Operating Instructions
NDJ Series Digital Viscometer

Please read operating manual before installation and operation.

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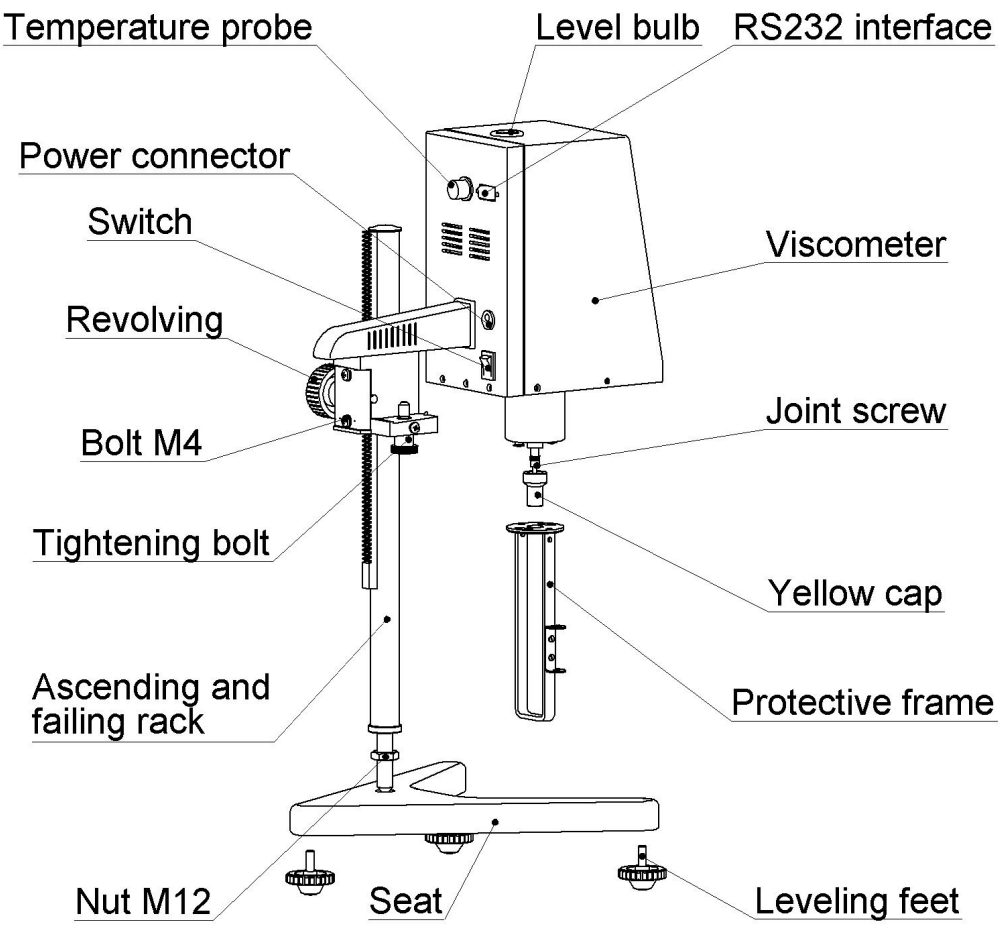
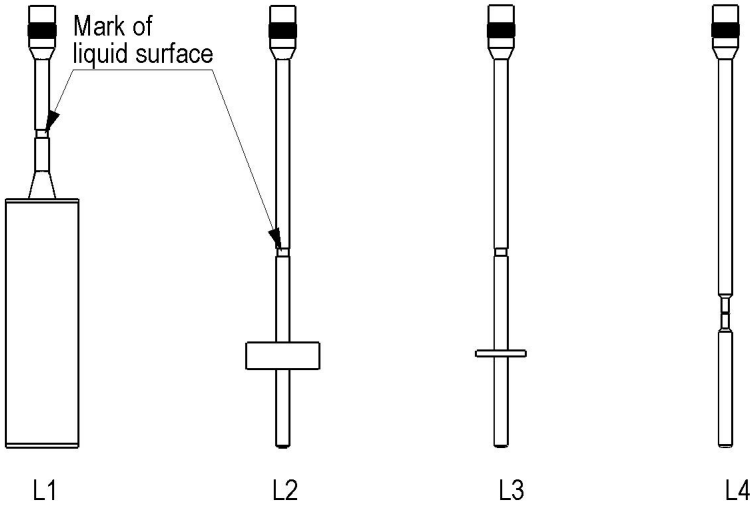
Main Installing Chart



Rotor Kits



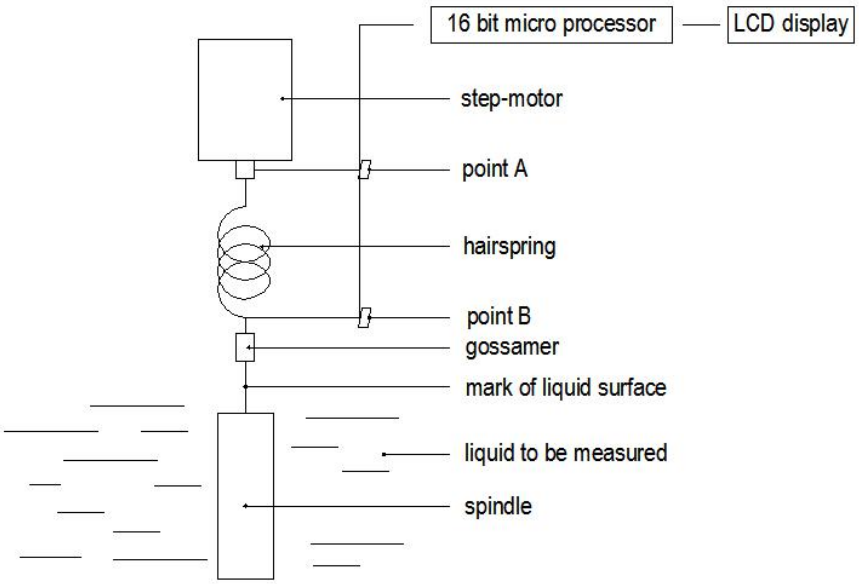
1. Main Technical Parameters

Model	NDJ-5S	NDJ-8S
Measuring Range （mPa·s）	20～100K	20～2M
Rotating Speed (RPM)	6，12，30，60	0.3, 0.6, 1.5，3，6，12, 30, 60
Spindles	Spindles (Code L1,L2,L3,L4) are equipped with the product Spindle (Code L0) is an option	
Accuracy	±1% full scale range in use	
Return Capacity	±0.5% full scale range in use	
Power	Power adapter(input:100～240V/50～60Hz,output: DC 12V/1A)	

***：K=1,000　M=1,000,000**

2. Basic Structure and Operation Principle

As shown in the following diagram, point A, spring, point B, axis and spindle rotate at a constant speed driven by the step motor. If the spindle is not resisted by liquid, Point A is in the same position with the pointer B. On the contrary, if the spindle is resisted by viscous liquid, the spring produces the torque and will repel or balance with the viscous resistance for reaching the balance at large. At this moment, by transmitting the angle difference between point A and Point B measured by the photoelectrical load cell to 16-bit microprocessor for data processing, the viscosity (mPa·s) will be displayed on LCD screen.



3. Components

Apparatus to be equipped

3.1 digital viscosity meter　　1 pce

3.2 ascending and falling rack 1 set
3.3 protective frame of spindle 1 pce
3.4 power adapter 1 pce
3.5 standard spindle (equipped according to the model) 1 set
3.6 spanner 1 pce
3.7 Seat and leveling feet 1 set

Options:

3.8 Extreme low viscometer adapter (with one spindle L0)
3.9 Small sample adapter (with spindle 21, 27, 28 and 29 each)
3.10 Temperature-controlled heater (with spindle 21, 27, 28 and 29 each)
3.11RTD temperature probe
3.12 RS232 standard output interface
3.13 Specially used printer

4. Installation (Please refer to the Main Installing Chart)

4.1 Take out the seat, ascending and descending rack, viscometer, spindle support and guard leg from the box and make sure no components is missing; If you purchase options, make sure no option is missing. The mental equipment case and other packages should be kept in good condition. In case there is some problems with the viscometer and should be returned to our company for maintenance, please package the viscometer and spindles with the referred specified equipment case properly before delivery. (There is no need to return the ascending and descending rack and the seat.)

4.2 Screw the ascending and descending rack in the screw hole of the seat according to the diagram and then screw down the nut with the wrench.

4.3 By running the knob of the ascending and descending rack, check the agility and self-locking capacity of the ascending and descending rack. If you find it too loosing or too tight, you can adjust the bolt on the back of the ascending and descending rack with the screw driver to make sure that it can either ascend or descend. It is preferable to screw it down more tightened so as to prevent the viscometer from going down after being installed.

4.4 Install the viscometer on the ascending and descending rack and make it tight with the bolt. The bolt that is unscrewed under the apparatus and remove and place the cap properly for next use. The cap plays a role in protecting the joint screw. Therefore, the joint screw should be covered by the cap when the viscometer is not in use for a long period of time or during the transportation.

4.5 By adjusting 2 leveling feet to make sure that the bubble is in the middle of the viscometer on the top. To avoid the slippery of the seat on the working desk, you can place three rubber pieces under three feet.

4.6 If RTD temperature probe is available, please connect it to the interface accordingly.

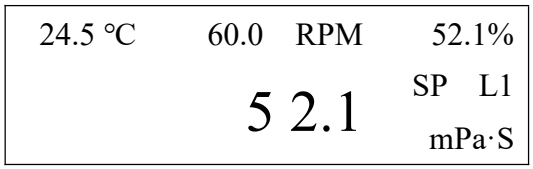
4.7 Make sure that the AC power switch at the rear of the viscometer is in the OFF position. Connect the power cord to the socket on the back panel of the instrument and plug it into the appropriate AC line (110～240V 50～60Hz).

5. Function of keys

Reset	Reset the application program. Then terminate the step motor and the viscometer is in stand-by state.
Print / Timing	Switch between printing and timing function. Set, confirm and start or cancel the printing function.
Speed	Selection of the motor rotating speed
Spindle	Select the desired spindle, and then set the spindle code with this key. The maximum range measured by this spindle under the current rotating speed will be displayed in this process.
Run	Start the motor to measure. And the viscometer is in working state.

6. Description of screen display

Select the spindle and set the appropriate spindle code as well as the rotating speed, then press the “Run” key. This will result in the following screen display:



“24.5℃” stands for the temperature measured by RTD temperature probe at ℃;

“SP L1” stands for spindle Code.L1;

“60.0 RPM” stands for the current rotating speed at 60 revolutions per minute;

Before pressing the “Run” key, the screen will display 100, it is the maximum viscosity measured by spindle L1 at the speed of 60 RPM.

After pressing the “Run” key, the screen will display “52.1 mPa·s” and “52.1 %”:

“52.1 mPa·s” stands for the viscosity measured at mPa·s

“52.1 %” stands for the mark of percentage meter, or called torque. The mark of the percentage meter between 20% and 90% is regarded as normal figures (for spindle Code.L0 the range is between 10% and 90%). The viscometer will alarm if it is beyond this range. As a result, the user should change the rotating speed or the spindle.

7. Operation Steps (For items (1) and (2) please refer to the main installing chart)

7.1 Make sure that the set-up steps have been finished.

7.2 Install the guard leg of spindle on the viscometer (revolving clockwise for installing and anticlockwise for uninstalling with top-view method)

7.3 Lift the motor shaft slightly with left hand and hold it firmly, then hold the upper part of the spindle with right hand and screw clockwise (from a top view) the spindle and the motor shaft to fix it.

7.4 Switch on the viscometer by pressing the button on the left side of the rear, then the screen flashes, the mainframe is on standby and the step motor does not work.

7.5 Input the spindle code, the displayed spindle code will be changed once the “Spindle” key is pressed and the code is circulated among L1→L2→L3→L4→L0.The input is over when the selected spindle code is displayed.

7.6 Selecting the rotating speed: the displayed speed of the spindle will be changed once the “Speed” key is pressed and it is circulated among the speed level specified (e.g. 6.0→12.0→30.0→60.0). The selection of the rotating speed is over when the speed of the selected spindle is displayed.

7.7 By revolving the knob of the ascending and descending rack, the viscometer will go down slowly and the spindle will be immersed into the liquid that will be measured until the mark of the spindle is in the same level with the liquid. And then adjust the position of the viscometer to the horizontal level.

7.8 By pressing the “Run” key, the step motor start to work, then you can measure the viscosity and the torque of the spindle under the current rotating speed. If the liquid is non-Newtonian, the figures will change slowly.

7.9 In the course of measurement, if you need to change the spindle, you can press the “Reset” key. At this moment, the motor stops and the viscometer is on standby. After the spindle is changed, you can continue to measure with the procedures from 7.5 to 7.8 mentioned above.

7.10 Pressing “Print/Timing” key to perform printing or timing measurement function.

7.10.1 Setting the time interval for printing

You should select the time interval for printing firstly. After press the “Print/Timing” key , S：00： 05 will be displayed. The time interval for printing will be changed once you press the “Print/Timing” key. 00：05→00：10→00：20→00：30→01：00→01：30→02：00→05：00→ will be circulated.

S： 00： 05 stands for printing every 5 seconds, 00： 10 stands for printing every 10 seconds, ……05： 00 stands for printing every 5 seconds. The rest result can be known by this way.

When the time interval for printing on the screen is desired, the selection of the time interval for printing is over.

After the printer is connected, press the “Print/Timing” key to start the printing. “on” will be printed out and the printing will be performed at the interval time set. To stop printing, press the “Print/Timing” key again, “off” will printed out and the printing stops.

7.10.2 Setting timing measurement

The timing measurement function has been added to series viscometers since the spindle, rotating speed and measurement time should be selected in measuring the “non Newton liquid”. The operator can set different measurement time according to the properties of the samples. The detailed procedure is given as follows:

Switch on the power of the viscometer, press the “Print/Timing” key before it comes into the measurement state. Do not release the “Print/Timing” key until the LCD display has changed

from “P:00:00” to “T:00:00”. Once press the “Print/Timing” key, the display will circulate among
“T:00:00→T:00:10→T:00:30→T:01:00→T:02:00→T:03:00→T:04:00→T:05:00→T:10:00→T:15:00→T:20:00→T:00:00”. It should be noted that “T:00:00” stands for no timing;“T:00:10” stands for ten-second measurement; “T:05:00” stands for five-minute measurement and so on. When the measurement time is displayed, it means that the setting has been completed automatically.

Since the timing measurement has been selected and set, when the measurement time reaches a certain value for each measurement, the viscometer meter will stop measuring. And the LCD screen will display the current viscosity and be locked as well. This function provides the operators the convenience to record, compare and analyze the progress and result of the “non Newton liquid” measurement.

In case that this function has to be cancelled, set the measurement time to “T:00:00” in the same procedures above.

8. Cautions

8.1 Be careful in installing and uninstalling the spindle. When installed and uninstalled, you should operate by uplifting the joint bolt slightly. Do not do it forcibly. The spindle should be placed vertically. And so as to protect it from being bended, it is important to prevent it from receiving a horizontal force.

8.2 Do not place the installed viscometer upside down or on side of it especially when spindle is installed.

8.3 Keep the screw thread and the side that connects the joint bolt with the spindle clean. The purpose of doing this is to prevent the rotating spindle from shaking, so as to ensure the accuracy of the measurement.

8.4 Hold the viscometer in your hand when rising and falling in case that the structure of ascending and descending rack is too loose.

8.5 Input the new spindle code if the spindle has been exchanged. The used spindle should be cleaned promptly and then put it back on the rack that collects spindles. To prevent the viscometer from being damaged, do not clean the spindle that is still on the viscometer and has not been uninstalled.

8.6 When the liquid has been removed, the spindle as well as the guard leg should be cleaned and wiped up to avoid the inaccuracy of the measurement caused by the interblended liquid.

8.7 Each viscometer has been equipped with its specified spindle. Do not interblend different spindles to use on viscometers of different types.

8.8 Do not dismantle and adjust the spare parts inside the viscometer mainframe.

8.9 When removing or transporting the viscometer, the joint screw should be covered by the cap and the bolt should be screwed down and be placed in the specified box.

8.10 To prevent the installed spindle from being damaged, do not circumrotate it for long time when there is no liquid.

8.11 Since most samples to be measured are “ non Newton liquid” and their viscosity values vary with the shear speed and the time, therefore, it is normal that their checking results vary when using different spindles and rotating speed. You can regulate the spindle, the rotating speed and

the time to measure the non Newton liquid according to it characteristic. . For measure time setting, please refer to 7.10.2 above.

9. How to reduce the inaccuracy of the measurement

9.1 Use the basin with constant temperature to precisely control the temperature of the liquid to be measured.

9.2 Make sure that the spindle and the protective frame have been cleaning before starting the measurement.

9.3 Before starting the measurement, make sure that the spindle is placed in the center of the vessel and the liquid surface mark of the spindle level off the surface of liquid to be measured.

9.4 Soak the spindle in the measured liquid for more than 10 minutes to get the same temperature for both, and then you can start the measurement.

9.5 Stop the motor at the time when high speed measurement is switched to low speed measurement by pressing the reset key. Set the value for low-speed measurement but do not start the measurement at this moment. In case of the inaccuracy caused by the circumvolved inertia of the liquid, wait until the liquid surface turns out to be stationary, and then press the “Run” key.

9.6 When measuring the low viscosity of the liquid, spindle Code.L1 should be selected, while measuring the high viscosity of the liquid, spindle Code.L4 should be chosen to do the measurement.

9.7 The measuring time for the viscosity measured at low speed is relatively longer.

9.8 During the measurement, to ascend or descend the viscometer, or to switch the spindle or the measured liquid will affect the horizontal situation of the viscometer. Therefore, it is necessary to check or adjust the level of the viscometer promptly.

9.9 Detect the viscometer by using standard viscosity liquid regularly or when necessary. The purpose of doing this is to follow up its performance and working condition from time to time. (To select the proper standard viscosity liquid, please refer to the range of the viscosity commonly-measured liquid.)

10. Sampling measurement for unknown viscosity

How to measure the liquid or sample with unknown viscosity range is a challenge to lab operator. In this case, please perform the measurement according to the following principles and methods.

10.1 The general principle for measurement: For the sample with high viscosity, you should choose the small size spindle (Code L3 and L4) and slow rotating speed. For the sample with low viscosity, you should choose the large size spindle (Code L1 and L2) and fast rotating speed.

10.2 You should estimate the viscosity range of the sample to be measured. According to the principle, you should choose the spindle first and then choose the rotating speed. For example, when the spindle L1 is rotating at the speed of 60RPM， the full capacity displayed on the screen is 1000 mPa.s. And when the rotating speed is changed into 6RPM, the full capacity is 100mPa.s that is reduced 10 fold.

10.3 In the case that you can not estimate the viscosity of the sample to be measured, you should try the spindle from small size to large size and the rotating speed from slow to fast. Then judge

whether the choices of spindle and rotating speed are appropriate by the torque.

10.4 When the sample is measured, the torque should between 20% and 90%. The viscosity measured within this range is the correct value. For Code L0 spindle, this torque range is between 10% and 90%. If it is not within this range, the viscometer will alarm, reminding the user to change the rotating speed and spindle. When is spindle is changed, the new spindle code should be input to the viscometer immediately, otherwise the measurement will be effected.

11. Frequent problems and trouble shooting:

Facts	Possible Reasons	Solutions
The level bulb can NOT be adjusted to the center	The slope of the working desk is large	Put some rubber pieces under the seat to adjust the horizontal level
The value is NOT accurate in measuring the Newton liquid	Protective frame is not installed	See Item 9.2
	The spindle used and the code displayed are not coherent	See the main installing chart and Part 5
	The viscometer is not adjusted to horizontal level; or the level is changed due to other operations.	See Items 7.7 and 9.8
	the surface of liquid is under the liquid surface mark of the spindle	See Item 9.3
	Spindle is not installed properly	See Item 8.3
	The spindle is not cleaned after last measurement	See Item 8.6
	The spindle does not match the viscometer	See Item 8.7
	The sample temperature varies in Measurement	See Item 9.1 and Item 9.4
	Mechanical parts of the viscometer is aging or damaged	See Item 9.9
No display of temp	RTD temperature probe is not equipped	See Part 3
Display of temp is abnormal	RTD temperature probe is damaged	Change a new one
	The probe and the viscometer is not connected properly	Connect them again
Measurement stops automatically	Measurement time of the timing function is activated.	See Item 7.10.2
Viscometer alarm	Exceed the measurement range (Torque should be within 20% and 90%. For spindle code L0, the range is from 10% to 90%.)	Change the speed or spindle
Value always varies in measurement	The sample measured is non Newton liquid	See Item 7.10.2 and Item 8.11
	The sample temperature varies in Measurement	See Item 9.1 and Item 9.4
	Mechanical parts of the viscometer is aging or damaged	See Item 9.9

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