurement will display the measurement elapsed time.

6. USING THE DISPOSABLE CUP

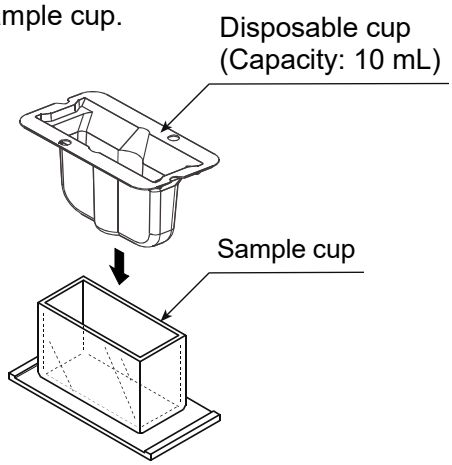
6-1 Introduction

The disposable cup is a cup with a capacity of 10 mL to be used in combination with a sample cup (capacity: 35 mL to 45 mL) or the water jacket. It can be disposed of after use.
The operating temperature range is 0°C to 80°C.

6-2 How to use

6-2-1 Using with a sample cup (Capacity: 35 mL to 45 mL)

Place the disposable cup into the sample cup.

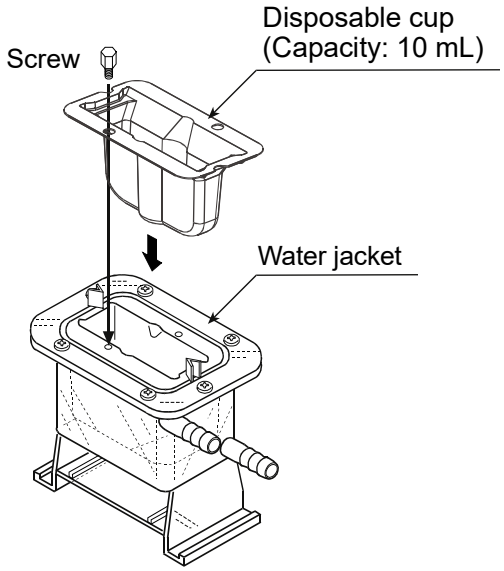


Pour the sample into the disposable cup up to the 10 mL line and measure the viscosity.

6-2-2 Using with the water jacket

Place the disposable cup into the water jacket. Secure the cup to the water jacket using the screw provided with the water jacket. (Refer to page 66 for the AX-SV-37 water jacket.)

- When used with the water jacket, in combination with a constant temperature bath for circulating the heating medium, the viscosity can be measured while changing the sample temperature or maintaining it constant.



Pour the sample into the disposable cup up to the 10 mL line and measure the viscosity.

6-3 Measuring the Absolute Value of Viscosity Using the Disposable Cup

The SV-10A/100A has been calibrated using the accessory sample cup (45 mL) when shipped. The distance between the inner wall and the sensor plates when the accessory sample cup is used, differs from the distance when the disposable cup is used. This causes a difference in the sensor plate's detection capability, thus causing a difference in the viscosity measured.

Therefore, to measure the absolute value of viscosity using the disposable cup, it is recommended that calibration be performed using a fluid with a known viscosity value which is close to the sample viscosity. (Refer to "7. VISCOSITY CALIBRATION".)

6-4 Specifications

Capacity	10 mL
Material	Polyethylene terephthalate (PET)
Operating temperature range	0°C to 80°C
Dimensions	67 (W) x 36 (D) x 41 (H) mm
Wall thickness	0.8 mm
Mass	Approx. 3.3 g

7. VISCOSITY CALIBRATION

- Viscosity calibration is to correct the viscosity value.
- Two calibration methods are available: one-point calibration and two-point calibration, using standard viscosity fluids.
  With the SV-10, simplified calibration using purified water is available.
- It is recommended that calibration be performed using a fluid with a known viscosity value which is close to the sample viscosity.
  When the measuring range is great, perform two-point calibration. Two-point calibration requires two standard viscosity fluids (high viscosity and low viscosity) that are appropriate for the measuring range.
- With the SV-10, when measuring the viscosity near 1 mPa·s, simplified calibration using purified water, which is a one-key operation, is available. The SV-10 has a built-in function to perform an automatic temperature compensation on the viscosity value, based on the temperature of the purified water used.
- In one-point and two-point calibration, the viscosity of a fluid with a known value, such as a standard viscosity fluid, is measured, displayed, corrected digitally and saved in memory.
- To obtain the absolute viscosity value precisely, use the correction value as described in "4-4-2 At Calibration".
- If the wrong calibration data such as a wrong correction value have been entered, the viscometer condition can be restored to the factory setting. For details, refer to "Initialization (CLr)" of the function setting.

7-1 Notes on Viscosity Calibration

- Pay close attention to the liquid temperature at calibration. Be sure to enter the temperature corrected viscosity value of the liquid at calibration. Even when using a standard viscosity fluid, the temperature change near room temperature causes viscosity change. If the temperature rises, the viscosity value decreases about 2 to 10 percent per degree Celsius. And even when using purified water, temperature rise causes viscosity decrease of about 2 percent per degree Celsius.
- The temperature of the standard viscosity fluid must be the same as the temperature of the sensor plates and the temperature sensor. Allow the displayed temperature to stabilize before calibration.
- Be sure to adjust the sample surface to the center of the narrow part of the sensor plates. Otherwise, a measurement error may occur.
- In the calibration mode, the unit of viscosity for the SV-10 is mPa·s, for the SV-100, Pa·s. The unit of temperature is fixed to °C.
- The viscometer has been calibrated with the protector attached when shipped. Please note that the value, obtained when the viscometer is calibrated without the protector, may be different from that upon shipment.
- If water other than purified water (such as tap water) is used for simplified calibration, or the water temperature is different from the ambient temperature, bubbles may accumulate on the sensor plates and cause a measurement error. Allow the sample to adjust to the ambient temperature and remove any accumulated bubbles before calibration.
- If the measured viscosity of the water is 3.00 mPa·s or greater, it is contaminated and simplified calibration cannot be performed using it. Replace the water.

7-2 Calibration Procedure

Note

As to the correction value used for one-point calibration and two-point calibration, enter the product of the absolute viscosity value and the density of the standard viscosity fluid. For details, refer to "4-4-2 At Calibration".
After calibration, check the values, comparing the product described above with the displayed value.

$$\text{Kinetic viscosity} = \frac{\text{Viscosity}}{\text{Density}} \qquad \text{From this, Viscosity} \times \text{Density} = \frac{\text{Viscosity}^2}{\text{Kinetic viscosity}} \quad \text{is obtained.}$$

Example 1: To calibrate the viscometer using a standard viscosity fluid:
Using the calculation sheet, calculate the value used for calibration.

(1) Check the kinetic viscosity and the viscosity at the temperature when the calibration is performed.

Here, 1011 mm^2/s for the kinetic viscosity and 889 mPa·s for the viscosity at 20°C as an example.

(2) Substitute the values above to obtain the value for $\frac{\text{Viscosity}^2}{\text{Kinetic viscosity}}$.

$$\frac{889^2}{1011} \cong 781$$

781 mPa·s is obtained as a correction value used for calibration.

Example 2: To calibrate using a standard viscosity fluid with known values of viscosity and density.
In this example, a standard viscosity fluid with a viscosity of 889 mPa·s at 20°C is used.

(1) Check the viscosity value and the density of the standard viscosity fluid at the temperature when the calibration is performed..

Here, 889 mPa·s for the viscosity and 0.878 for the density at 20°C as an example.

(2) Substitute the values above to obtain the value for Viscosity × Density.

$889 \times 0.878 \cong 781$

781 mPa·s is obtained as a correction value used for calibration.

7-2-1 One-point Calibration

1 In the standby mode, press and hold the HOLD key to enter the calibration mode. "CAL " appears.

2 Select one-point calibration (CAL-1) and press the PRINT key to confirm. The standby mode of the one-calibration mode appears.
Use the MODE key to switch between the calibration modes, one-point calibration (CAL-1) or two-point calibration (CAL-2).
Press the STOP key to exit the calibration mode. The display returns to the standby mode.

3 Place the standard viscosity fluid in the sample cup. Press the START key to start a measurement.

4 After the measurement, wait for the display to become stable and press the PRINT key. The measurement value blinks and is ready to be corrected.

5 Correct the value using the following keys:

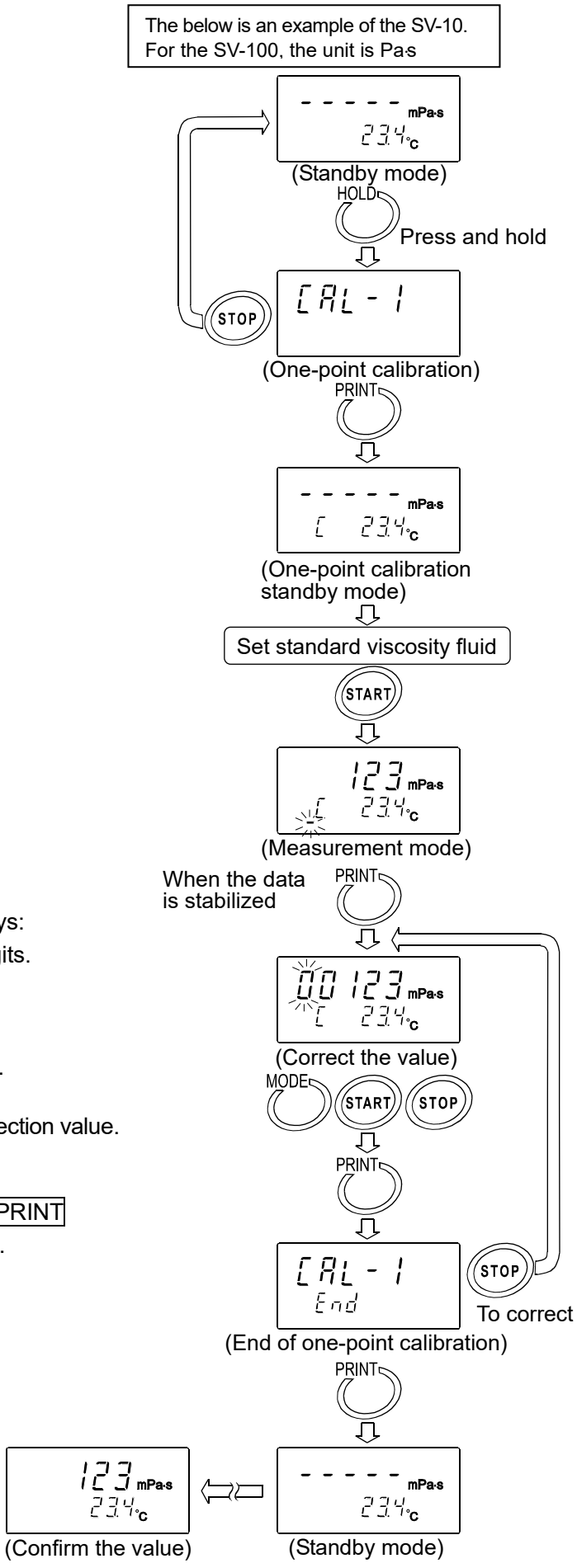
MODE key	Switches the blinking digits.
START key	Changes the setting of a blinking digit.
STOP key	Moves the decimal point.

6 Press the PRINT key to confirm the correction value.

7 To exit the calibration mode:
With " End " being displayed, press the PRINT key again to return to the standby mode.

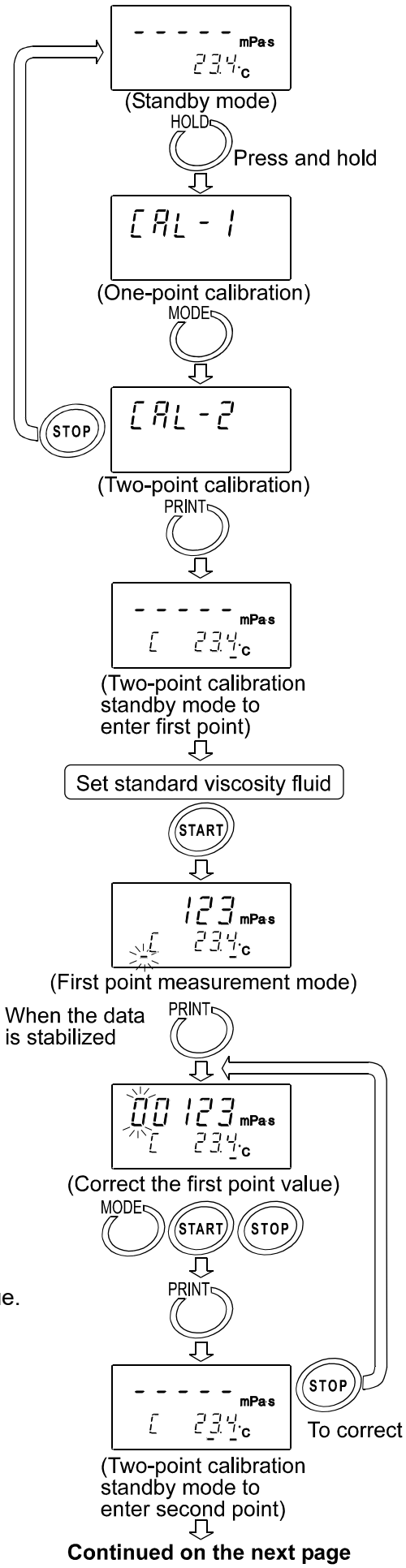
To correct the value:
With " End " being displayed, press the STOP key and correct the value.

8 Measure the viscosity of the standard viscosity fluid used. Confirm that the viscometer displays the similar value as the entered correction value.



7-2-2 Two-point Calibration

The below is an example of the SV-10.
For the SV-100, the unit is Pa·s



1 In the standby mode, press and hold the HOLD key to enter the calibration mode. "CAL " appears.

2 Select two-point calibration (CAL-2) and press the PRINT key to confirm. The standby mode of the two-calibration mode appears.
Use the MODE key to switch between the calibration modes, one-point calibration (CAL-1) or two-point calibration (CAL-2).
Press the STOP key to exit the calibration mode. The display returns to the standby mode.

3 In two-point calibration mode, the calibration mode ID indicator (-) appears below the temperature display.

4 Place the standard viscosity fluid in the sample cup. Press the START key to start the measurement of the first point.

5 After the measurement, wait for the display to become stable and press the PRINT key. The measurement value blinks and is ready to be corrected.

6 Correct the value using the following keys:

MODE key	Switches the blinking digits.
START key	Changes the setting of a blinking digit.
STOP key	Moves the decimal point.

7 Press the PRINT key to confirm the correction value.

8 To correct the value:
In the calibration standby mode to enter the second point, press the STOP key and correct the value.

Continued on the next page

9 When the measurement of the first point has completed, clean the sensor plates, temperature sensor and protector and prepare the second standard viscosity fluid.

10 Place the second standard viscosity fluid in the sample cup. Press the START key to start the measurement of the second point.

11 After the measurement, wait for the display to become stable and press the PRINT key. The measurement value blinks and is ready to be corrected.

12 Correct the value using the following keys:

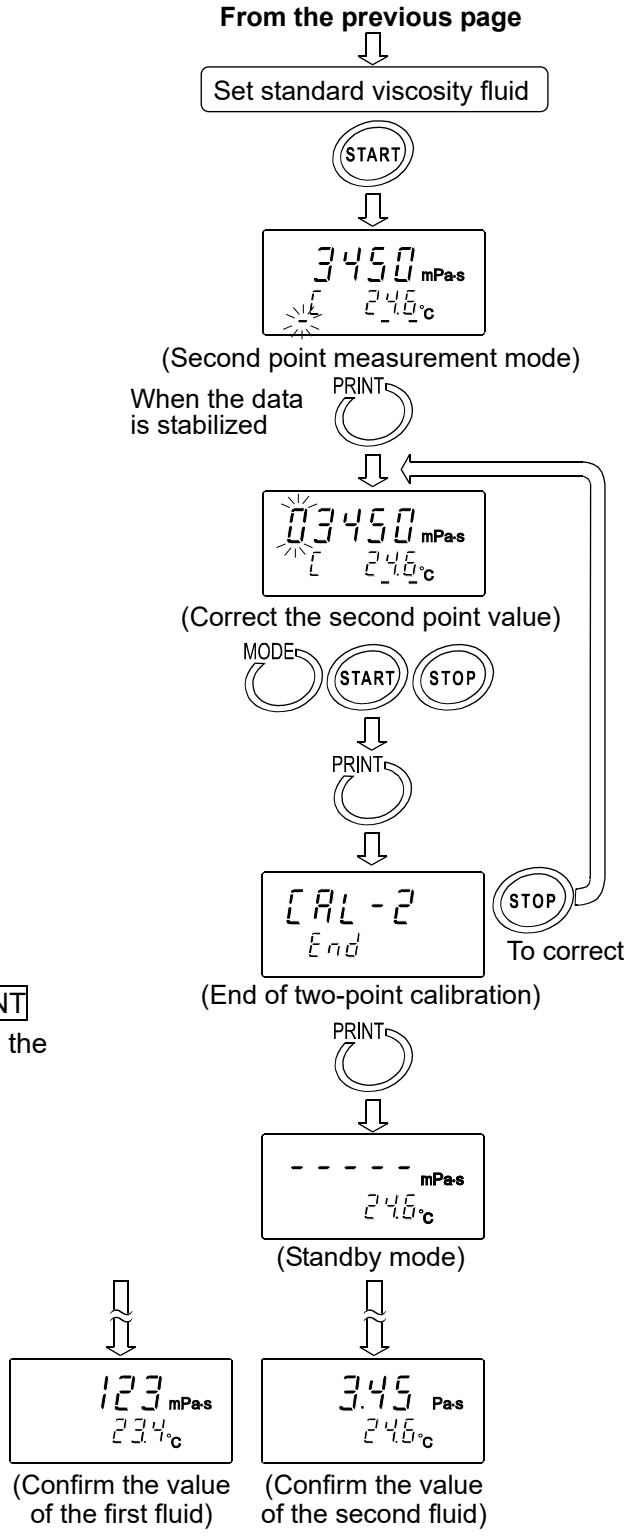
MODE key	Switches the blinking digits.
START key	Changes the setting of a blinking digit.
STOP key	Moves the decimal point.

13 Press the PRINT key to confirm the correction value.

14 To exit the calibration mode:
With " End " being displayed, press the PRINT key again. The calibration data is saved and the display returns to the standby mode.

(To correct the value:
With " End " being displayed, press the STOP key and correct the value.)

15 Measure the viscosity of the two standard viscosity fluids used. Confirm that the viscometer displays the similar value as the entered correction value for each fluid.



7-2-3 Simplified Calibration Using Purified Water (SV-10 only)

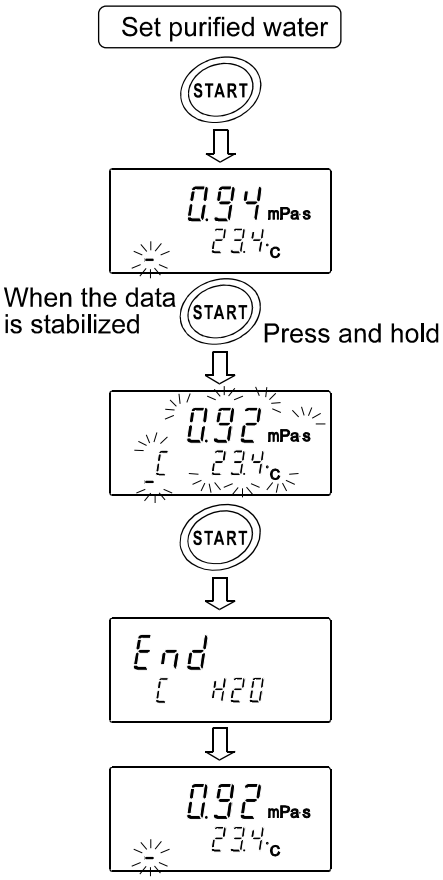
1 Place the purified water in the sample cup.

2 Press the START key to measure the purified water. Confirm that the viscosity and temperature values are stabilized.

3 Press and hold the START key.
The theoretical viscosity value (Viscosity × Density) of the purified water at the measuring temperature is displayed and all the displays blink.

To cancel the operation, press the STOP key. The display returns to the status before calibration.

4 Press the START key again to perform calibration.
When calibration is completed, " End " is displayed. Then, the viscosity returns to the measurement mode.



Reference data: Theoretical viscosity value (Viscosity × Density) of the purified water at various temperatures

Temperature (°C)	Viscosity × Density (mPa·s)
10.0	1.31
11.0	1.27
12.0	1.24
13.0	1.20
14.0	1.17
15.0	1.14
16.0	1.11
17.0	1.08
18.0	1.05
19.0	1.03
20.0	1.00
21.0	0.98
22.0	0.95
23.0	0.93
24.0	0.91
25.0	0.89
26.0	0.87
27.0	0.85
28.0	0.83
29.0	0.81
30.0	0.79

8. FUNCTION SETTING

The viscometer, by selecting functions to be used in the function setting, can specify the performance appropriate to the usage.

Each function is assigned parameters. The performance of a function is specified by changing the parameter.

The parameters saved, even if the power is turned off, are maintained in non-volatile memory.

8-1 Operation

The operational procedure of the function setting is as follows:

1 In the standby mode, press and hold the MODE key to enter the function setting mode.

2 Press the MODE key to select a function item.

3 Press the PRINT key to confirm the function item. The changeable digit blinks.

4 Press the START key or HOLD key to change the blinking digit.

START key Increases the value of the blinking digit. When the value reaches the upper limit of the setting range, the minimum value appears again.

HOLD key Decreases the value of the blinking digit. When the value reaches the lower limit of the setting range, the maximum value appears again.

5 To save the new setting, press the PRINT key. After " End ", the next item is displayed.

To cancel the new setting, press the STOP key. The next item is displayed.

6 To change other settings, repeat the procedure starting at step 2.

7 To exit the function setting mode, press the STOP key. The viscometer returns to the standby mode.

Note

The operational procedures for setting the date and time ("CLAdJ"), ID number ("id") and initialization ("CLr") are not the same as the procedure described above. Refer to "8-3 Description of Items".

"Date/Time" pages 35-37

"Device ID Number" pages 41-42

Example of the function setting procedure

Using the SV-10, to change the setting of "Unit upon power-on (Unit)" to the viscosity: cP (Centipoise) and the temperature: °C (Celsius).

1 In the standby mode, press and hold the MODE key to enter the function setting mode. "CLAdJ" appears.

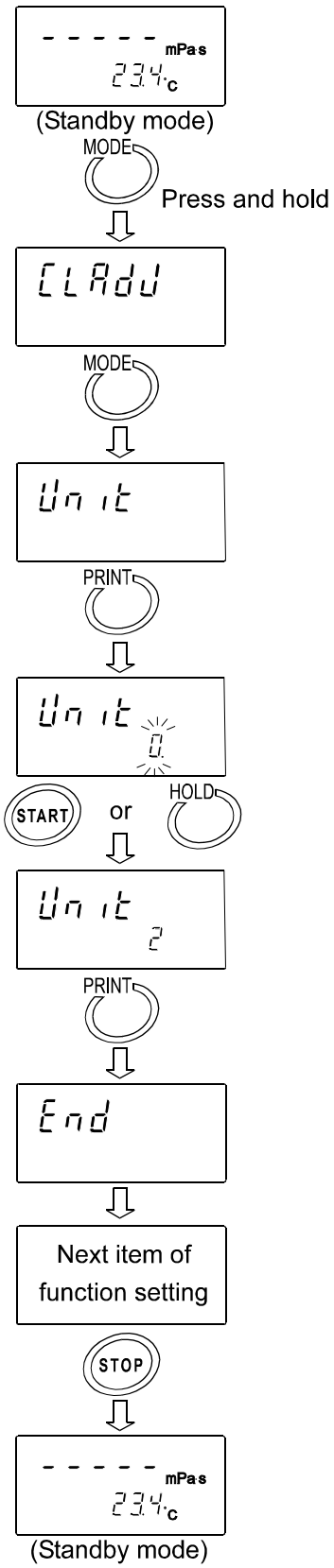
2 Press the MODE key to select "Unit".

3 Press the PRINT key to confirm the item.
(The decimal point illuminates when the setting currently saved is displayed.)

4 Press the START key or HOLD key to select the unit to be used.
(In this example, "2" is selected. Viscosity: cP, Temperature: °C)

5 Press the PRINT key to save the setting.
After "End", the next item is displayed.

6 Press the STOP key to return to the standby mode.



8-2 Details of the Function Items

Function item	Parameter	Description				
CLAdJ Date/Time		Sets the order of the date (YMD,MDY,DMY) and the date/time.				
Cond	0	Follows the viscosity changes quickly. (Prone to vibration)				
Condition	1 •	↕				
	2	Follows the viscosity changes slowly. (Stable values)				
Unit Unit upon power-on	0 •	Viscos-ity	mPa·s	Temper-ature	°C	Factory setting: SV-10=0 SV-100= 1
	1 •		Pa·s			
	2		cP			
	3		P		°F	
	4		mPa·s			
	5		Pa·s			
	6		cP			
	7		P			
Pnt Decimal point	0 •	Dot				With "Comma" selected, the separator for CSV format will be ";" (semicolon).
	1	Comma				
Fnc	0 •	Switches viscosity units.				
MODE key function during measurement	1	Switches between the temperature display and the measurement elapsed time display.				
Prt	0 •	Key mode				Press the PRINT key to output data.
Data output mode	1	Auto print mode				Outputs automatically when the STOP key ends the measurement.
	2	Stream mode				Continuous output during measurement. Outputs the viscosity only when D.P. format is selected.
tYPE	0	A&D standard format				For AD-8121B MODES 1&2
Data output format	1 •	D.P. format				For AD-8121B MODE 3
	2	CSV format				For a personal computer
	3	RsVisco format				For graphing program RsVisco
S-At Measurement elapsed time output	0	No output				Available only for D.P. format
	1 •	Output				
S-td Date/time output	0	No output				Available only for D.P. and CSV formats
	1 •	Output				
S-Ed	0	No output				
Other output	1	Outputs remarks.				Available only for D.P. format
	2 •	Outputs remarks, Device ID information and signature.				
	3	Outputs ID number.				Available only for CSV format
PUSE Pause at data output	0	No pause				
	1 •	Pause (Approx. 2 seconds)				
ErFnc Reserved	0 •	Usually use this parameter.				
	|					
	7					
id Device ID number		Set the device ID number.				With "S-Ed", the device ID information is added to the measurement data.
CLr Initialization		Restores the function settings and calibration data to the factory setting.				

• Factory setting

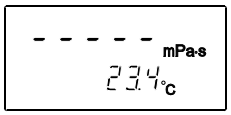
8-3 Description of Items

Date/Time (CLAdJ)

- The upper two digits of the year are not displayed. For example, the year 2003 is displayed as "03".
- The time is set using the 24-hour system.
- Do not enter a non-existing date and time.

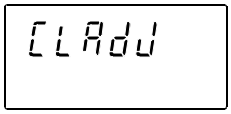
Set the order of the date, the date and time as follows:
(Example: To change April 5, 2003, 11:22:33 to June 8, 2004, 12:34:00)

1 In the standby mode, press and hold the MODE key to enter the function setting mode. "CLAdJ" appears.



(Standby mode)

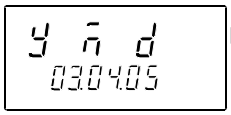
Press and hold

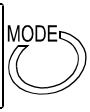


2 Press the PRINT key to display the current date.
When the date is not to be changed, press the MODE key to display the current time.

Changing the order of the date

3 Press the PRINT key. "y" (Year), "n" (Month) and "d" (Day) blink.

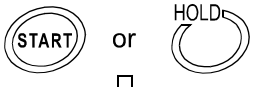




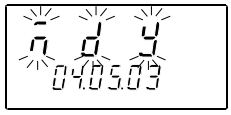
To current time display (Go to page 37)

(Current date display)

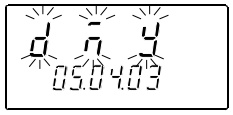
4 Press the START key or HOLD key to change the order of displaying the date.



(Year/Month/Day)



(Month/Day/Year)



(Day/Month/Year)

Changing the date

The date is changed in the selected displaying order.

The following is an example when the order of " Y " (Year), " n " (Month) and " d " (Day) is selected.

5 Press the MODE key to select the setting value of " Y " (Year). (Example:03)

6 Press the START key or HOLD key to change the year. (Example:03→04)

START key Increases the value of the blinking digit by one.

HOLD key Decreases the value of the blinking digit by one.

7 Press the MODE key to select the setting value of " n " (Month). (Example:04)

8 Press the START key or HOLD key to change the month. (Example:04→06)

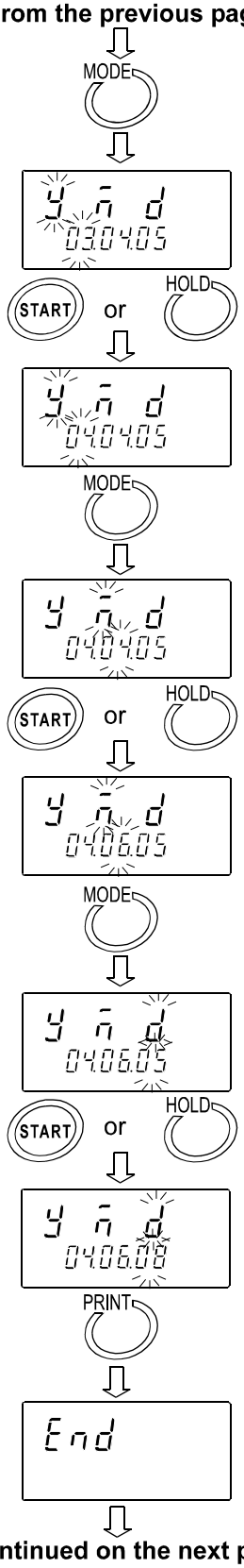
9 Press the MODE key to select the setting value of " d " (Day). (Example:05)

10 Press the START key or HOLD key to change the day. (Example:05→08)

11 Press the PRINT key to save the date.

After " End ", the current time is displayed.

From the previous page



Continued on the next page

Changing the time

12 The current time is displayed. Press the MODE key to display the current date.

13 Press the PRINT key to select the setting value of the hour. (Example:11)

14 Press the START key or HOLD key to change the hour. (Example:11→12)

15 Press the MODE key to select the setting value of the minute. (Example:22)

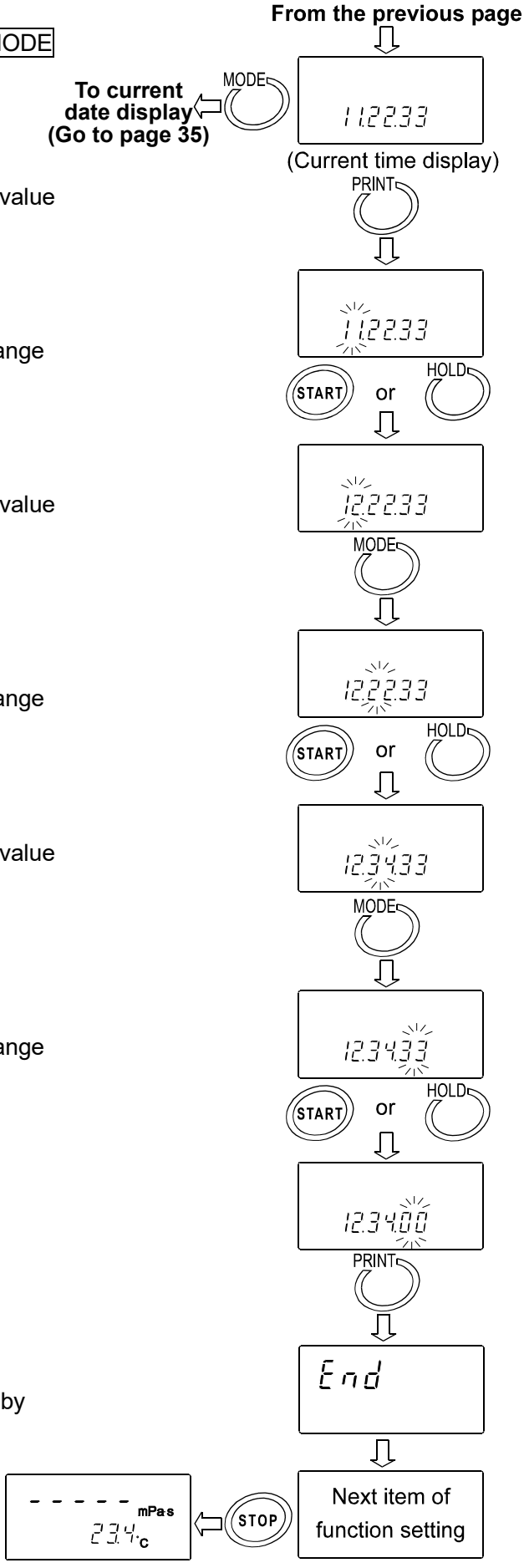
16 Press the START key or HOLD key to change the minute. (Example:22→34)

17 Press the MODE key to select the setting value of the second. (Example:33)

18 Press the START key or HOLD key to change the second. (Example:33→00)

19 Press the PRINT key to save the time.
After "End ", the next item is displayed.

20 Press the STOP key to return to the standby mode.



Condition (Cond)

The stability of the viscosity measurement results can be adjusted, taking ambient conditions such as vibration into consideration.

Parameter	Settings	Description
0	Follows the viscosity changes quickly. (Prone to vibration)	When the viscosity value is unstable due to external vibration, set a greater parameter. To measure while following the rapid changes in viscosity, set a smaller parameter. With a smaller setting, the measurement is prone to external vibration. Consider the ambient conditions of the installation site.
1 •	↕	
2	Follows the viscosity changes slowly. (Stable values)	

Unit Upon Power-on (Unit)

The units of viscosity and temperature displayed when the power is turned on are specified.

SV-10

Parameter	Settings				Description
0 •	Viscosity	mPa·s (Millipascal second)	Temperature	°C (Celsius)	In the standby mode, pressing the MODE key switches the viscosity unit. mPa·s ⇔ Pa·s, cP ⇔ P With "Fnc 0" selected, units can be switched even during measurement. *1
1		Pa·s (Pascal second)			
2		cP (Centipoise)			
3		P (Poise)			
4		mPa·s (Millipascal second)		°F (Fahrenheit)	
5		Pa·s (Pascal second)			
6		cP (Centipoise)			
7		P (Poise)			

SV-100

Parameter	Settings				Description
1 •	Viscosity	Pa·s (Pascal second)	Temperature	°C (Celsius)	In the standby mode, pressing the MODE key switches the viscosity unit. Pa·s ⇔ P With "Fnc 0" selected, units can be switched even during measurement. *1
3		P (Poise)			
5		Pa·s (Pascal second)		°F (Fahrenheit)	
7		P (Poise)			

*1 While the measurement is being performed using the graphing program RsVisco, unit changes using the MODE key is not available.
With the SV-10, for a viscosity over 1000 mPa·s, the unit is fixed to Pa·s, and for a viscosity over 1000 cP, the unit is fixed to P.

Decimal Point (Pnt)

Parameter	Settings	Description
0 •	Dot "."	The decimal point format for the displayed measurement data and the decimal point code for measurement data output via RS-232C are specified. With "Comma" selected, the separator for CSV format and RsVisco format will be ";" (semicolon).
1	Comma ","	

MODE Key Function During Measurement (Fnc)

Parameter	Settings	Description
0 •	Switches the viscosity units.	Each time the MODE key is pressed, the viscosity unit is switched. SV-10: mPa·s ⇔ Pa·s, cP ⇔ P sv-100: Pa·s ⇔ P **Note** **With the SV-10, for the viscosity over 1000 mPa·s, the unit is fixed to Pa·s and for the viscosity over 1000 cP, the unit is fixed to P.**
1	Switches between the temperature display and the measurement elapsed time display	Each time the MODE key is pressed, the display is switched between the temperature display and the measurement elapsed time display. Upon a measurement start, the temperature display is selected. When the elapsed time reaches 100 hours, the display returns to 0. (99.59.59→00.00.00)

Data Output Mode (Prt)

The condition to output the measurement data via RS-232C is set.

Parameter	Settings	Description
0 •	Key mode	During measurement or in the data hold mode, pressing the PRINT key outputs the current measurement values. *2
1	Auto print mode	The measurement values are output automatically when the STOP key ends the measurement. Pressing the PRINT key outputs the current measurement values. *2
2	Stream mode	The measurement values are output continuously during measurement. When D.P. format is selected in "Output format (tYPE)" of the function setting, only the viscosity value is output, regardless of the settings of "S-At", "S-td" and "S-Ed". When this mode is selected, the data hold mode using the HOLD key is not available.

*2 When A&D standard format is selected in "Output format (tYPE)" of the function setting, pressing the PRINT key in the standby mode will not output the measurement data.

Data Output Format (tYPE)

The output format appropriate for the device connected to RS-232C can be selected.

Parameter	Settings	Description
0	A&D standard format	Used with the printer MODE 1 or MODE 2 when the optional compact printer, AD-8121B is connected. Only the viscosity value is output.
1 •	D.P. format	Used with the printer MODE 3 when the optional compact printer, AD-8121B is connected. With "Prt 0" or "Prt 1" selected for "Data output mode (Prt)", output contents can be selected by the settings of "S-At", "S-td" and "S-Ed". With "Prt 2" selected for "Data output mode (Prt)", only the viscosity value is output.
2	CSV format	Appropriate when a personal computer is used to collect data. Measurement values are output in comma separated format. With "S-td" and " id" settings, the date/time and ID number can be added to the measurement data. When a comma is selected as the decimal point by "Pnt 1", a semicolon ";" is used as a data separator. The viscosity value and the temperature are output using the internal resolution. *3
3	RsVisco format	Used with the graphing program RsVisco. When a measurement is started using RsVisco, the viscometer automatically selects this format. The viscosity value and the temperature are output using the internal resolution.*3

*3 The relation between the measuring unit and the internal resolution is as follows:

	Model	Viscosity				Temperature	
		mPa·s	Pa·s	cP	P	°C	°F
Internal resolution	SV-10	0.01	0.0001	0.01	0.0001	0.01	0.01
	SV-100	-	0.01	-	0.1		

Measurement Elapsed Time Output (S-At)

Parameter	Settings	Description
0	No output	With D.P. format selected, whether or not to add the measurement elapsed time (the time elapsed from a measurement start) to the measurement data can be selected. For examples of output format, refer to "8-4 Data Output Format Examples".
1 •	Output	

Date/time Output (S-td)

Parameter	Settings	Description
0	No output	With D.P. format or CSV format selected, whether or not to add the date and time to the measurement data can be selected. For examples of output format, refer to "8-4 Data Output Format Examples".
1 •	Output	

Other Output (S-Ed)

Parameter	Settings	Description
0	No output	
1	Outputs remarks.	With D.P. format selected, whether or not to add remarks, Device ID information or signature to the measurement data can be selected. For examples of output format, refer to "8-4 Data Output Format Examples".
2 •	Outputs remarks, Device ID information and signature.	
3	Outputs ID number.	With CSV format selected, whether or not to add ID number to the measurement data can be selected. For examples of output format, refer to "8-4 Data Output Format Examples".

Pause at Data Output (PUSE)

Parameter	Settings	Description
0	No pause	Whether or not to take a pause of two seconds each time one line is output can be selected, when the data are output via RS-232C. When MODE 3 of the optional compact printer, AD-8121B is used, select "1".
1 •	Pause (Approx. 2 seconds)	

Device ID Number (id)

- The ID number is used to identify the viscometer.
- Whether or not to add the ID number to the measurement data can be selected by "S-Ed" of the function setting.
- The ID number is six characters long. The following characters are available for the ID number.

Character	0	1	2	3	4	5	6	7	8	9	(Space)	-(hyphen)	A	B	C	D	E
Display	0	1	2	3	4	5	6	7	8	9	(Space)	-	A	b	C	d	E

Character	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Display	F	G	H	I	J	K	L	M	N	o	P	q	r	S	t	U	v	w	x	y	z

For examples of output format, refer to "8-4 Data Output Format Examples".

Setting the ID number

1 In the standby mode, press and hold the MODE key to enter the function setting mode. " CLAdJ " appears.

2 Press the MODE key to select " id ".

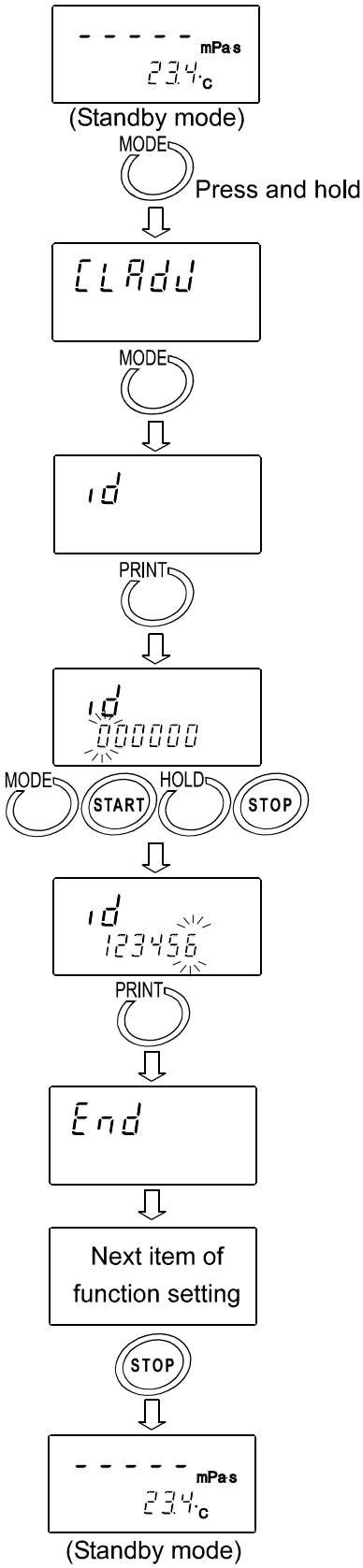
3 Press the PRINT key to enter the ID number setting mode.

4 Set the ID number using the following keys:

MODE key	Switches the blinking digits.
START key	Increases the value of the blinking digit by one.
HOLD key	Decreases the value of the blinking digit by one.
STOP key	Cancel the operation.

5 Press the PRINT key to save the setting.
After " End ", the next item is displayed.

6 Press the STOP key to return to the standby mode.



Initialization (CLr)

Restores the following data to the factory setting.

- Function setting
- Calibration data

After initialization, check the viscosity value and perform calibration as necessary. (Refer to 7. VISCOSITY CALIBRATION").

1 In the standby mode, press and hold the MODE key to enter the function setting mode. " CLAdJ " appears.

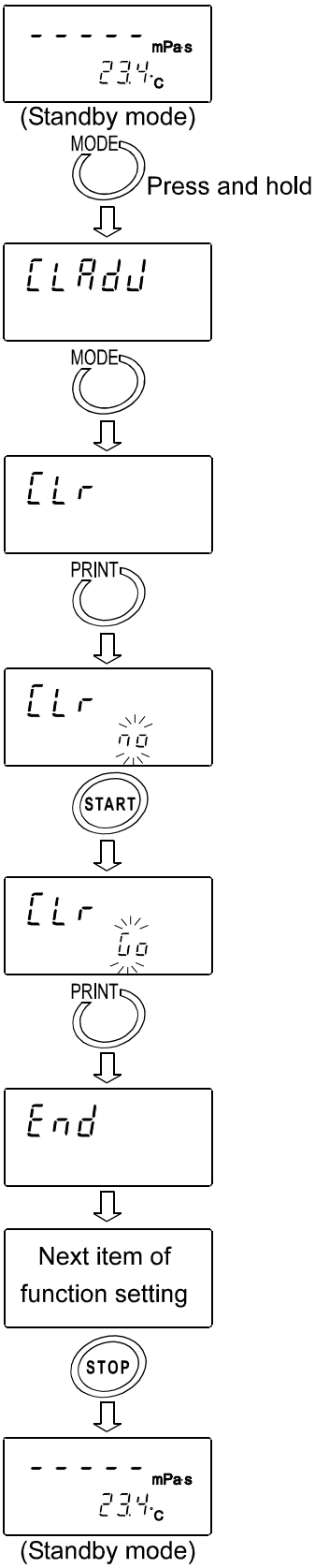
2 Press the MODE key to select " CLr ".

3 Press the PRINT key to display " CLr no ".

4 Press the START key to select " CLr Go ".

5 Press the PRINT key to execute initialization. After " End ", the next item is displayed. Initialization has completed.

6 Press the STOP key to return to the standby mode.



8-4 Data Output Format Examples

8-4-1 A&D Standard Format

Used with the printer MODE 3 when the optional compact printer, AD-8121B is connected. Only the viscosity value is output.

SV-10 output format example

Viscosity unit	Display	Output format	Remarks
mPa·s	L mPa·s	OL,-99999999mPs	Below measuring range error
	0.30mPa·s	ST,+00000.30mPs	
	10.0 mPa·s	ST,+00010.00mPs	The digit of 0.01mPa·s is always zero.
	100 mPa·s	ST,+00100.00mPs	The digits of 0.01mPa·s and 0.1mPa·s are always zero.
	1.00 Pa·s	ST,+01000.00mPs	For 1000mPa·s or greater, the displayed unit is Pa·s, but the output unit remains mPa·s. The digits of 0.01mPa·s, 0.1mPa·s and 1mPa·s are always zero.
	H Pa·s	OL,+99999999mPs	Above measuring range error
Pa·s	L Pa·s	OL,-99999999Pas	Below measuring range error
	0.0003 Pa·s	ST,+000.0003Pas	
	0.0100 Pa·s	ST,+000.0100Pas	
	0.100 Pa·s	ST,+000.1000Pas	The digit of 0.0001Pa·s is always zero.
	1.00 Pa·s	ST,+001.0000Pas	The digits of 0.0001Pa·s and 0.001Pa·s are always zero.
	H Pa·s	OL,+99999999Pas	Above measuring range error
cP	L cP	OL,-99999999␣cP	Below measuring range error
	0.30 cP	ST,+00000.30␣cP	
	10.0 cP	ST,+00010.00␣cP	The digit of 0.01cP is always zero.
	100 cP	ST,+00100.00␣cP	The digits of 0.01cP and 0.1cP are always zero.
	10.0 P	ST,+01000.00␣cP	For 1000 cP or greater, the displayed unit is P, but the output unit remains cP. The digits of 0.01cP, 0.1cP and 1cP are always zero.
	H P	OL,+99999999␣cP	Above measuring range error
P	L P	OL,-99999999␣␣P	Below measuring range error
	0.0030 P	ST,+000.0030␣␣P	
	0.100 P	ST,+000.1000␣␣P	The digit of 0.0001P is always zero.
	1.00 P	ST,+001.0000␣␣P	The digits of 0.0001P and 0.001P are always zero.
	10.0 P	ST,+010.0000␣␣P	The digits of 0.0001P, 0.001P and 0.01P are always zero.
	H P	OL,+99999999␣␣P	Above measuring range error

␣ : Space (ASC 20h)

SV-100 output format example

Viscosity unit	Display	Output format	Remarks
Pa·s	L Pa·s	OL,-99999999Pas	Below measuring range error
	1.00 Pa・s	ST,+00001.00Pas	
	10.0 Pa·s	ST,+00010.00Pas	The digit of 0.01Pa·s is always zero.
	H Pa·s	OL,+99999999Pas	Above measuring range error
P	L P	OL,-99999999␣␣P	Below measuring range error
	10.0 P	ST,+000010.0␣␣P	
	100 P	ST,+000100.0␣␣P	The digit of 0.1P is always zero.
	H P	OL,+99999999␣␣P	Above measuring range error

␣ : Space (ASC 20h)

8-4-2 D.P. Format

Used with the printer MODE 3 when the optional compact printer, AD-8121B is connected.

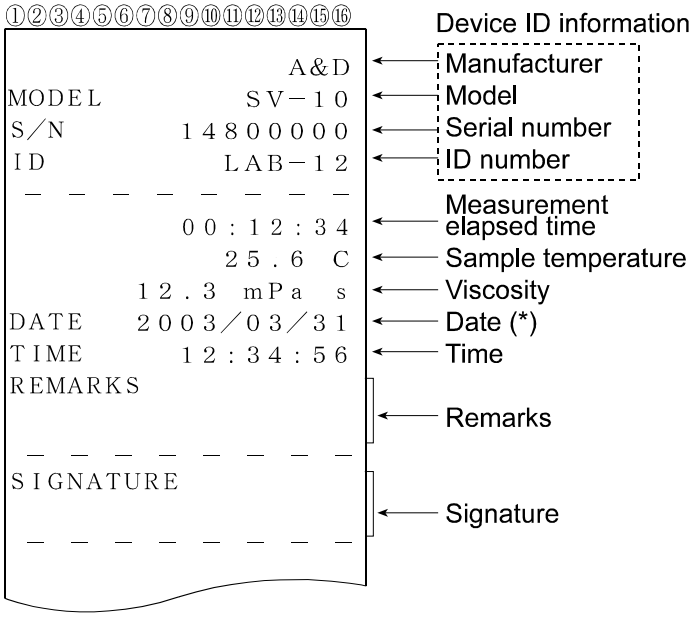
With "Prt 0" or "Prt 1" selected for "Data output mode (Prt)", output contents can be selected by the settings of "S-At", "S-td" and "S-Ed".

With "Prt 2" selected for "Data output mode (Prt)", only the viscosity value is output

Shown below are SV-10 printing examples.

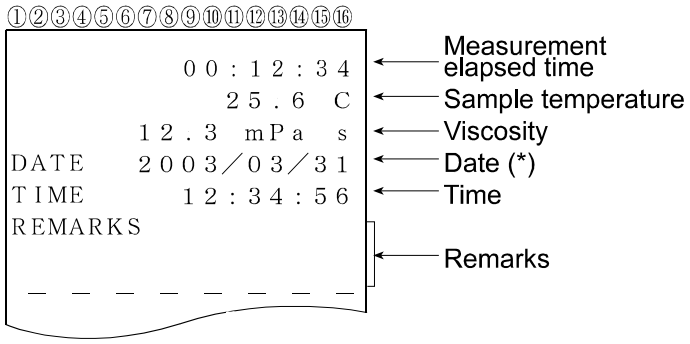
Printing format example (1)

Function setting (√=Output Blank=No output)			
S-At	1	Measurement elapsed time	√
S-td	1	Date/time	√
S-Ed	2	Remarks	√
		Device ID information	√
		Signature	



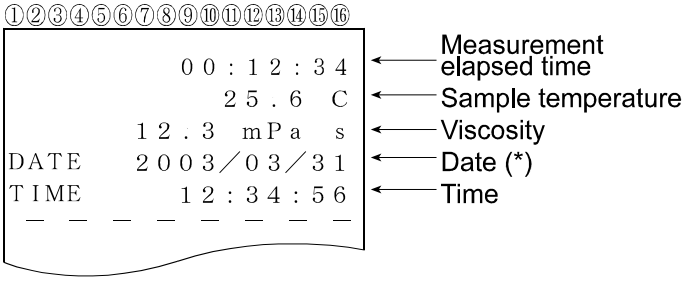
Printing format example (2)

Function setting (√=Output Blank=No output)			
S-At	1	Measurement elapsed time	√
S-td	1	Date/time	√
S-Ed	1	Remarks	√
		Device ID information	
		Signature	



Printing format example (3)

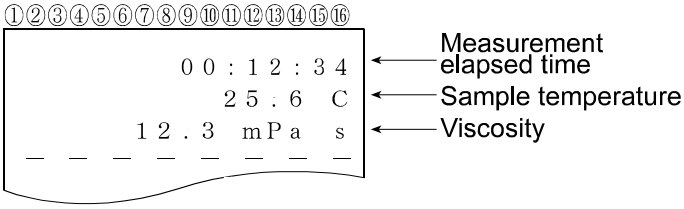
Function setting (√=Output Blank=No output)			
S-At	1	Measurement elapsed time	√
S-td	1	Date/time	√
S-Ed	0	Remarks	
		Device ID information	
		Signature	



(*) The displaying order of the date (YMD/DMY/MDY) depends on the setting of "Date/Time (CLAdJ)".

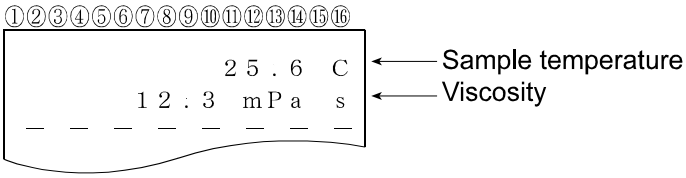
Printing format example (4)

Function setting (√=Output Blank=No output)		
S-At 1	Measurement elapsed time	√
S-td 0	Date/time	
S-Ed 0	Remarks	
	Device ID information	
	Signature	



Printing format example (5)

Function setting (√=Output Blank=No output)		
S-At 0	Measurement elapsed time	
S-td 0	Date/time	
S-Ed 0	Remarks	
	Device ID information	
	Signature	



8-4-3 CSV Format

Appropriate when a personal computer is used to collect data. Measurement values are output in comma separated format.

With "S-td" setting, the date and time can be added to the measurement data.

When a comma is selected as the decimal point by "Pnt 1", a semicolon ";" is used as a data separator.

With CSV format selected, the viscosity value and the temperature are output using the internal resolution.

The relation between the measuring unit and the internal resolution is as follows:

	Model	Viscosity				Temperature	
		mPa·s	Pa·s	cP	P	°C	°F
Internal resolution	SV-10	0.01	0.0001	0.01	0.0001	0.01	0.01
	SV-100	-	0.01	-	0.1		

Output format example (1) With ID number, date and time added

Function setting (√=Output Blank=No output)		
S-td 1	Date/time	√
S-Ed 3	Device ID number	√

Outputs in the order of ID number, date, time, temperature, temperature unit, viscosity and viscosity unit.
The output data are 52 characters long excluding the terminator.

SV-10 output format example

Viscosity / Temper-ature	Display	Output format example	Remarks
mPa·s / °C	L mPa·s	LAB-12,2003/03/19,12:34:56,+025.67,C,+00000.00,mPa␣s	Zeroes are output for below measuring range error.
	0.30mPa·s	LAB-12,2003/03/19,12:34:56,+025.67,C,+00000.30,mPa␣s	
	10.0 mPa·s	LAB-12,2003/03/19,12:34:56,+025.67,C,+00010.00,mPa␣s	
	100 mPa·s	LAB-12,2003/03/19,12:34:56,+025.67,C,+00100.00,mPa␣s	
	1.00 Pa·s	LAB-12,2003/03/19,12:34:56,+025.67,C,+01000.00,mPa␣s	For 1000 mPa·s or greater, the displayed unit is Pa·s, but the output unit remains mPa·s.
	H Pa·s	LAB-12,2003/03/19,12:34:56,+025.67,C,+12000.00,mPa␣s	12000 is output for above measuring range error.
Pa·s / °F	L Pa·s	LAB-12,2003/03/19,12:34:56,+051.23,F,+000.0000,␣Pa␣s	Zeroes are output for below measuring range error.
	0.0003 Pa·s	LAB-12,2003/03/19,12:34:56,+051.23,F,+000.0003,␣Pa␣s	
	0.0100 Pa·s	LAB-12,2003/03/19,12:34:56,+051.23,F,+000.0100,␣Pa␣s	
	0.100 Pa·s	LAB-12,2003/03/19,12:34:56,+051.23,F,+000.1000,␣Pa␣s	
	1.00 Pa·s	LAB-12,2003/03/19,12:34:56,+051.23,F,+001.0000,␣Pa␣s	
	H Pa·s	LAB-12,2003/03/19,12:34:56,+051.23,F,+012.0000,␣Pa␣s	12 is output for above measuring range error.
cP / °C	L cP	LAB-12,2003/03/19,12:34:56,+025.67,C,+000.0000,␣cP␣␣	Zeroes are output for below measuring range error.
	0.30 cP	LAB-12,2003/03/19,12:34:56,+025.67,C,+00000.30,␣cP␣␣	
	10.0 cP	LAB-12,2003/03/19,12:34:56,+025.67,C,+00010.00,␣cP␣␣	
	100 cP	LAB-12,2003/03/19,12:34:56,+025.67,C,+00100.00,␣cP␣␣	
	10.0 P	LAB-12,2003/03/19,12:34:56,+025.67,C,+01000.00,␣cP␣␣	For 1000 cP or greater, the displayed unit is P, but the output unit remains cP.
	H P	LAB-12,2003/03/19,12:34:56,+025.67,C,+12000.00,␣cP␣␣	12000 is output for above measuring range error.
P / °F	L P	LAB-12,2003/03/19,12:34:56,+051.23,F,+000.0000,␣␣P␣␣	Zeroes are output for below measuring range error.
	0.0030 P	LAB-12,2003/03/19,12:34:56,+051.23,F,+000.0030,␣␣P␣␣	
	0.100 P	LAB-12,2003/03/19,12:34:56,+051.23,F,+000.1000,␣␣P␣␣	
	1.00 P	LAB-12,2003/03/19,12:34:56,+051.23,F,+001.0000,␣␣P␣␣	
	10.0 P	LAB-12,2003/03/19,12:34:56,+051.23,F,+010.0000,␣␣P␣␣	
	H P	LAB-12,2003/03/19,12:34:56,+051.23,F,+120.0000,␣␣P␣␣	120 is output for above measuring range error.

␣ : Space (ASC 20h)

SV-100 output format example

Viscosity / Temper-ature	Display	Output format example	Remarks
Pa･s / °C	L Pa･s	LAB-12,2003/03/19,12:34:56,+025.67,C,+00000.00,␣Pa␣S	Zeroes are output for below measuring range error.
	1.00 Pa･s	LAB-12,2003/03/19,12:34:56,+025.67,C,+00001.00,␣Pa␣S	
	10.0 Pa･s	LAB-12,2003/03/19,12:34:56,+025.67,C,+00010.00,␣Pa␣S	
	H Pa･s	LAB-12,2003/03/19,12:34:56,+025.67,C,+00120.00,␣Pa␣S	120 is output for above measuring range error.
P / °F	L P	LAB-12,2003/03/19,12:34:56,+051.23,F,+000000.0,␣␣P␣␣	Zeroes are output for below measuring range error.
	10.0 P	LAB-12,2003/03/19,12:34:56,+051.23,F,+000010.0,␣␣P␣␣	
	100 P	LAB-12,2003/03/19,12:34:56,+051.23,F,+000100.0,␣␣P␣␣	
	H P	LAB-12,2003/03/19,12:34:56,+051.23,F,+001200.0,␣␣P␣␣	1200 is output for above measuring range error.

␣ : Space (ASC 20h)

Output format example (2) With date and time added

Function setting (√=Output Blank=No output)		
S-td 1	Date/time	√
S-Ed 0	Device ID number	

Outputs in the order of date, time, temperature, temperature unit, viscosity and viscosity unit.
The output data are 46 characters long excluding the terminator.

SV-10 output format example

Viscosity / Temperature	Display	Output format example
mPa·s / °C	1.23 mPa·s	,2003/03/19,12:34:56,+025.67,C,+00001.23,mPa␣s

␣ : Space (ASC 20h)

SV-100 output format example

Viscosity / Temperature	Display	Output format example
Pa·s / °C	1.23 Pa·s	,2003/03/19,12:34:56,+025.67,C,+00001.23,␣Pa␣s

␣ : Space (ASC 20h)

Output format example (3) To output the measured temperature and viscosity only

Function setting (√=Output Blank=No output)		
S-td 0	Date/time	
S-Ed 0	Device ID number	

Outputs in the order of temperature, temperature unit, viscosity and viscosity unit.
The output data are 28 characters long excluding the terminator.

SV-10 output format example

Viscosity / Temperature	Display	Output format example
mPa·s / °C	1.23 mPa·s	,,,+025.67,C,+00001.23,mPa␣s

␣ : Space (ASC 20h)

SV-100 output format example

Viscosity / Temperature	Display	Output format example
Pa·s / °C	1.23 Pa·s	,,,+025.67,C,+00001.23,␣Pa␣s

␣ : Space (ASC 20h)

8-4-4 RsVisco Format

Used with the graphing program RsVisco. Measurement data are output in comma separated format. When a comma is selected as the decimal point by "Pnt ,", a semicolon ";" is used as a data separator.

When a measurement is started using RsVisco, the viscometer automatically selects this format.

Measurement data are output in the order of viscosity, viscosity unit, temperature and temperature unit.

The output data are 25 characters long excluding the terminator

With RsVisco format selected, the viscosity value and the temperature are output using the internal resolution.

The relation between the measuring unit and the internal resolution is as follows:

	Model	Viscosity				Temperature	
		mPa·s	Pa·s	cP	P	°C	°F
Internal resolution	SV-10	0.01	0.0001	0.01	0.0001	0.01	0.01
	SV-100	-	0.01	-	0.1		

SV-10 output format example

Viscosity / Temper-ature	Display	Output format example	Remarks
mPa·s / °C	L mPa·s	+00000.00,mPa␣s,+025.67,C	Zeroes are output for below measuring range error.
	0.30 mPa·s	+00000.30,mPa␣s,+025.67,C	
	10.0 mPa·s	+00010.00,mPa␣s,+025.67,C	
	100 mPa·s	+00100.00,mPa␣s,+025.67,C	
	1.00 Pa·s	+01000.00,mPa␣s,+025.67,C	For 1000 mPa·s or greater, the displayed unit is Pa·s, but the output unit remains mPa·s.
	H Pa·s	+12000.00,mPa␣s,+025.67,C	12000 is output for above measuring range error.
Pa·s / °F	L Pa·s	+000.0000,␣Pa␣s,+051.23,F	Zeroes are output for below measuring range error.
	0.0003 Pa·s	+000.0003,␣Pa␣s,+051.23,F	
	0.0100 Pa·s	+000.0100,␣Pa␣s,+051.23,F	
	0.100 Pa·s	+000.1000,␣Pa␣s,+051.23,F	
	1.00 Pa·s	+001.0000,␣Pa␣s,+051.23,F	
	H Pa·s	+012.0000,␣Pa␣␣,+051.23,F	12 is output for above measuring range error.
cP / °C	L cP	+000.0000,␣cP␣␣,+025.67,C	Zeroes are output for below measuring range error.
	0.30 cP	+00000.30,␣cP␣␣,+025.67,C	
	10.0 cP	+00010.00,␣cP␣␣,+025.67,C	
	100 cP	+00100.00,␣cP␣␣,+025.67,C	
	10.0 P	+01000.00,␣cP␣␣,+025.67,C	For 1000 cP or greater, the displayed unit is P, but the output unit remains cP.
	H P	+12000.00,␣cP␣␣,+025.67,C	12000 is output for above measuring range error.
P / °F	L P	+000.0000,␣␣P␣␣,+051.23,F	Zeroes are output for below measuring range error.
	0.0030 P	+000.0030,␣␣P␣␣,+051.23,F	
	0.100 P	+000.1000,␣␣P␣␣,+051.23,F	
	1.00 P	+001.0000,␣␣P␣␣,+051.23,F	
	10.0 P	+010.0000,␣␣P␣␣,+051.23,F	
	H P	+120.0000,␣␣P␣␣,+051.23,F	120 is output for above measuring range error.

␣ : Space (ASC 20h)

SV-100 output format example

Viscosity / Temper-ature	Display	Output format example	Remarks
Pa·s / °C	L Pa·s	+0000.000,␣Pa␣s,+025.67,C	Zeroes are output for below measuring range error.
	1.00 Pa·s	+00001.00,␣Pa␣s,+025.67,C	
	10.0 Pa·s	+00010.00,␣Pa␣s,+025.67,C	
	H Pa·s	+00120.00,␣Pa␣␣,+025.67,C	120 is output for above measuring range error.
P / °F	L P	+000000.0,␣␣P␣␣,+051.23,F	Zeroes are output for below measuring range error.
	10.0 P	+000010.0,␣␣P␣␣,+051.23,F	
	100 P	+000100.0,␣␣P␣␣,+051.23,F	
	H P	+001200.0,␣␣P␣␣,+051.23,F	1200 is output for above measuring range error.

␣ : Space (ASC 20h)

9. CONNECTION TO A PERSONAL COMPUTER

Using the standard RS-232C serial interface and the RS-232C cable provided, the viscometer can be connected to a personal computer.

In addition, using the graphing program RsVisco, contained in the accessory Windows communication tools WinCT-Viscosity, measurement data are imported to a Windows-based personal computer to display a graph in real time.

For details, refer to "\English\ReadMe.txt" on the CR-ROM.

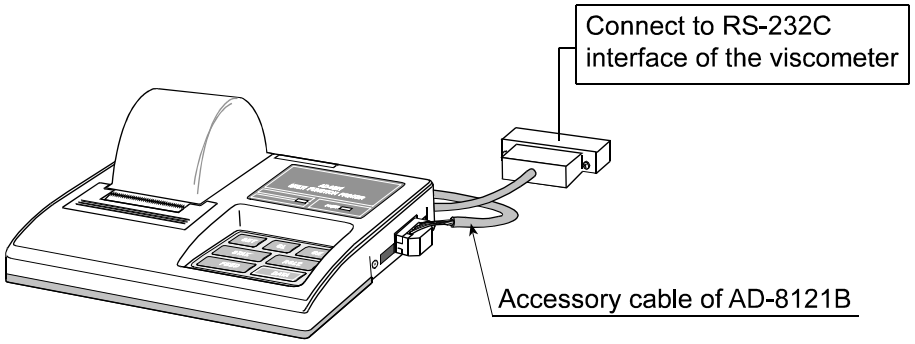
10. CONNECTION TO A PRINTER

- The viscometer can be connected to the optional compact printer, AD-8121B using the standard RS-232C serial interface and the measurement results can be printed.
- The statistical calculation data of the results and the changes in the viscosity value per a certain time can be printed using the function of the AD-8121B.
- Use the AD-8121B accessory cable to connect the printer to the viscometer.

Setting List

What to print	Viscometer function settings						AD-8121B settings
	Prt	tYPE	S-At	S-td	S-Ed	PUSE	
Measurement results	0、1	1	0、1	0、1	0、1、2	1	MODE 3
Statistical calculation	0、1	0	—	—	—	—	MODE 1
Changes in the viscosity value per a certain time	2	0	—	—	—	0	MODE 2 (Interval printing is used.)

— : Not applicable.



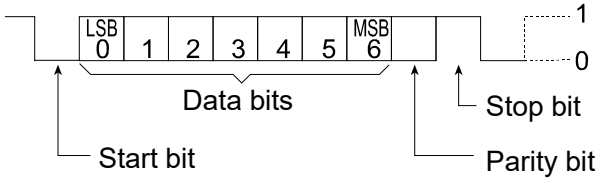
Compact printer, AD-8121B

11. RS-232C SERIAL INTERFACE

RS-232C Serial Interface

Transmission system	EIA RS-232C
Transmission form	Asynchronous, bi-directional, half duplex
Data format	Baud rate 2400 bps
Data bits	7 bits
Parity	EVEN
Stop bit	1 bit
Code	ASCII
Terminator	CR LF (CR: 0Dh, LF: 0Ah)

Bit format

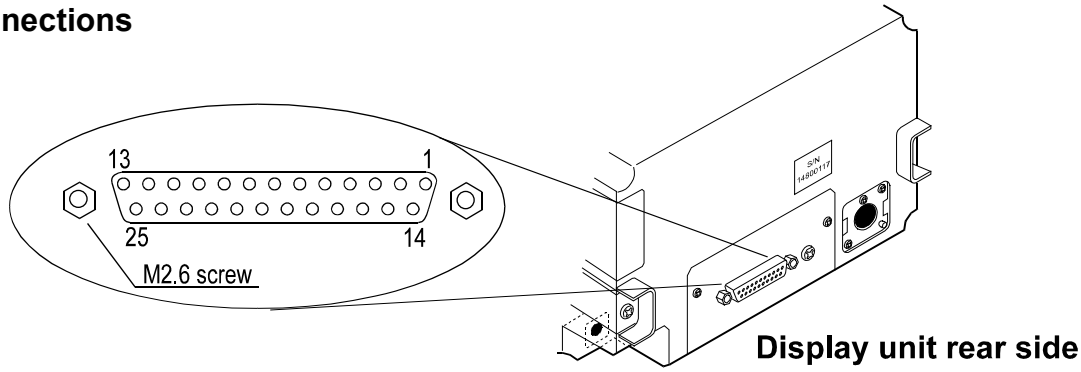


RS-232C

1 -5 V to -15 V

0 +5 V to +15 V

Pin Connections



Display unit rear side

	SV-10/SV-100 (DCE)		Computer (DTE)	
Pin No.	Signal Name *1	Description	Direction	Signal Name
1	FG	Frame ground	-	FG
2	RXD	Receive data	←	TXD
3	TXD	Transmit data	→	RXD
4	RTS	Ready to send *2	←	RTS
5	CTS	Clear to send *2	→	CTS
6	DSR	Data set ready	→	DSR
7	SG	Signal ground	-	SG
16, 18, 19, 21, 23	Internal use		Do not connect *3	
Others	Not used			

*1: Signal names of the viscometer side are the same as the DTE side with TXD and RXD reversed.

*2: RTS and CTS flow control are not used. CTS output is HI always.

*3: Normal DOS/V cables do not use these terminals.

12. COMMAND LIST

The viscometer can be controlled by the following commands from the computer.
Add a terminator CR LF (0Dh、0Ah) to each command.

Command	Description
Q	Outputs the current data.
SIR	Outputs data continuously
C	Stops data output by SIR command.
QM	Outputs the data during measurement. (Effective only during measurement.)
START	Same as the START key
STOP	Same as the STOP key
HOLD	Same as the HOLD key
MODE	Same as the MODE key
PRINT	Same as the PRINT key

13. TROUBLESHOOTING

The viscometer is a precision instrument. When the measuring environment or the measurement method is inadequate, correct values cannot be obtained. If measurement values do not become stable or they seem to be incorrect, check as described below. If improper performance persists after checking, contact the local A&D dealer for repair.

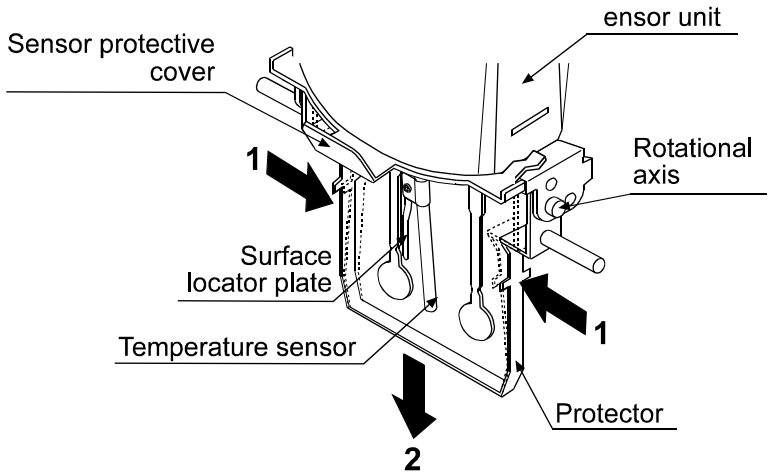
When measurement values do not become stable:

- ✓ Is the ambient environment free from vibration and drafts?
  - ● Places such as second or higher floor or near busy highways or rail lines are prone to vibration.
    Avoid these places or use an anti-vibration table, AD-1671A.
  - ● Reconsider the setting of "Condition (Cond) " of the function setting.
    Set it to "Cond 2".
  - ● Avoid direct drafts in the vicinity of the viscometer.

- ✓ Is there a strong electrical or magnetic noise source such as a motor near the viscometer?
  - ● Install the viscometer away from the electrical or magnetic noise sources.

- ✓ Is the protector or the sensor protective cover in contact with the sensor plates or the temperature sensor?
  - ● Attach the protector and the sensor protective cover properly so that they do not touch the sensor plates or the temperature sensor.
  - ● Remove the protector, the surface locator plate or the sensor protective cover when necessary.

How to remove the protector

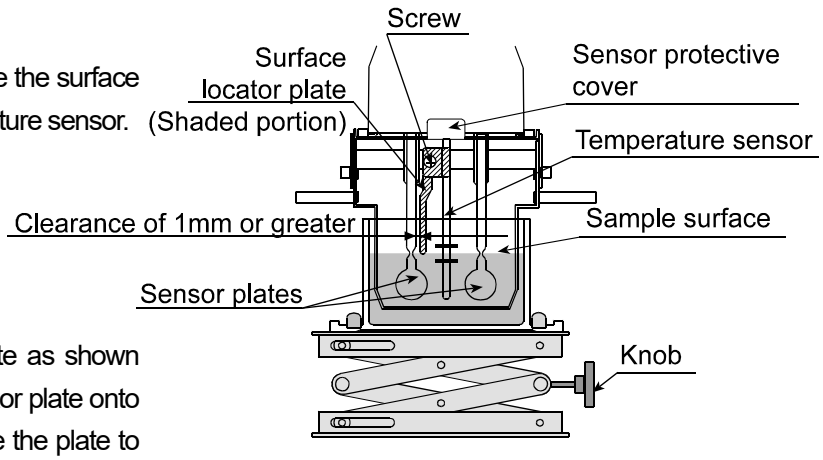


Press the left and right side frames lightly in the direction indicated as **1** to release the rotational axes. Pull the protector in the direction indicated as **2** to remove.

How to remove and attach the surface locator plate

Removing

Loosen the screw and remove the surface locator plate from the temperature sensor.



Attaching

Install the surface locator plate as shown in the illustration. Slip the locator plate onto the temperature sensor. Move the plate to the top of the sensor.

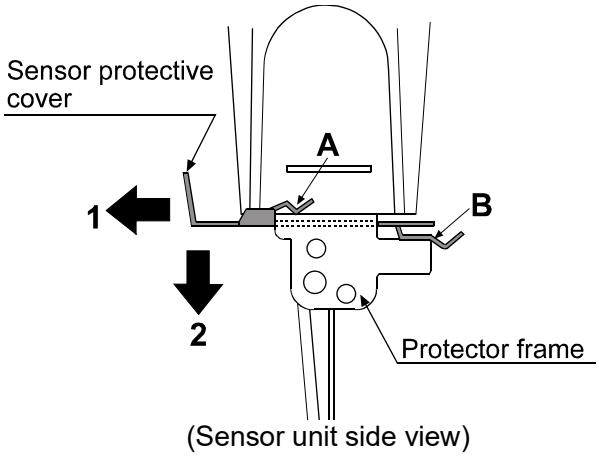
Adjust the position of the locator plate so that the tip of the locator plate aligns to the center of the narrow part of the sensor plates.

Tighten the screw.

Note

When the sensor plate and the surface locator plate are too close, a measurement error may occur due to the liquid surface tension. Therefore, secure a clearance of at least 1 mm between the sensor plate and the surface locator plate. Maintain the clearance by rotating the surface locator plate when necessary.

How to remove the sensor protective cover



(Sensor unit side view)

Remove the protector and the surface locator plate.

Pull the sensor protective cover in the direction indicated as **1** to release the portions **A** (two) and **B** from the protector frame.

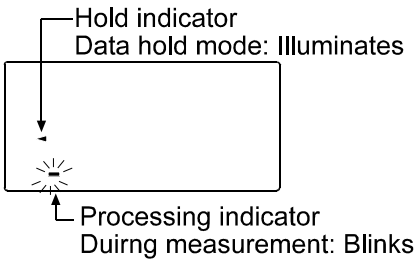
Pull the sensor protective cover in the direction indicated as **2** to remove.

Note

When removing the sensor protective cover, it may touch the sensor plates and the temperature sensor. Use much care not to damage them.

When measurement values are not correct:

- ✓ Has the sample surface been adjusted to the center of the narrow part of the sensor plates?
  - ● Adjust the table height by turning the knob so that the center of the narrow part of the sensor plates is on the sample surface.
- ✓ Are the positions of the left and right sensor plates in the sample surface the same?
  - ● If not the same, level the viscometer using the leveling feet so that the liquid surface will be leveled.
- ✓ Are the sensor plates clean?
  - ● Remove any residual sample material from the sensor plates using alcohol.
  - ● When any residual sample material is on the portion of the sensor plates above the sample surface, changes in the mass cause the vibration frequency to shift, which will result in a measurement error.
- ✓ Are the sensor plates bent?
  - ● If bent, contact the local A&D dealer for repair.
- ✓ Does the sample generate bubbles because of the differences in the sample temperature and the ambient temperature and do the bubbles accumulate on the sensor plates?
- ✓ The sample viscosity depends on the temperature.
  - ● In general, because the viscosity of a liquid depends on its temperature, the viscosity value decreases about 2 to 10 percent per degree Celsius if increasing the temperature.
- ✓ Is the sample surface lowered?
  - ● In a measurement that takes a long time, evaporation may cause the sample surface to be lowered. Maintain the sample surface level.
- ✓ Do the main unit and the display unit have the same serial number?
  - ● The main unit and the display unit have been adjusted in pairs. Confirm that the main unit and the display unit have the same serial number.
- ✓ Is the viscometer in the data hold mode?
  - ● To release the data hold mode, press the HOLD key.
  - ● The processing indicator blinks while a measurement is performed.



- ✓ Is calibration performed?
  - ● When the absolute viscosity value is important, it is recommend that a periodic calibration be performed using a standard viscosity fluid.

When more precise measurement is required:

- ✓ When the viscometer is installed for the first time or is moved to another location, plug in the AC adapter and warm up the viscometer for one hour or more, to acclimatize the viscometer to the measuring environment.
  And before measurement, calibrate the viscometer using the sample cup that will be used for measurement.

- ✓ Placing the sensor plates and the temperature sensor in the sample may change the sample temperature. For precise measurement, leave the sample as is for a while, after placing the sensor plates and the temperature sensor, to ensure no changes to the sample temperature. And then, start a measurement.

- ✓ When the sensor plates and the temperature sensor are cleaned using alcohol, the plates and the sensor are cooled temporarily and their temperature is lowered. Allow the plates and the sensor to acclimatize to the measuring environment before measurement.

When the temperature values are not correct:

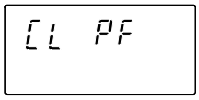
- ✓ Is the display unit connected to the main unit properly using the connection cable?
  - ● Refer to "2-2 Installing the Viscometer" on page 9 to make a connection between the display unit and the main unit.

When water viscosity is to be measured:

- ✓ When tap water is poured into the sample cup directly and is measured, bubbles are generated on the sensor plates due to the difference in pressure and temperature and the viscosity may increase gradually. Pressurized tap water generates bubbles easily. Therefore, use distilled or purified water that is not pressurized.

- ✓ In a measurement that takes a long time, the sample viscosity may increase due to water contamination. Perform a periodic check on water quality.

14. ERROR DISPLAY

Error display	Description
	Above measuring range error The viscosity value exceeds the upper limit of the viscosity measuring range (SV-10: 11.99 Pa·s, SV-100: 119.9 Pa·s). The viscosity of the sample cannot be measured. This error may occur when the display unit is not connected to the main unit.
	Below measuring range error The viscosity value is below the lower limit of the viscosity measuring range (SV-10: 0.30 mPa·s, SV-100: 0.90 Pa·s) The viscosity of the sample cannot be measured. This error may occur when the display unit is not connected to the main unit.
	The power supply for the internal clock is depleted. Press any key to enter the clock correction mode. Setting the clock enables the viscometer to be used temporarily. If the error occurs frequently, contact the local A&D dealer for repair.
	Internal IC error Turn the power off. Then, turn the power on again. If this does not resolve the error, contact the local A&D dealer for repair.

15. SPECIFICATIONS

<table>
<tr><td colspan="2">Measurement method</td><td colspan="3">SV-10</td><td colspan="2">SV-100</td></tr>
<tr><td colspan="2">Measurement method</td><td colspan="5">Sine-wave Vibro Viscometer using the Tuning-fork Vibration method
Vibration frequency 30 Hz</td></tr>
<tr><td colspan="2">Viscosity measuring range</td><td colspan="3">0.3 to 10000 mPa·s</td><td colspan="2">1 to 100 Pa·s
(1000 to 100000 mPa·s)</td></tr>
<tr><td rowspan="2">Measurement accuracy *1</td><td>Repeatability *2</td><td colspan="5">1% (Standard deviation)</td></tr>
<tr><td>Accuracy *3</td><td colspan="3">±3% (1 to 1000 mPa·s)</td><td colspan="2">±5% (1 to 10 Pa·s)
(1000 to 10000 mPa·s)</td></tr>
<tr><td colspan="2" rowspan="5">Minimum display</td><td>Range (mPa·s)</td><td>Minimum display (mPa·s)</td><td>Minimum display (Pa·s)</td><td>Range (Pa·s)</td><td>Minimum display (Pa·s)</td></tr>
<tr><td>0.3-10</td><td>0.01</td><td>0.0001</td><td>1-10</td><td>0.01</td></tr>
<tr><td>10-100</td><td>0.1</td><td>0.0001</td><td>10-100</td><td>0.1</td></tr>
<tr><td>100-1000</td><td>1</td><td>0.001</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>1000-10000</td><td>10 *4</td><td>0.01</td></tr>
<tr><td colspan="2">Unit (Viscosity)</td><td colspan="3">mPa·s, Pa·s, cP, P</td><td colspan="2">Pa·s, P</td></tr>
<tr><td colspan="2">Operating temperature</td><td colspan="5">10 to 40°C (50 to 104°F)</td></tr>
<tr><td colspan="2">Minimum sample amount</td><td colspan="5">35 mL</td></tr>
<tr><td colspan="2">Temperature display</td><td colspan="5">0 to 160°C/0.1°C, (32 to 320°F/0.1°F) *5</td></tr>
<tr><td colspan="2" rowspan="4">Temperature measurement accuracy</td><td colspan="5">0 to 20°C/32 to 68°F: ±1°C/±1.8°F</td></tr>
<tr><td colspan="5">20 to 30°C/68 to 86°F: ±0.5°C/±0.9°F</td></tr>
<tr><td colspan="5">30 to 100°C/86 to 212°F: ±2°C/±3.6°F</td></tr>
<tr><td colspan="5">100 to 160°C/212 to 320°F: ±4°C/±7.2°F</td></tr>
<tr><td colspan="2">Display</td><td colspan="5">Vacuum fluorescent display (VFD)</td></tr>
<tr><td colspan="2">Connection cable length</td><td colspan="5">1.5 m (between the main unit and the display unit)</td></tr>
<tr><td colspan="2">Communication</td><td colspan="5">RS-232C standard</td></tr>
<tr><td colspan="2">Power supply</td><td colspan="5">AC adapter (Confirm that the adapter type is correct for the local voltage and power receptacle type.)</td></tr>
<tr><td colspan="2">Power consumption</td><td colspan="5">Approx. 14 VA (Including the AC adapter)</td></tr>
<tr><td colspan="2" rowspan="2">External dimensions/mass</td><td colspan="5">Main unit: 332 (W) x 314 (D) x 536 (H) mm/Approx. 5.0 kg</td></tr>
<tr><td colspan="5">Display unit: 238(W) x 132 (D) x 170 (H) mm/Approx. 1.3 kg</td></tr>
<tr><td colspan="2" rowspan="5">Standard accessories</td><td colspan="5">AC adapter (1 pc)</td></tr>
<tr><td colspan="5">Windows communication tools for viscosity (WinCT-Viscosity) CD (1 pc.)</td></tr>
<tr><td colspan="5">Sample cups (Capacity: 45 mL, 4 pcs)</td></tr>
<tr><td colspan="5">RS-232C cable (25P-9P, 1 pc)</td></tr>
<tr><td colspan="5">Connection cable (1.5 m, 1pc)</td></tr>
<tr><td colspan="2"></td><td colspan="5">Disposable cup (Capacity: 10 mL, 5 pcs)</td></tr>
</table>

*1 to *5: See the next page for the detailed description.

*1 When a sample cup of 45 mL is used.

*2 Repetitive measurement with the sensor plates remaining in the sample

*3 The value after calibration using a standard viscosity fluid at a temperature range between 20°C and 30°C with no condensation.
In a measurement that takes a long time, perform calibration using a standard viscosity fluid or purified water periodically, as necessary.

*4 The unit switches to Pa·s.

*5 The operating temperature of each standard and optional accessory is as follows:

Sample cup (Standard and optional)	AX-SV-33:	0 to 120°C
Small sample cup (Optional)	AX-SV-34:	0 to 120°C
Glass sample cup (Optional)	AX-SV-35:	0 to 230°C
Water jacket assembly (Optional)	AX-SV-37:	0 to 100°C
Glass storage container (Optional)	AX-SV-38:	0 to 180°C (Lid: 80°C max.)
Disposable cup (Standard and optional)	AX-SV-63:	0 to 80°C

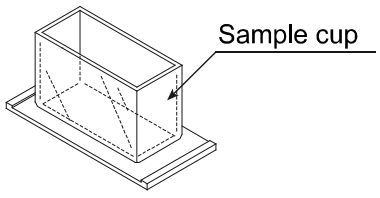
Take the operating temperature shown above into considerations when using the above items.

16. OPTIONAL ACCESSORIES

List of Optional Accessories (sold separately)

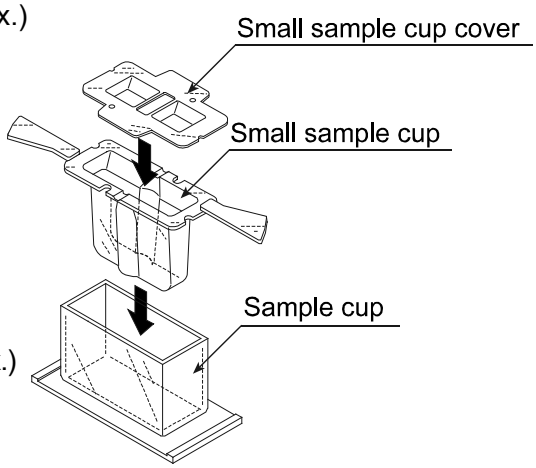
Name		Number
Standard viscosity fluid (JS2.5) *1	Capacity: 500 mL, with certification according to JIS Z8809	AX-SV-31-2.5
Standard viscosity fluid (JS5) *1		AX-SV-31-5
Standard viscosity fluid (JS10) *1		AX-SV-31-10
Standard viscosity fluid (JS20) *1		AX-SV-31-20
Standard viscosity fluid (JS50) *1		AX-SV-31-50
Standard viscosity fluid (JS100) *1		AX-SV-31-100
Standard viscosity fluid (JS200) *1		AX-SV-31-200
Standard viscosity fluid (JS500) *1		AX-SV-31-500
Standard viscosity fluid (JS1000) *1		AX-SV-31-1000
Standard viscosity fluid (JS2000) *2		AX-SV-31-2000
Standard viscosity fluid (JS14000)		AX-SV-31-14000
Standard viscosity fluid (JS160000) *3		AX-SV-31-160000
Sample cup (Capacity: 35 to 45 mL) Same as the standard accessory.	10 pieces/set	AX-SV-33
Small sample cup (Capacity: 10 mL)	10 pieces/set	AX-SV-34
Glass sample cup (Capacity: Approx. 13 mL)		AX-SV-35
Positioning stopper		AX-SV-36
Water jacket assembly		AX-SV-37
Glass storage container (Capacity: Approx. 50 mL)	10 pieces/set	AX-SV-38
Plastic storage container (Capacity: 120 mL)	20 pieces/set	AX-SV-39
Analog output		AX-SV-42
Extension cable (5 m) To extend the distance between the main unit and the display unit.		AX-SV-43
Dust cover for the main unit		AX-SV-62-1
Dust cover for the display unit		AX-SV-62-2
Disposable cup (PET, Capacity 10 mL)	40 pieces/set	AX-SV-63
Serial-USB converter		AX-USB-25P
Anti-vibration table		AD-1671A
Weighing environment logger		AD-1687
Weighing data logger		AD-1688
Compact printer		AD-8121B
Quick USB adapter		AD-8527

*1 Only available for the SV-10
*2 When calibrating with the SV-100, use the viscosity fluid at 25°C or below.
*3 Only available for the SV-100



AX-SV-33 Sample Cup

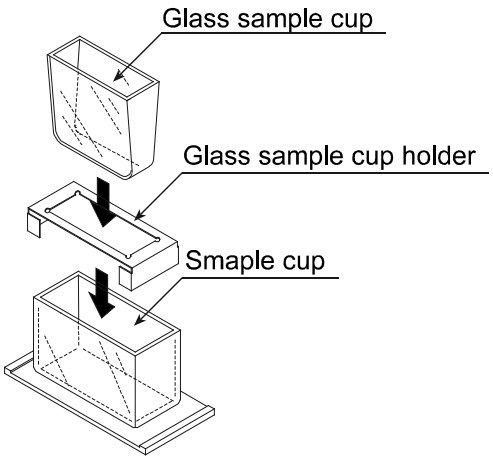
- The AX-SV-33 consists of :
  Sample cup (Capacity: 35 to 45 mL) 10 pcs
  (Polycarbonate, Operating temperature: 120°C max.)



AX-SV-34 Small Sample Cup (10mL)

- Used to measure a small amount of sample.
- The AX-SV-34 consists of :
  Small sample cup (10 mL) 10 pcs
  Small sample cup cover 10 pcs
  Sample cup 1 pc
  (All: Polycarbonate, Operating temperature: 120°C max.)

AX-SV-35 Glass Sample Cup (Approx. 13 mL)



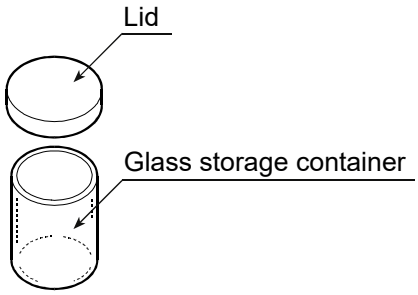
- Used to measure organic solvents
- The AX-SV-35 consists of :

  Glass sample cup (Capacity: Approx.13mL) 1 pc
  (Pyrex® glass, Operating temperature: 230°C max.)

  Glass sample cup holder (Stainless steel) 1 pc

  Sample cup 1 pc
  (Polycarbonate, Operating temperature: 120°C max.)

AX-SV-38 Glass Storage Container

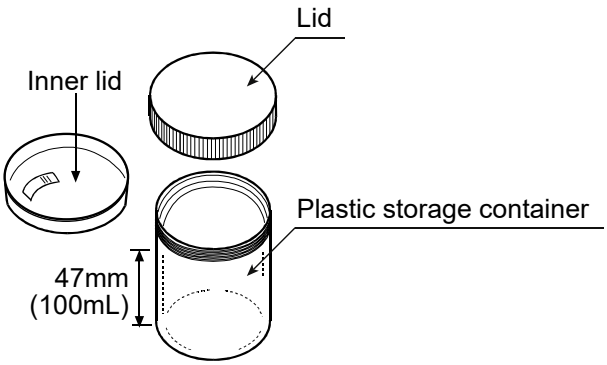


- Used to store sample fluids.
- The viscosity of the sample stored in the container can be measured as it is.
- The AX-SV-38 consists of :

  Glass storage container 10 pcs
  Capacity: Approx. 50mL
  Material: Polypropylene
  Operating temperature: 180°C max.

  Lid 10 pcs
  Material: Polyethylene
  Operating temperature: 80°C max.

AX-SV-39 Plastic Storage Container



- Used to store sample fluids.
- The viscosity of the sample stored in the container can be measured as it is.
- The AX-SV-39 consists of :

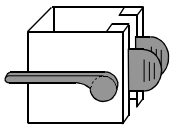
  Plastic storage container 20 pcs
  Capacity: 120mL max.
  Material: Polypropylene
  Operating temperature: 120°C max.

  Lid 20 pcs
  Material: Polypropylene
  Operating temperature: 120°C max.

  Inner lid 20 pcs
  Material: Low density polyethylene
  Operating temperature: 80°C max.

AX-SV-36 Positioning Stopper

- Used to secure the position of the sensor unit and the sensor plates so that positioning the sensor plates and the sample surface is not required each time a measurement is performed in a repetitive test. See below for how to attach the positioning stopper.



How to attach the positioning stopper:

1 Raise the lever so that the sensor unit can be moved.

2 While pinching the grips, lift out the sensor unit from above.

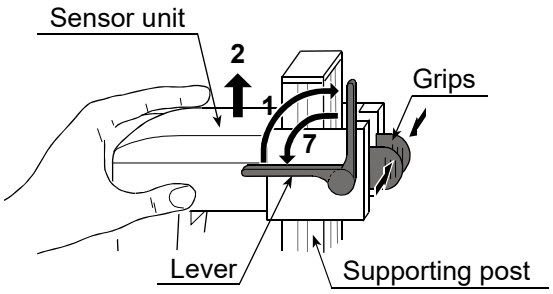
3 While pinching the grips on the positioning stopper, attach the stopper, with the lever on the left side as seen from front, on the supportintg post. Be sure to place the guides located on the inner wall of the stopper in the guide channels located on the supporting post.

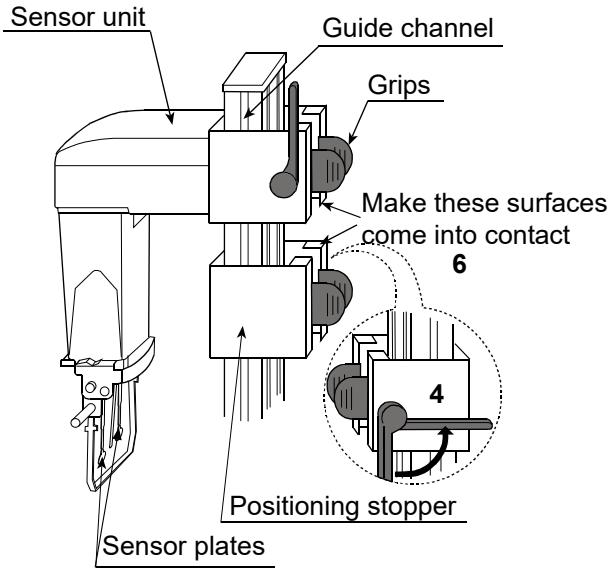
4 Position the stopper at an appropriate height. Raise the lever to secure the stopper.

5 While pinching the grips, attach the sensor unit on the supporting post.

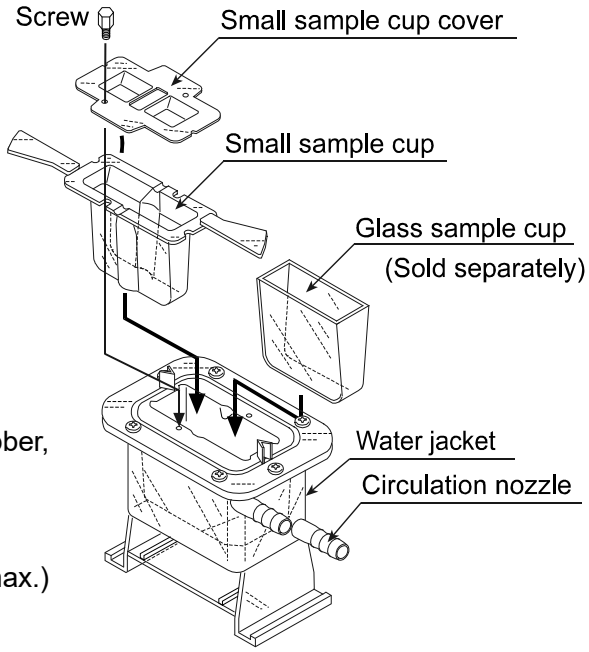
6 Lower the sensor unit until it comes into contact with the stopper.

7 Lower the lever to secure the sensor unit.





AX-SV-37 Water Jacket Assembly



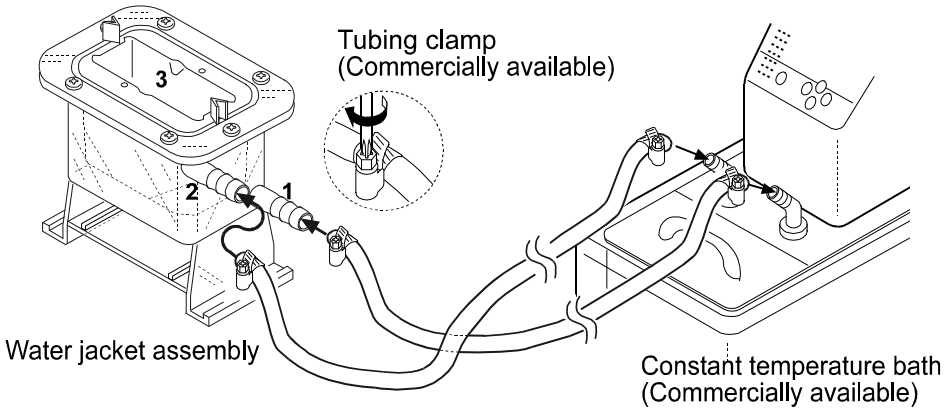
- Used, in combination with a commercially available constant temperature bath for heating medium circulation, to maintain the sample temperature constant or to measure the viscosity while changing the sample temperature.
- The glass sample cup sold separately can also be used.
- The AX-SV-37 consists of :

  Water jacket 1 pc
  (Main body: Polycarbonate, Packing: Silicone rubber, Washer: Nylon)

  Small sample cup 4 pcs
  (Polycarbonate, Operating temperature: 120°C max.)

  Small sample cup cover 4 pcs
  (Polycarbonate, Operating temperature: 120°C max.)

  Screw 1 pc
  (Screw: Polyacetal, Washer: Nylon)



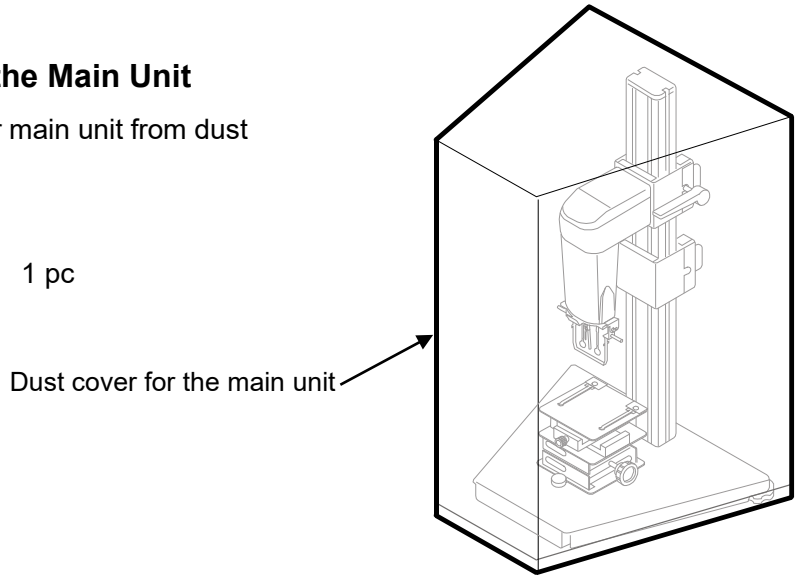
- Specifications Circulation nozzle: Outside diameter 10.5 mm
  Recommended hose: Silicone tube, inside diameter 8 mm
- It is recommended that, for safety, a commercially available tubing clamp (clamping size: 11 to 20 mm) be used to fasten the tube securely to the nozzle.
- When using the water jacket, make sure that no inner pressure is exerted in the water jacket due to the kinked or blocked tubes, as that could exert the pressure in the water jacket, causing it to break.
- Set the circulation flow rate to 5 L/min or less. Otherwise, the water jacket may be damaged.
- When a stirrer is attached at the bottom of the water jacket, the sample viscosity can be measured while the sample is being stirred. The maximum viscosity value which can be measured is 1000 mPa·s. (Only for SV-10)
  Stirrer: VARIOMAG MICRO manufactured by H+P Labortechnik AG
  Use a rotator with a size of 6 mm (length) x 4 mm (diameter).

AX-SV-62-1 Dust Cover for the Main Unit

- Used to protect the viscometer main unit from dust and dirt.

- Consists of :

  Dust cover for the main unit 1 pc
  (Nylon, light gray)

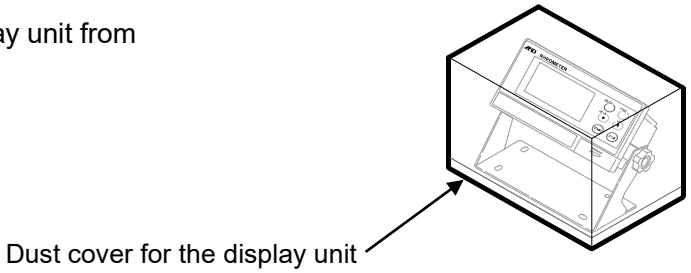


AX-SV-62-2 Dust Cover for the Display Unit

- Used to protect the viscometer display unit from dust and dirt.

- Consists of :

  Dust cover for the display unit 1 pc
  (Nylon, light gray)

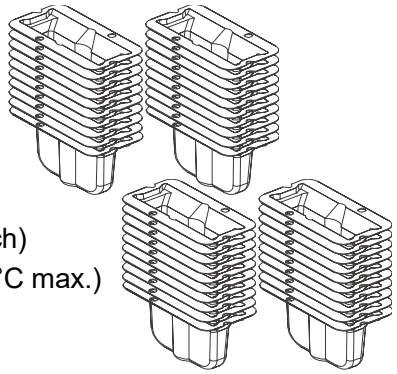


AX-SV-63 Disposable Cup (PET)

- Used in place of the small sample cup or the glass sample cup and can be disposed of after use.

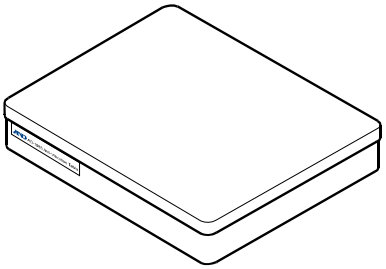
- Consists of :

  Disposable cup (10 mL) 40 pcs (Two bags of 20 cups each)
  (Polyethylene terephthalate (PET), Operating temperature: 80°C max.)



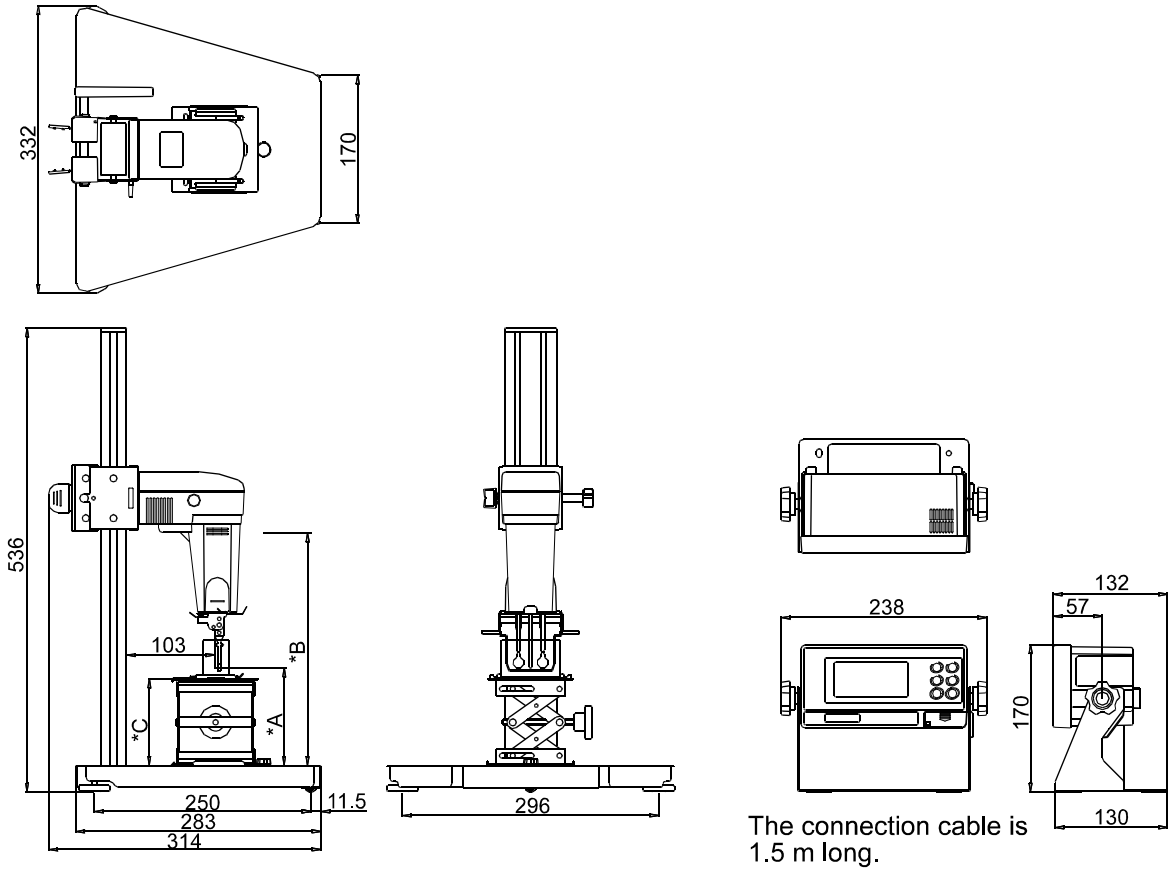
AD-1671A Anti-vibration table

- Used when the viscosity value is unstable due to external vibration, especially for measuring low viscosity.



17. EXTERNAL DIMENSIONS

Whole View



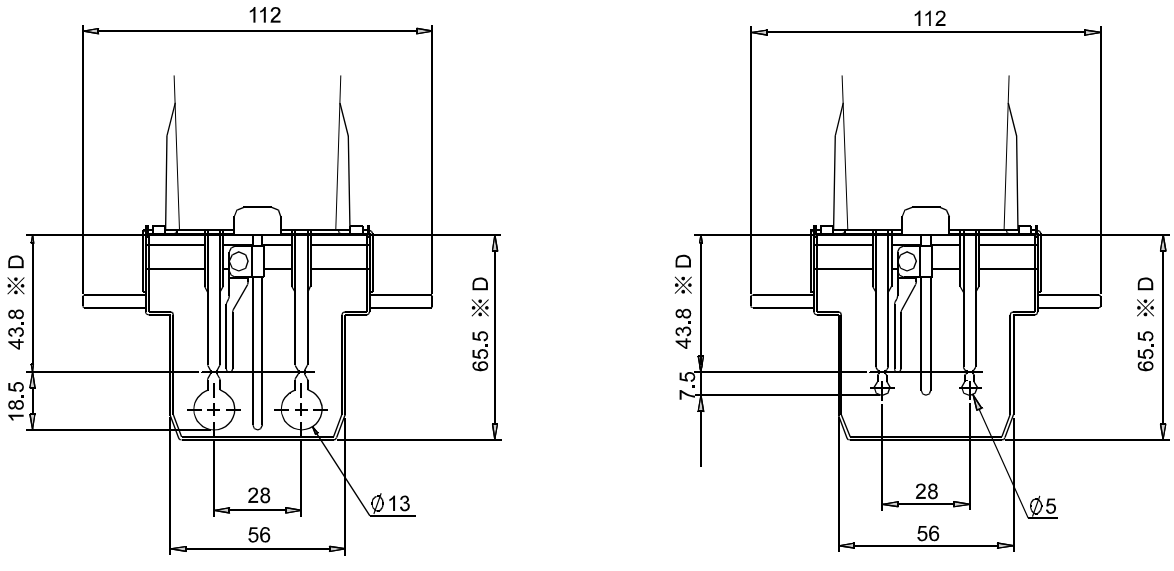
*A=Sensor plates lowest position 3.5 mm (With protector used, no table)

*B=Sensor plates highest position 268 mm

*C=Table height 54 to 140 mm

Unit: mm

Detailed View of the Sensor Unit



SV-10 SV-100

Unit: mm

*D=Distance from the sensor protective cover

MEMO

MEMO

THIS PAGE INTENTIONALLY LEFT BLANK.

A&D Company, Limited
3-23-14 Higashi-Ikebukuro, Toshima-ku, Tokyo 170-0013, JAPAN
Telephone: [81] (3) 5391-6132 Fax: [81] (3) 5391-1566

A&D ENGINEERING, INC.
47747 Warm Springs Blvd, Fremont, California 94539, U.S.A.
Tel: [1] (800) 726-3364 Weighing Support:[1] (888) 726-5931 Inspection Support:[1] (855) 332-8815

A&D INSTRUMENTS LIMITED
Unit 24/26 Blacklands Way, Abingdon Business Park, Abingdon, Oxfordshire OX14 1DY United Kingdom
Telephone: [44] (1235) 550420 Fax: [44] (1235) 550485

A&D AUSTRALASIA PTY LTD
32 Dew Street, Thebarton, South Australia 5031, AUSTRALIA
Telephone: [61] (8) 8301-8100 Fax: [61] (8) 8352-7409

A&D KOREA Limited 한국에이.엔.디(주)
서울특별시 영등포구 국제금융로6길33 (여의도동) 맨하탄빌딩 817 우편 번호 07331
(817, Manhattan Bldg., 33. Gukjegeumyung-ro 6-gil, Yeongdeungpo-gu, Seoul, 07331 Korea)
전화: [82] (2) 780-4101 팩스: [82] (2) 782-4264

OOO A&D RUS ООО "ЭЙ энд ДИ РУС"
Почтовый адрес:121357, Российская Федерация, г.Москва, ул. Верейская, дом 17
Юридический адрес: 117545, Российская Федерация, г. Москва, ул. Дорожная, д.3, корп.6, комн. 8б
(121357, Russian Federation, Moscow, Vereyskaya Street 17)
тел.: [7] (495) 937-33-44 факс: [7] (495) 937-55-66

A&D Instruments India Private Limited **ऐ&डी इन्स्ट्रूमेन्ट्स इण्डिया प्रा० लिमिटेड**
D-48, उद्योग विहार , फेस -5, गुड़गांव - 122016, हरियाणा , भारत
(D-48, Udyog Vihar, Phase-V, Gurgaon - 122016, Haryana, India)
फोन : [91] (124) 4715555 फैक्स : [91] (124) 4715599

A&D SCIENTECH TAIWAN LIMITED. **A&D**台灣分公司 艾安得股份有限公司
台湾台北市中正區青島東路 5 號 4 樓
(4F No.5 Ching Tao East Road, Taipei Taiwan R.O.C.)
Tel : [886](02) 2322-4722 Fax : [886](02) 2392-1794

A&D INSTRUMENTS (THAILAND) LIMITED บริษัท เอ แอนด์ ดี อินสทรูเม้นท์ (ไทยแลนด์) จำกัด
168/16 หมู่ที่ 1 ตำบลรังสิต อำเภอธัญบุรี จังหวัดปทุมธานี 12110 ประเทศไทย
(168/16 Moo 1, Rangsit, Thanyaburi, Pathumthani 12110 Thailand)
Tel : [66] 20038911