

Digital Viscometer

Instruction Manual

Dear User:

Thank you for selecting our viscometer, please read through this Instruction Manual before correctly using this product.

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I. Working principle and applicability

The brand new digital viscometer is an intelligent instrument based on single chip intelligent control. This series of viscometer is integrated with a high performance step motor and a driver running accurately and stably as per the program setting, and the motor drives the rotor to rotate through a torque sensor at a constant speed. When the rotor meets any viscous resistance in the liquid tested, the resistant force will be fed back to the torque sensor, processed and computed internally, and then displayed on the liquid crystal screen as a viscosity value of the liquid tested. Comparing with similar instruments, this series of instrument is advantages in convenient operation, direct reading, rich display, high measuring accuracy, stable rotating speed, high interference resistance and wide working voltage (100V~240V, 50/60Hz), etc.

In instrumental operation, this series of instruments can display the percentage of measured value to the full measurable range, warning of measurable range overflow, scan automatically and measure timely, and depending on these functions, the user can rapidly and precisely select a suitable combination of rotor and rotating speed, save the determined measuring conditions, and use it conveniently in future production and test.

This series of instrument can be extensively used in measuring the viscosity of solvent adhesive, emulsion, biochemical product, paint, coating material, cosmetics, ink, paper pulp, food and starch, etc.

II. Main technical performance

1. NDJ-5S

Measuring range	1mPa.S ~ 100,000mPa.S (Rotor #0 must be used for 15CP below)
Displaying resolution	0.01mPa.S
Measuring accuracy	±2% (Full measuring range)
Rotor spec.	Rotor #1, #2, #3, and #4 (Rotor #0 is optional)
Rotating speed	6, 12, 30, and 60 rpm
External dimensions	95mm×130mm×155mm (excluding the base)
Net weight	2kg (excluding the base)

2. NDJ-8S

Measuring range	1mPa.S ~ 2,000,000mPa.S (Rotor #0 must be used for 15CP below)
Displaying resolution	0.01mPa.S
Measuring accuracy	±2% (full measuring range)
Rotor spec.	Rotor #1, #2, #3, and #4 (Rotor #0 is optional)
Rotating speed	0.3, 0.6, 1.5, 3, 6, 12, 30, and 60 rpm
External dimensions	95mm×130mm×155mm (excluding the base)
Net weight	2kg (excluding the base)

* Unit conversion: 1Pa.s=1,000mPa.S, 1P=100mPa.S, 1cp=1mPa.S

III. Environmental conditions

Ambient temperature: 5°C ~ 35°C (recommended 20°C)

Relative humidity: ≤80%

Power supply: AC100~240V (50/60Hz)

There is no strong electromagnetic interference, no terrible vibration and no corrosive gas near the instrument.

IV. Instrument installation

1. Take out the base, lifting pole, viscometer main machine, main machine connecting bar, and power supply adapter, etc. As shown in Fig. 1, insert the lifting pole into the base hole and tighten by the nut (**notice: the lifting knob is at the right**), remove the screw from the main machine connecting bar, insert it into the installing hole at the back and bottom of the main machine, and then tightly fix the main machine connecting bar to the base with the hexagonal screw removed. Finally, insert the main machine with the well fixed connecting bar into the installing hole of the elevating slider, and tighten the fixing knob at the calibrated position.

2. Turn the elevating knob and adjust into a suitable elevating tightness at which the main machine will not slide down automatically, and the damping feeling is favorable in elevating, and the cross nut in front of the elevating slider can be rotated to adjust if it is too loose or too tight.

3. Adjust the three horizontal feet under the base and make the leveling air bubble in front of the instrument is at the center of the black circle.

4. Remove the protective cap under the instrument.

5. Connect the instrument to the power supply, and the assembled shaped is shown as Fig. 2.

6. Rotors #1~#4 equipped with the instrument are shown in Fig. 3 below.

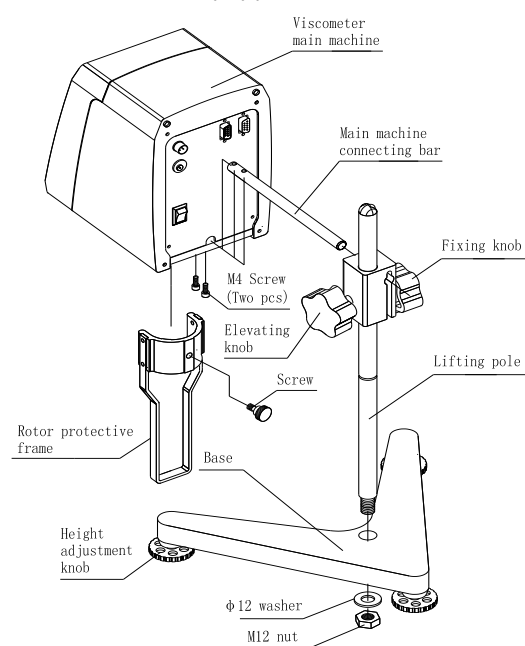


Fig. 1

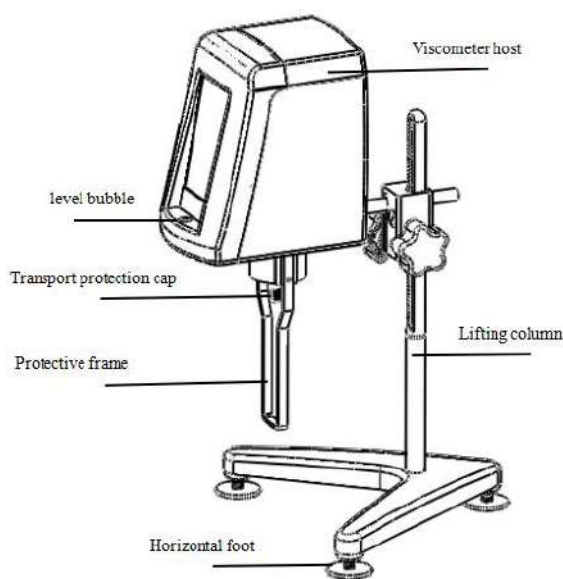


Fig. 2

7. Installation and operation of ULR Rotor Accessories (this part is optional)

(1) ULR Rotor Accessories consists of a fixing sleeve, rotor #0 and a testing tube, as shown in Fig. 4. This part can be only used in testing with rotor #0, and cannot be used with any other rotor.

(2) Install rotor #0 as per Fig. 5, firstly mount rotor #0 onto the rotor connecting screw (universal joint) clockwise.

(3) Attach the fixing sleeve to the cylinder under the instrument from the bottom up (avoid touching rotor #0), and fix the sleeve with fixing screws.

(4) Transfer 20mL of the tested liquid into the testing tube.

(5) Insert the sample cup with liquid from bottom to the topmost of the fixing sleeve, and then fasten by the fixing screws, the fixing screw must be tipped to the triangular chute on the upper end of the outer sample cup. The completed installation of rotor #0 is shown as Fig. 6, and testing can be started when the liquid temperature is controlled and the instrument is leveled.

(6) Rotor #0 cannot be running with no load when no liquid is filled, and the rotor protective frame is unnecessary if rotor #0 is used.

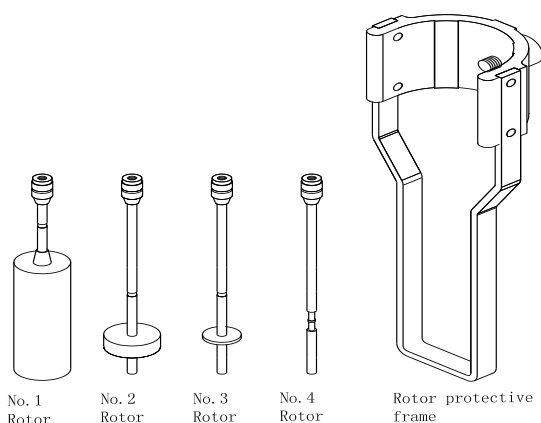


Fig. 3

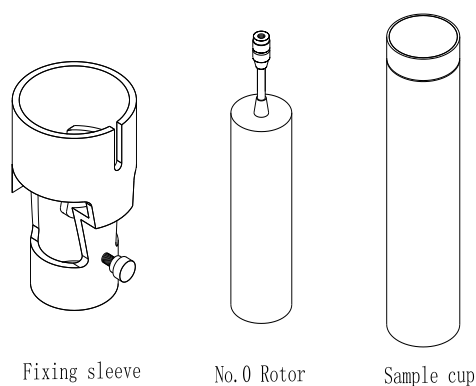


Fig. 4

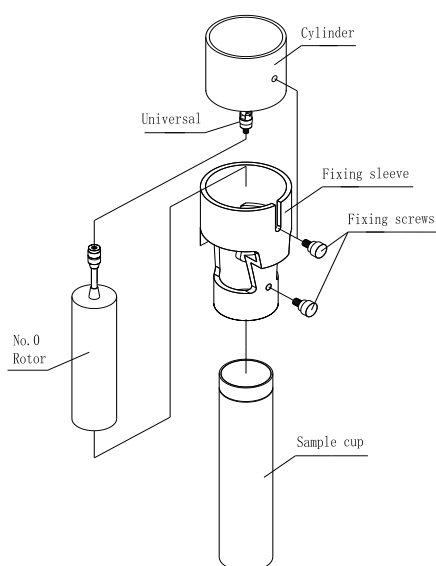


Fig. 5

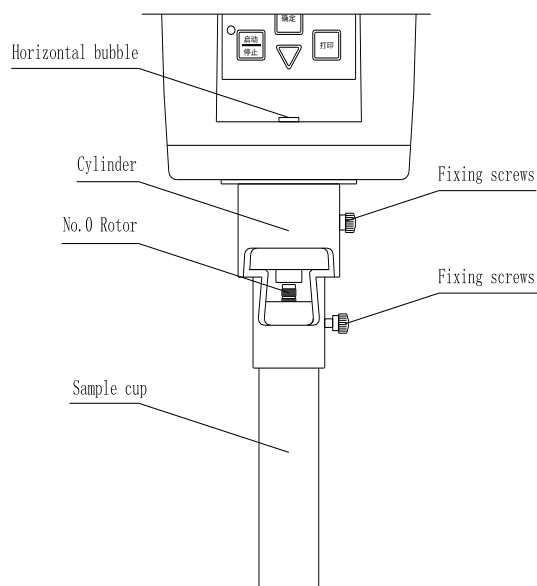


Fig. 6

V. Preparation before test

1. Pour the test sample into a round flat bottom container in a diameter of 70mm at least.
2. Mount the rotor protective frame onto the casing under the instrument.
- 3) Select a suitable rotor, and clockwise screw it to the shaft connector under the main machine.
4. Rotate the elevating knob to lower the instrument slowly, immerse the rotor into the sample and align the liquid level mark (the concave or convex line on the rotor pole) to the level of the tested liquid.
5. Check if the front level meter of the instrument is at the level position.

Notice: Never downwards or transversally pull the shaft connector when attaching or detaching the rotor, or the inner structure may be damaged.

The ambient temperature must be constant during measuring so as to maintain the stability and correctness of the measured value.

VI. Instrument operating interface and operating method

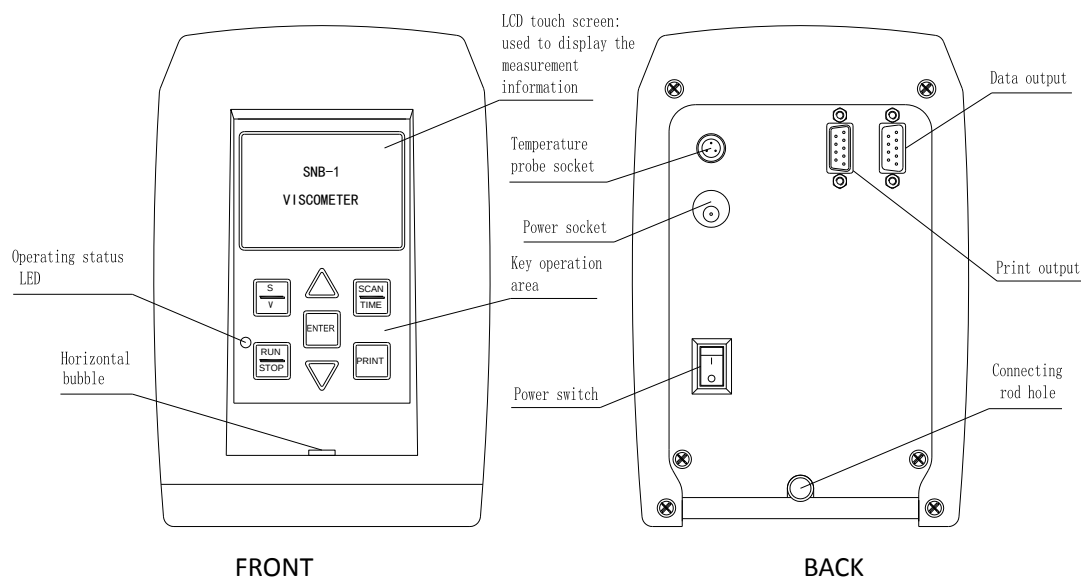


Fig. 7

6.1 Panel operating interface and each port

(1) There are totally 7 keys and 1 LED indicator on the operating area at the front panel of the main machine (Front of the main machine in Fig. 10).

(S / V) Key: select a rotor and a rotating speed;

(RUN/STOP) Key: start or stop the instrument;

(▼ / ▲) Key: adjust a corresponded parameter;

(ENTER) Key: confirm any parameter or option;

(SCAN/TIME): start automatic scanning and time to stop automatically;

(PRINT) Key: print any measured data (an external printer is required);

LED Indicator: this indicator will turn on when the motor starts to run and turn off when the motor stops running, and the instrument state can be determined through the indicator at a low rotating speed.

(2) Ports and sockets at the back of the main machine (Fig. 7)

Temperature probe socket: connected to a temperature sensor (optional);

Power supply adaptor socket: connected to the power supply adaptor equipped with the instrument;

Power supply switch: power supply control switch of the main machine;

Data output port: connected to a computer with a data cable;

Printer output port: connected to a portable printer;

(3) Description of LCD screen

When the instrument is turned on, the model information will be displayed at first, it will enter the standby state 3sec later, and four rows of parameters will be displayed on the LCD (Fig.8):

S: code of the rotor selected;

V: rotating speed at the current state;

R: the full measuring range value at the corresponded combination of rotor and rotating speed;

00:00: the preset time for the stop of timed test, 60min at the longest and 30sec at the shortest, and not set in default;

0.0°C: the current temperature detected by the temperature probe (displayed by 0.0°C if no temperature probe is inserted)

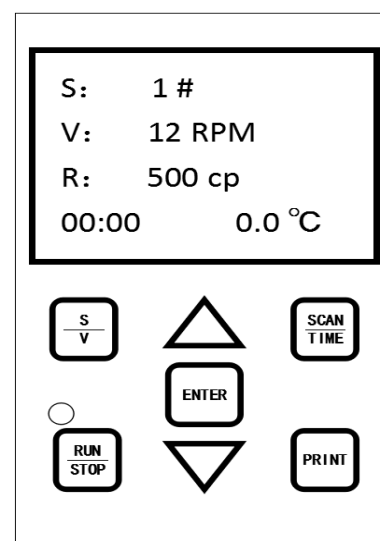


Fig. 8

This instrument is integrated with a memory function at power failure, i.e. the rotor, RPM, and timed length well set before a power failure will be kept and displayed after restart so that they can be used by the user conveniently.

6.2. Operating method

Press the “Rotor/RPM” key to select a suitable rotor and a suitable rotating speed before press the “Start” key to start testing and the instrument will display as Fig. 9. When the viscosity data of the tested sample is displayed on the screen, don’t read it immediately but wait till the instrument has rotated for 4~6 circles totally as the viscosity value is not valid unless the “%” value at the bottom is 10%~95%. If the “%” value is smaller than 10% or larger than 95%, another measuring range must be selected as it means the current one selected is not suitable. (Operating steps: the measuring range selected is large and must be reduced or the rotating speed must be improved or a larger rotor must be selected if the “%” value is smaller than 10%; the measuring range selected is small and must be enlarged or the rotating speed must be reduced or a smaller rotor must be selected if the “%” value is larger than 95%). This instrument will give a warning with buzzing if it goes beyond the full measuring range, and “EEEE” will be displayed if the torque is larger than 95%, in this case, a larger measuring range must be selected.

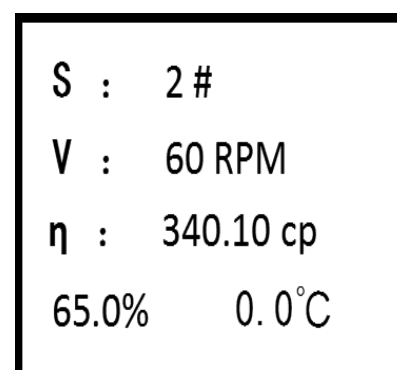


Fig. 9

For measuring the viscosity of an unknown sample, the viscosity of the sample shall be estimated at first before selecting the corresponding combination of rotor and rotating speed. For measuring the viscosity of an unknown sample, the viscosity of the sample shall be

estimated at first before selecting the corresponding combination of rotor and rotating speed. If it is hard to estimate the approximate viscosity of the sample, it is necessary to imagine the sample has a high viscosity before measuring by rotors from small to large (cubage) and in a rotating speed from low to high.

The principle for viscosity measuring is: small (cubage) rotor and low rotating speed for a high viscosity fluid; big (cubage) rotor and high rotating speed for a low viscosity fluid.

The measuring range of each combination of rotor and rotating speed is shown in the table below:

Rotor RPM	No.0	No.1	No.2	No.3	No.4
	Full measuring range mPa.s				
60 r/min	10	100	500	2000	10000
30 r/min	20	200	1000	4000	20000
12 r/min	50	500	2500	10000	50000
6 r/min	100	1000	5000	20000	100000
3 r/min	200	2000	10000	40000	200000
1.5 r/min	400	4000	20000	80000	400000
0.6 r/min	1000	10000	50000	200000	1000000
0.3 r/min	2000	20000	100000	400000	2000000

VII. Precautions

1. The viscosity is a function of temperature, so the temperature wave shall be controlled within $\pm 0.1^{\circ}\text{C}$ when the instrument is working at the normal temperature, or the measurement accuracy will be degraded. A constant temperature tank can be used if necessary.

2. The rotor surface must be kept clean.

3. The hairspring has a certain linear area, so the angle percentage shall be controlled during measurement, and this value shall be 10%~90%, and if the angle percentage is too high or too low, “EEEE” will be displayed for the torque and viscosity, the rotor or rotating speed shall be changed, or the measurement accuracy will be degraded.

E.g.: when SNB-1 is used for sample testing by the combination of “Rotor #1 and rpm 60”, the torque percentage displayed is “EEEE”, so the rotating speed shall be decreased. If the value is decreased to “rpm 0.3” but the torque percentage displayed is still “EEEE”, it means a smaller rotor (smaller surface area) shall be used for measuring. If the torque percentage is always 10%~95% at different rotating speed with a same rotor, the one whose intermediate percentage is larger shall be used, and other tests are performed by analogy.

4. The rotor shall be carefully mounted or removed by lifting the universal joint up gently. The rotor cannot be forced under any horizontal stress or pulled down, otherwise the shaft will be damaged.

5. Because the rotor and the universal joint are connected in left thread, rotor attaching or detaching must be performed in the correct the rotating direction (Fig. 10), or the universal joint will be damaged.

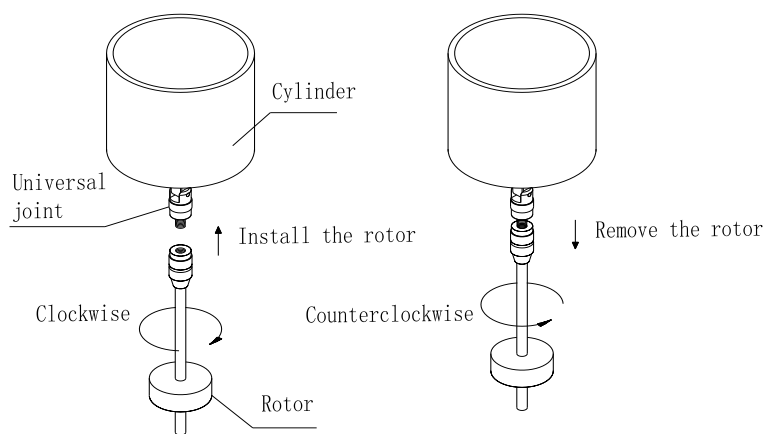


Fig. 10

6. The universal joint shall be kept clean.

7. The instrument shall be lowered slowly by carrying it by hands to protect the shaft from vibration.

8. The universal joint shall be protected by the cap when the instrument is being transported or handled.

9. Suspending liquid, emulsion liquid, high polymer and some other high viscosity liquid are mostly “Non-Newton” liquid, and their viscosity is varying with shear velocity and time, so there will be different measured values when measuring with different rotors, rotating speeds and durations, (the result will be also varying if measuring a non-Newton liquid with a same rotor in different rotating speeds) it is determined by the liquid property, and is not any problem arising from the instrument.

VIII. Viscometer standard packing list

SN	Name	Qty	SN	Name	Qty
1	Digital display viscometer main machine	1 set	6	Power adaptor	1 pcs
2	Main machine connecting rod	1 pcs	7	Rotor	4 total
3	Elevating pole and elevating slider	1 set	8	Allen wrench (one big, one small)	2 pcs
4	Triangle base	1 pcs	9	Instruction Manual	1 pcs
5	Rotor protective frame	1 pcs			

IX. Optional accessories

SN	Name	Qty	Remark
1	Temperature probe	1 pcs	Displaying the current temperature of the fluid tested (0°~100°C)
2	Portable printer	1 set	Printed the tested data directly
3	Constant temperature water bath tank	1 set	Control the sample temperature precisely
4	ULR Rotor Accessories	1 set	Testing the viscosity of any sample whose viscosity is below 15mPa.s