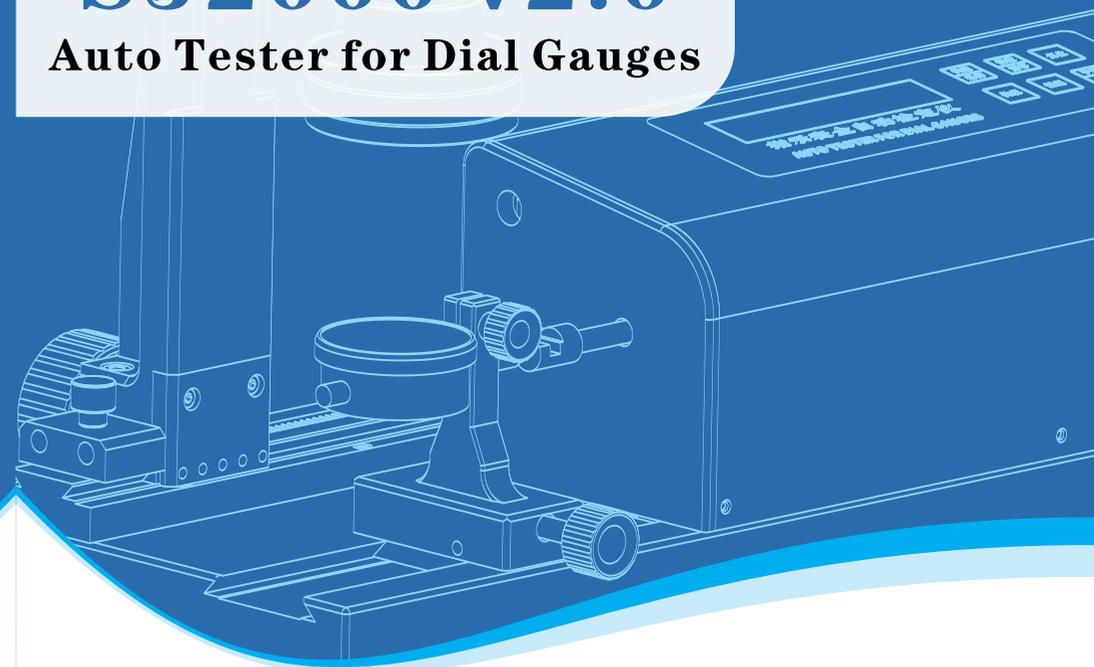


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SJ2000 v2.0

Auto Tester for Dial Gauges



User Guide

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Chapter I Brief Introduction

1.1 About this guide

Thanks for choosing “Auto Tester for Dial Gauges”. This guide can help you understand the operation method of this instrument and test the dial gauges easily. Before using the instrument, please read this guide and keep it for future reference.

No notice will be given in advance for the change of partial information of this guide due to constant improvement of the design and performance of the instrument.

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1.2 About this instrument

1.2.1 Summary of instrument's functions

Based on software technology and simple operation interface, the human-centric design of this instrument makes the operator get familiar with this instrument in a short period.

The testing procedure is intelligent. What the operator need do is to install the dial gauge, select the type of the gauge in the computer, and click the button of “Start Testing”, and then the tester will drive the gauge to test according to regulations. After testing is completed, the testing record, including the error curve, will be printed rapidly, with the testing speed 4–5 times than that of the semi-automatic tester. The operator will definitely feel that the testing efficiency is improved greatly, and the uncertainty of testing result will be obviously optimized, so the original tense and tired work becomes easy.

This instrument adopts computer database with large volume for storage, capable of saving all testing records. This instrument also has the following features:

Accurate and reliable. Good repeatability and fast speed for testing the data of the same gauge; the operation is convenient and the clamping is fast, no strict requirement on gauge position, and the parameter setup is simple; the display is legible, and testing personnel can master it quickly.

Updated standard. It complies with national standard and metrological verification regulation. It will be updated in time for any change of regulation.

Complete functions. It covers all functions of all kinds of semi-automatic products in the market, reliably and accurately simulating human eyes by CCD image identification technology.

Powerful printing capacity. It prints in 3 types (curve, form and all kinds of error value). The printing format is formal and beautiful. The testing date can be saved or printed collectively.

1.2.2 Technical indexes of the instrument

Items	Parameters
Auto measurement	Dial gauges (reading in 0.01 mm and 0.001 mm), dial test indicator, internal dial gauge, wide range dial gauge (reading in 0.01 mm), digital display meter, Imperial Units Meter
Manual measurement	Dial gauges (reading in 0.01 mm and 0.001 mm), dial test indicator, internal dial gauge, wide range dial gauge (reading in 0.01 mm), digital display meter, Imperial Units Meter
Measurement scope	(0–50)mm
Indication resolution	0.1 μ m
Image resolution	0.05
Digital display digits	8 digits
Measuring precision	(0–50)mm: equal to or less than 1.0 μ m if within 2mm, equal to or less than 2.0 μ m if within 10mm, maximum error of whole course is equal to or less than 3.0 μ m, and the return error is equal to or less than 0.5 μ m.
Power supply	220V \pm 10%, 50Hz
Size	566mm*214mm*669.5mm(L*W*H)
Weight	25kg
Working environment	(20 \pm 5) $^{\circ}$ C
Storage temperature	(10–35) $^{\circ}$ C, relative humidity (10–60)% RH
Computer interface	USB2.0

Table 1

Note: the digital display meter and Imperial Units Meter are optional. Please refer to Appendix E Appendix I for detailed parameters of meters to be tested by this instrument in accordance with latest national regulations.

1.3 Instrument overview

1.3.1 Hardware

1.3.1.1 Main body

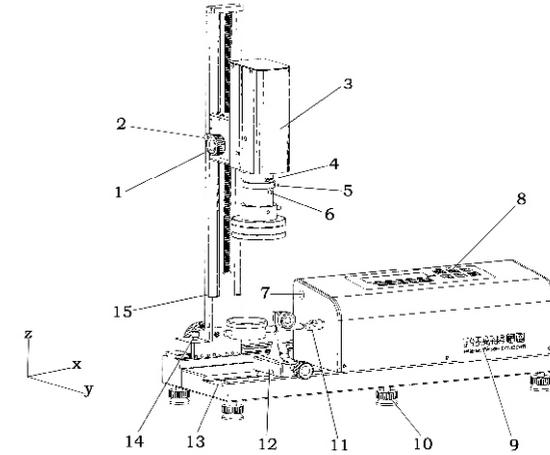


Figure 1

No.	Name of each part	Purpose
1	DV's horizontal adjusting knob	Move DV along y-axis
2	DV's bracket fixing knob	Fix the bracket of DV
3	Main body of DV	
4	Lens object distance adjusting knob	Adjust the distance of object
5	Lens aperture adjusting knob	Adjust the light of camera
6	Lens focus adjusting knob	Adjust lens focus to make image clear
7	DV's power supply jack	For power supply
8	Display and control panel	See Figure 5 for its functions
9	Company's Logo	
10	Ground screw	When instrument is placed on platform, adjust it to keep the platform horizontal
11	Feeler pin	
12	Clamp I	Used for clamping gauges
13	Sliding guide	Used for placing clamp
14	Column fixing knob	Fix the knob
15	Column	

Table 2

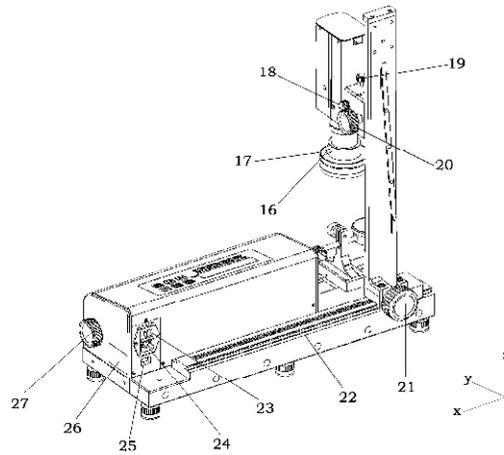


Figure 2

No.	Name of each part	Purpose	Remark
16	Lampshade fixing knob	Lock the lampshade on the lens	
17	External ring of lampshade	Adjust it to eliminate the shade in the center of image	Rotate it to adjust
18	DV fixing knob	Fix DV on the bracket	
19	DV fixing knob	Fix DV on the bracket	
20	DV vertical adjusting knob	Move DV along z-axis	
21	Column horizontal fixing knob	Move DV along x-axis	
22	Column slide-rail	For power supply	
23	Instrument switch	Control the on/off of power supply	
24	Instrument power supply jack	Connection with 220V power supply	
25	USB interface	Connection with computer	
26	Instrument nameplate	Instrument code and production date	
27	Manual knob	Move feeler pin horizontally under manual status	

Table 3

1.3.1.2 Display panel

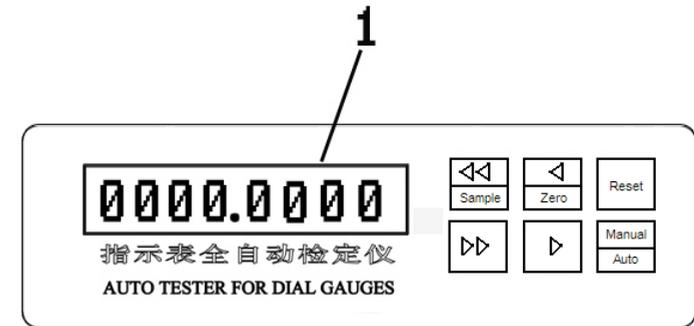


Figure 3 Panel

1. Specification of digital display zone

Instrument status		Displayed Contents
Power on		SJ2000V2
Under test	Auto	1 st digit displays testing status "A", 2 nd digit displays nothing, 3 rd and following digits display the step length of step motor
	Manual	1 st digit displays testing status "H", 2 nd digit displays nothing, 3 rd and following digits display the step length of step motor

Table 4

Note: the unit of the displayed data is "mm".

Specification of each functional button on the panel

Note: this instrument has two testing methods: automatic and manual.

Refer to Table 5 for functional buttons:

Testing status	Functional buttons	Specifications on buttons
Automatic	Fast forward	Make the feeler pin advance rapidly
	Fast backward	Make the feeler pin back off rapidly
	Slow forward	Make the feeler pin advance slowly
	Slow backward	Make the feeler pin back off slowly
Manual	Zero clearing	Reset the data on the display panel
	Sample	Sample the inspected points of the inspected gauges
Auto/Manual	Reset	Return the grating to the physical original position
Auto/Manual	Manual/Auto	Switch between automatic testing and manual testing

Table 5

1.3.2 Software

1.3.2.1 Main operation interface

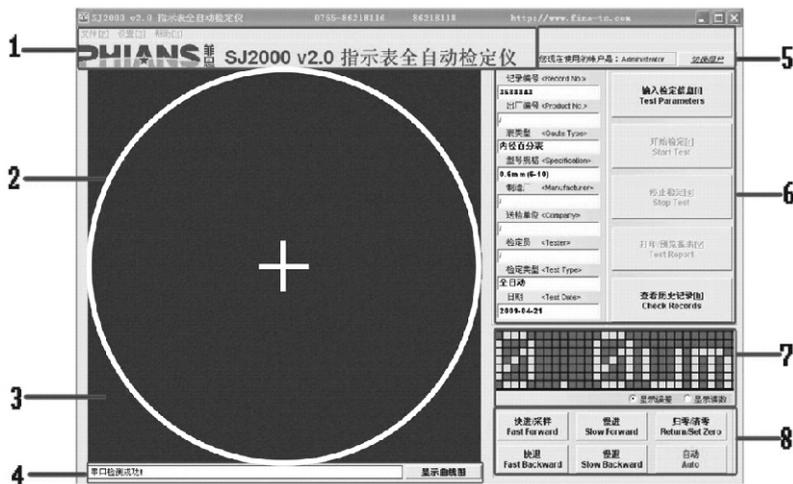


Figure 4 Main operation interface

- 1. Display zone of main menu, company LOGO, instrument name and edition number

Refer to Table 6 for each functional button

Menu	Sub-menu	Functions
File	Exit	Exit the testing program
Set	Sampling Set	During manual testing, it is used to set up sampling time, and the default is automatic sampling
	Testing Speed Set	Set tesing speed before testing
	Buzzer(Open/Close)	Open or close buzzer when testing
Operation	Serial port testing	After software is started, it is used to test if the software is normally connected with the instrument
	Digital display force equipment test	Force measurement using the digital display force equipment
Help	Show Computer ID	Compute a value which is used to produce registry code
	Registration	After the software expires, register it by inputting registration code
	Operation	Introduction to the software operation
	About	Specification on software edition and other information

Table 6

- 2. Image positioning circle
- 3. Image display zone during the testing procedure
- 4. Hint window for testing information
- 5. Hint window for operator status

Operator's status	Operator's rights
Administrator	Operator has the rights of testing gauges and modifying data
Operator	Operator only has the basic testing rights
Guest	Operator only has the right of checking historic data

Table 7

6. Display zone and main operation zone of basic testing information

Button	Functions
Start test	Button of starting automatic/manual testing
Stop test	Stop the testing (and the instrument will return to preliminary testing status)
Input Test Parameters	Button of activating the testing information input window (see Figure 5)
Print/Preview report	Button of activating the report window
View History	Button of activating the historic record window (see Figure 7)

Table 8

7. Simulation LCD

Note: this display zone is divided into two kinds of display methods:

Display error (Display current error)

Display reading (Display the value of scale mark)

8. Functional button zone

1.3.2.2 Specification of functional buttons

Figure 5 Input testing information

Specification of "Gauge information" in the "Input testing information"

Figure 6 Gauge information

No.	Option	Specification
1	Category	It refers to the gauge categories, like dial gauges (reading in 0.01 mm and 0.001 mm)
2	Types of gauges	Detailed types for each gauge, for example, internal dial gauge is divided into three types like "with positioning protection bridge" "expanding head bore" and "steel ball"
3	Model	It refers to the gauge of the meter to be tested
4	Testing types	It is divided into first testing, subsequent testing and testing during usage according to new regulations
5	Gauge scale	It refers to the number of scales around a circle of the dial
6	Gauge graduation	It refers to the distance between two adjacent scale marks, and the unit is mm.
7	Testing spacing	
8	Testing method	Automatic and semiautomatic

Table 9

Figure 7 Check historic records

Specification of each button of "Check historic records"

Operation	Functional buttons	Functions	Remark
Main operation type	Print selected record	Print error data list of selected record	
	Print curve graph	Print error curve graph of selected record	
	Delete record	Delete selected record	
	Printed	Mark the printed records	
	Data Management	Revise partial wrongly input information, like the name of client.	Only Administrator has such right
	see reports	Check the detailed data of selected testing records	
	Exit	Exit the interface of "Check historic record"	
	Print Table Head	Print the head information of selected testing records	
	Page Up	Move records' cursor the prev page	
	Page Down	Move records' cursor to the next page	
Query type	Query By Conditions	Inquire records according to gauge types or other conditions	
	Query By Date	Inquire records according to the date	
	Query In Results	The second inquiry can be done according to available conditions in the inquiry results	It can realize the inquiry of several times
	All records	Display all records	After inquiring according to certain conditions, all records can be displayed by clicking "all records"

Table 10

Chapter II Instrument Installation and Usage

2.1 Hardware installation and notes

2.1.1 Hardware installation procedure

a. As showed in the figure, place the column vertically in the direction of arrow, then fasten the screw.

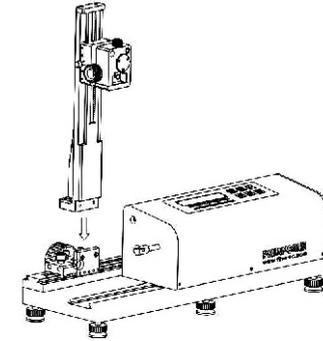


Figure 8

b. As showed in the figure, insert DC in the direction of arrow.

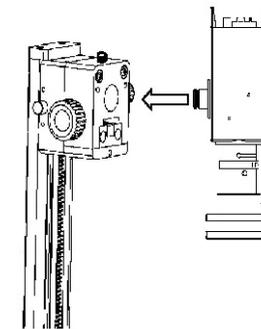


Figure 9

c. The following figure shows the status after installation.

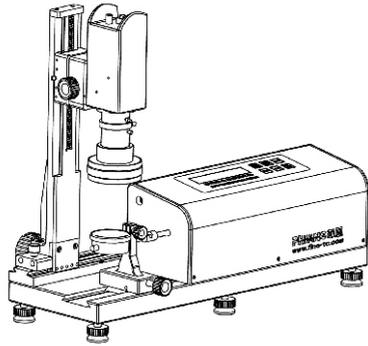


Figure 10

2.1.2 Sketch map of clamping common gauges

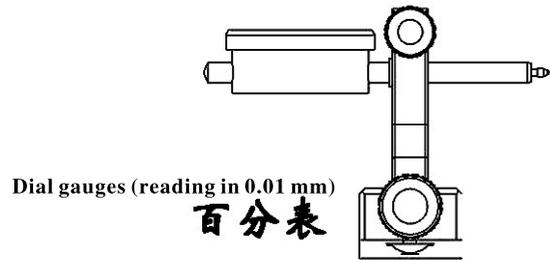


Figure 11

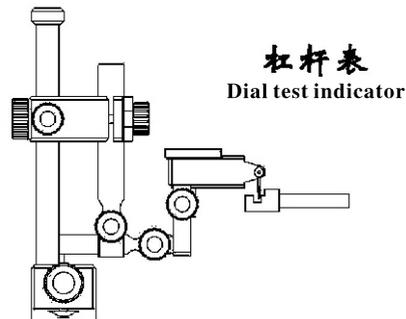


Figure 12

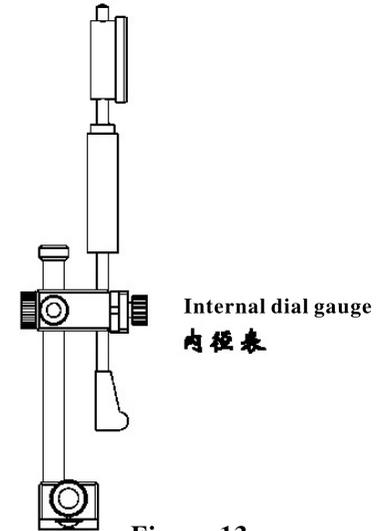


Figure 13

2.1.3 Preparation for power on

1. Before power on, check if the instrument is well connected with the computer and power supply. The following is the list of connection lines:

No.	Name of connection lines	Connection object	Purpose
1	220V power cord	Instrument is connected with power supply	Power supply to instrument
2	USB connection line	Instrument is connected with computer	Data transmission between instrument and computer
3	Coaxial cable	Instrument DC is connected with computer	Image transmission

Table 11

2. After checking each connection line, adjust the "ground screw" to make each "ground screw" bear force evenly, so that the instrument can be placed horizontally.

2.2 Software installation and notes

Note: the installation CD includes 3 drivers:

1. Installation program of testing software of "SJ2000 v2.0 auto tester for dial gauges"
2. USB driver of "SJ2000 series port drive"
3. Driver of video capture card

The detailed installation procedure is as follows:

2.2.1 Installation procedure of testing software

Before installing this software, please ensure that this software of other edition has not been installed in your computer; if it has been installed, it shall be uninstalled before installing this software; otherwise, there may be software conflict and this software may not be used normally.

Note: when the computer system or testing software needs to be reinstalled, firstly backup the file data.mdb under C:\windows\database\; after reinstalling system or testing software, cover the data file under C:\windows\database\ by the backup file data.mdb, so as to avoid the loss of testing data or the conflict between new and old software.



Figure 14

- a. Place the CD into the CD-ROM of computer. After CD is read, click the installation program of "SJ2000 v2.0 auto tester for dial gauges".

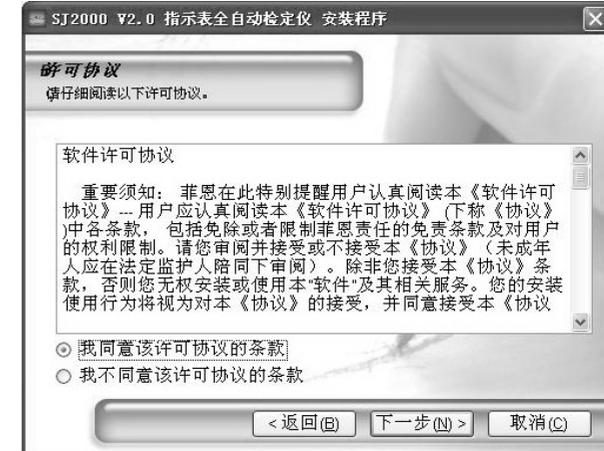


Figure 15

- b. Select "I agree with the clauses of the license agreement" and click Next Step.



Figure 16

- c. Input corresponding name and company, and click Next Step.



Figure 17

d. Click “Change” to select the route of installing the software (the default is under Disk C), and click Next Step.



Figure 18

e. If no error is found, click Next Step to install the program.



Figure 19



Figure 20

f. Click "Finish" to complete the installation and a shortcut of the program will appear on the desk.

2.2.2 Procedure of installing USB driver



PL-2303 Driver
Installer

Figure 21

a. Double click "PL-2303" installation procedure.



Figure 22

b. Click Next Step.



Figure 23

c. Click "Finish" to end the installation.

2.2.3 Procedure of installing the drive of video capture card

a. Open the folder "Driver" and select the driver corresponding to the computer configuration.

4. After completing the installation, restart the computer.

2.3 Procedure and skills of adjusting the instrument

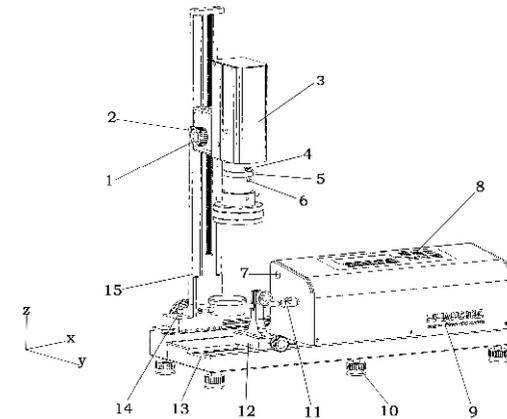


Figure 1

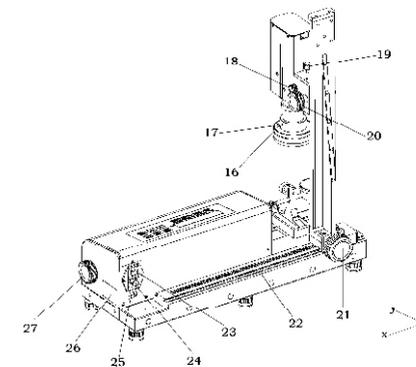


Figure 2

This instrument adjustment is divided into coarse adjustment and fine adjustment. Taking pointer gauge as example, the procedure is as follows:

2.3.1 Coarse adjustment

1. As showed in Figure 1, place the tested gauge on the sliding guide, move the clamp to make the gauge outfit about 3mm away from the feeler pin of the instrument, and then adjust the clamp's knob to fasten it.
2. Open the testing software to check if there is image in the "image display zone". If not, check if DV is well connected with the video line of the computer. If the connection has no problem but the display zone is still black, adjust "5.Lens aperture adjusting knob" in Figure 1.
3. Select the option corresponding to the gauge to be tested in the column of "Input testing information".
4. Adjust "20.DV vertical adjusting knob" in Figure 2 to make the height from the lens to the surface of the tested gauge about 60mm (this height takes the most common dial gauges reading in 0.01 mm as the reference, and the actual distance may fluctuate with the size of dial: the bigger the dial, the longer the distance. The adjustment scope of the distance is usually "20–30mm of the reference height).
5. Adjust "21.Column horizontal fixing knob" in Figure 2 to make the tested gauge is within the visual scope of the lens (this knob makes the image move vertically).
6. If the image in the "Image display zone" of the testing software is very dim, adjust "6.Lens focus adjusting knob" in Figure 1 to make the image clear.
7. Adjust "4.Lens object distance adjusting knob" in Figure 1 to make "image positioning circle" tangent to the scale mark of the tested gauge. After adjusting the object distance, focus and aperture of the lens during coarse adjustment, you can start the fine adjustment.

2.3.2 Fine adjustment

1. Firstly, check the image of "Image display zone". If there is obvious shade in the image zone, adjust "20.DV vertical adjusting knob" in Figure 2 to make the shade on the surface disappear, so that the surface of the tested gauge receives light more evenly.
2. Adjust the image into the effect showed in Figure 24 by adjusting "1. DV's horizontal adjusting knob" (make the image move horizontally) in Figure 1 and "21. Column horizontal fixing knob" (make the image move vertically) in Figure 2.

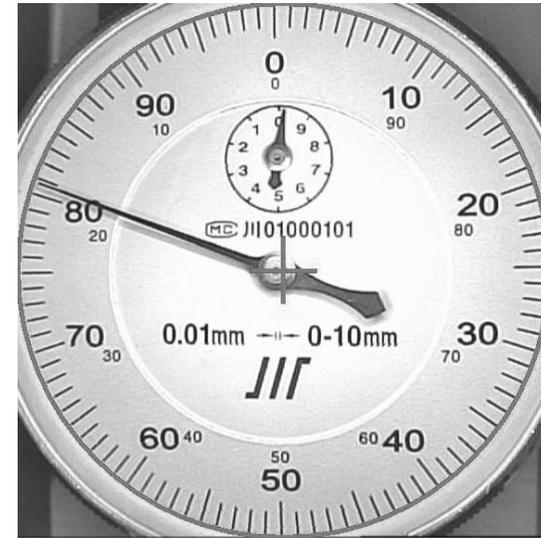


Figure 24

- a. "Positioning circle" must be evenly tangent to the external side of the scale mark. Lack of tangency or partial tangency is unacceptable.
- b. Since this instrument adopts advanced scale mark identification technology, during adjustment, the cross center of "Positioning circle" is only used for the reference of eccentricity of the tested gauge, so it is not required to fully overlap the center of the pointer of the tested gauge. Refer to "Image adjustment contrast figure" for image adjustment standard.

2.3.4 Image adjustment contrast figure of dial gauge

Correct images

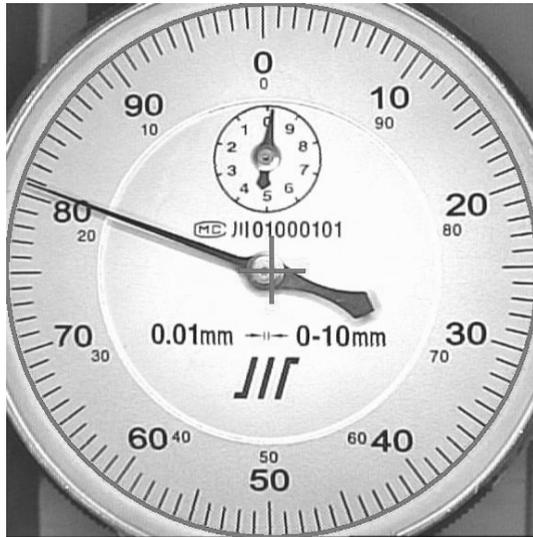


Figure 25

(Positioning circle is evenly tangent to the side of scale mark)

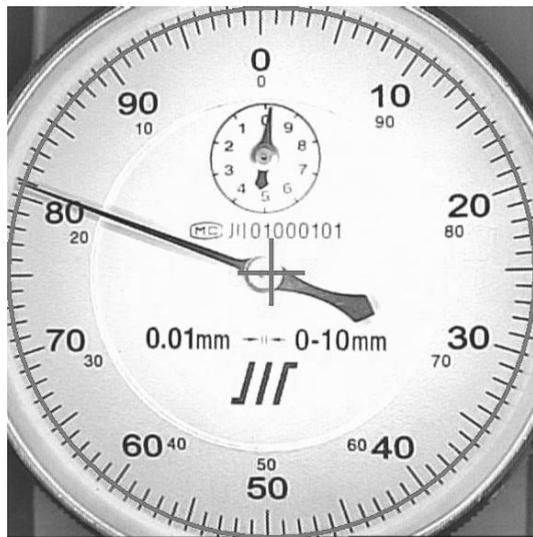


Figure 26

(Positioning circle is evenly tangent to the middle of scale mark)

Wrong images

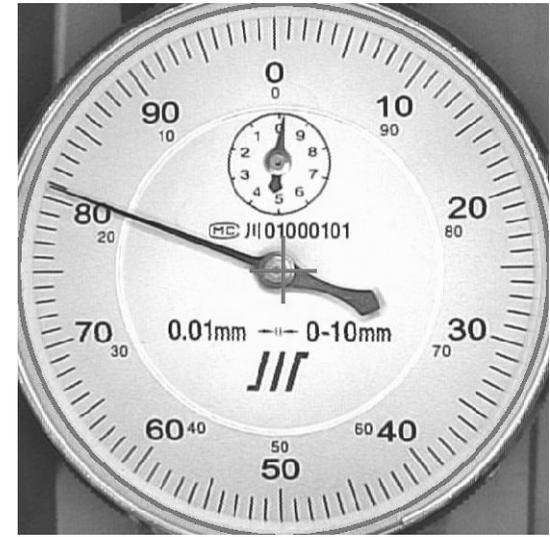


Figure 27

(Positioning circle fails to be tangent to the scale mark)

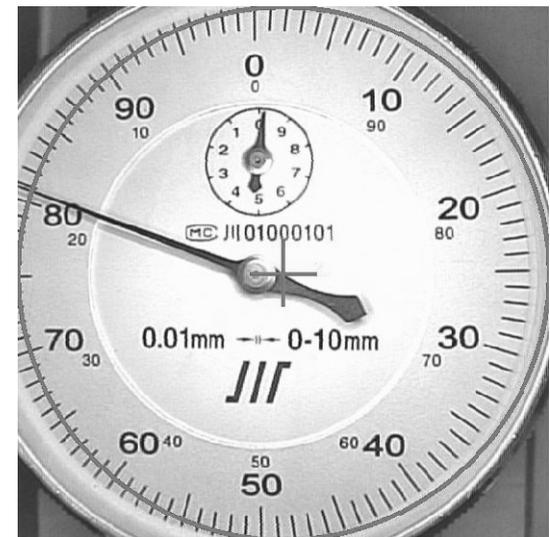


Figure 28

(Positioning circle fails is partially tangent to the scale mark)

2.3.5 Image adjustment contrast figure of digital display meter

Correct image



Figure 29

(The upper and lower lines of the positioning box are tangent to the side of digits, and left and right lines are tangent to the side of digital display screen)

Wrong images



Figure 30

(The left line of the positioning box lies outside of the digital display screen)



Figure 31

(The upper and lower lines of the positioning box are tangent to the digits)

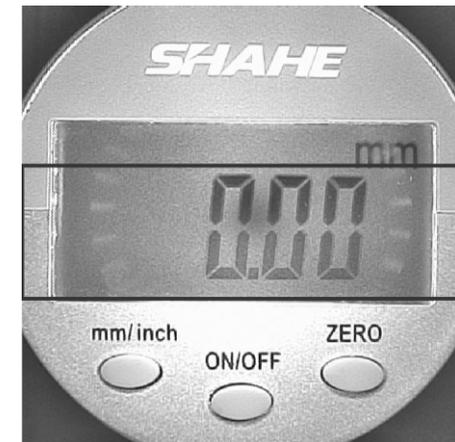


Figure 32

(The left and right lines of the positioning box lie outside of digital display screen, and the upper line is tangent to unit MM)

Skills of adjusting digital display meters:

1. The left and right lines of the positioning box are internally tangent to the sides of digital display screen.
2. The lower line of the positioning box is internally tangent to the side of digital display screen.
3. The upper line of the positioning box shall lie between the unit MM and the upper side of digits.

2.4 Specification on instrument software operation

2.4.1 Operation procedure of automatic testing software



Figure 33

a. Start the testing software: double click the testing icon to start the testing program.



Figure 34

b. Select corresponding user type and input password, and the instrument will begin detecting serial port and hint "Serial port is detected". If not detected, please ensure that the USB connection line is well connected or restart the software.

Note: when modifying password, the initial password is empty and requires no input. You can just input the new password, which shall contain 5–8 digits.



Figure 35

- c. Input testing information: click "Input testing information" and input correct information about the tested gauge in the popped dialog box of "Input testing information", and then click "Confirm"
- d. Fix the tested gauge and adjust the tested picture. Refer to "2.3 Procedure and skills of adjusting the instrument".
- e. Start testing: click "Start testing", and the instrument will enter the status of testing gauge until the testing is completed. The display box will display the error and corresponding readings of that test during the testing procedure and display the testing result OK (Qualified) or NG (not qualified) after testing is completed.
- f. Print/preview report: click "Print/preview report" to check the detailed data and testing result of this testing. Click "Historic record" to check the testing results in the past.
- g. This testing is temporarily ended.
- Note: during the overall testing procedure, when the instrument is in the automatic testing status, all functional buttons, except "Stop testing", are invalid. If you require stopping testing, click button of "Stop testing".

2.4.2 Operation procedure of semiautomatic testing software

Note: The semiautomatic testing procedure is similar to automatic testing, with the differences of:

1. Select the option of "Semiautomatic" in the testing method column of "Gauge information" in "Input testing information".

2. Change the motor's automatic running under automatic status into turning handwheel manually.
3. Under semiautomatic testing status, there are options of "Manual sampling" and "Automatic sampling", which are selected in the Setup – Sampling Setup in the main operation interface. Under automatic testing status, the option is "Automatic sampling".

Chapter III Trouble Shooting

Faults	Reasons	Clearing of fault
System displays error after starting testing software	Illegal operation of software will make the process of testing software exits in the task manager	Open task manager, end the process of SJ2000v2.0, and restart the testing software
System displays error after closing testing software	After testing software is started, USB connection line is illegally plugged	After plugging USB connection line, restart the testing software
Image display zone is blue after power on	Video capture card fails to collect the data	Check if DV is well connected with the computer or power supply
Image display zone has no image	The aperture of DV's lens is adjusted to max. darkness	Turn the aperture adjustment knob to make the image bright
The image is not complete or only half of the image is displayed	The computer resolution is wrongly set	Close testing procedure and set the resolution as 1280*800 (recommended setup)

Note: if the above treatment fails, please contact our company.

Chapter IV Maintenance and Transportation of Instrument

4.1 Daily maintenance

1. This instrument is a precise measuring instrument with precise grating scale and optic system, raising strict requirements on the operating environment, including no vibration, $(20 \pm 5)^{\circ}\text{C}$, suitable humidity, working voltage of $\text{AC}220\text{V} \pm 10\%$, and without the irradiation of strong light.
2. The instrument contains mechanical and optic sensor and measuring system. You should clear the metal working face of the sliding guide and feeler pin regularly by gasoline or ethanol, and add antirust oil on the sliding guide on which clamp moves. If the instrument will not be used in a long time, it shall be packed and placed in a dry environment.
3. Each plug used by the instrument is standard one. During daily usage, you shall ensure that the instrument has good earthing, so as to improve its anti-jamming capacity and safety.

4.2 Maintenance when the instrument is not operated for a long time

If you have not used the instrument for a long time, please clear the metal working face of the sliding guide, feeler pin and clamp before adding antirust oil. The detachable parts shall be packed after being cleaned, and placed in dry environment. When you need use the instrument again after long term storage, you should check if the screws of each part are loose. If they are loose, you should fasten them before this instrument can be used. In addition, when not used, this instrument cannot be inverted or stand on its side; it shall be placed horizontally.

4.3 Instrument conveyance and transportation (this instrument is equipped with A alloy box)

1. Shut off the power supply and pull the power cord out of the socket of power supply.
2. Pack the instrument and its clamps with original package box.
3. Convey it carefully without vibration.
4. During conveyance, do not press "Column" and "Manual Knob" (in case of deforming), and strong vibration shall be avoided.

Chapter V Unpack and Check

After unpacking, check the packing list attached with the instrument. If there is discrepancy between the packing list and the actual articles, please contact PHIANS Product & Technology Center.

Chapter VI After-sale Service

6.1 Maintenance service

1. Free software upgrade for life.
2. Customer service hotline
3. Free door-to-door service for hardware fault for one year

We promise that within one year since the date of buying the instrument, when there is hardware fault, the user can enjoy the free door-to-door service offered by our authorized personnel. If the instrument fails to be repaired at the door-to-door service, it will be brought to after-sale service department of our company, and it will be returned to the user after being repaired.

4. Users can also send the products to our after-sale service department, and we will send it back to user after it is repaired.

5. Response time for maintenance service:

After receiving the demand on door-to-door service, we will respond to it and make arrangement within 4 hours. The detailed maintenance requirement is subject to National Regulations on Three Guarantees.

6. Charging standards of paid repairing service

The repairing personnel shall show the charging rules issued by the company when charging the paid repairing; otherwise, you can refuse to pay.

Note: The printer and computer are not within the scope of guarantee.

6.2 Exception clauses

Circumstances not applicable to the free maintenance service:

1. Beyond the guarantee period;
2. Damage due to improper usage or maintenance: such as hot plugging or no grounding.
3. Damage due to detachment by users or the repairers unauthorized by PHIANS;
4. Failure to show the warranty or valid invoice (except the user can prove that the product is within guarantee period);
5. The product model or number in the warranty does not accord with the product itself or unauthorized alteration to warranty;
6. Damage due to force majeure;
7. Fault or damage caused by using the parts not produced by our company;
8. The products without factory name, delivery number and date or certificate of conformity.

Appendix A Required and Optional Accessories

Required accessories	Testing platform
Optional accessories	600mm extension bar
	Digital display force instrument
	Working platform with strias
	3-bead working platform
	Floating working platform

1. Testing platform

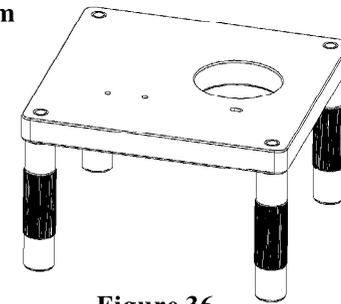


Figure 36

2. 600mm extension bar

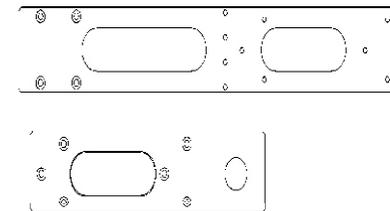


Figure 37

Note: the length of the extension bar can be customized.

3. Digital display force instrument

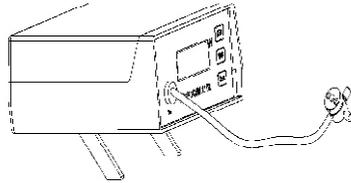


Figure 38

4. Working platform with strias

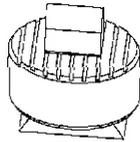


Figure 39

5. 3-bead working platform



Figure 40

6. Floating working platform

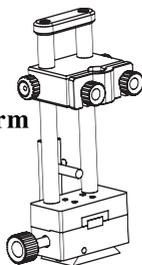


Figure 41

Appendix B Sketch map of installing testing platform, 3-bead working platform and extension bar

1. Installing and using testing platform ("Usage of 3-bead working platform is attached")

After being installed on the testing platform, the instrument can be tested and calibrated by Grade-3 gauge block and inductance mesdial. The installation method is as follows:

a. Place the instrument horizontally on the testing platform showed in the following figure, and fasten the screws in 1 and 2.

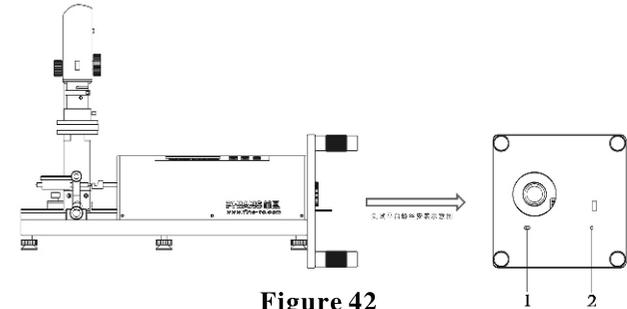


Figure 42

b. After fastening the screws, place the whole organ in the way showed in following figure, and install the 3-bead working platform on the side level of the instrument as showed in Figure 43, and gauge block test can be conducted on this instrument.

Note: During conveyance, do not press "Column" and "Manual Knob" (in case of deforming).

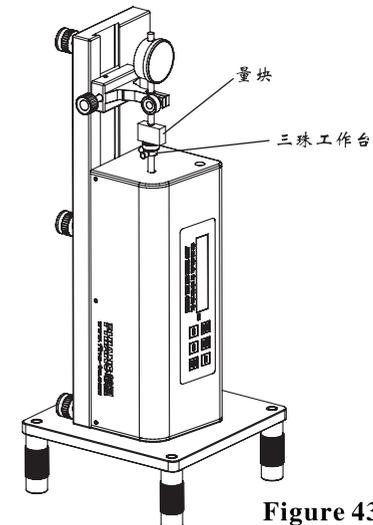


Figure 43

2. Sketch map for installing extension bar

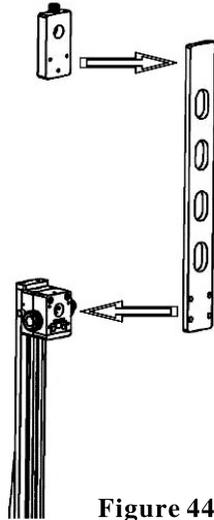


Figure 44

Appendix C Sketch map for installing digital display force instrument, working platform with strias and floating working platform

1. Digital display force instrument

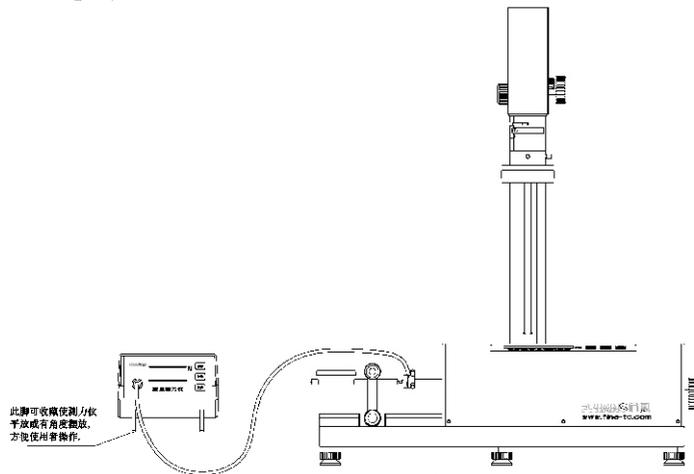


Figure 45

As showed in the figure, install the feeler pin of the digital display force instrument on the side bar of the instrument. Refer to "CL-2008D Digital Force instrument User Manual" for the detailed operation.

2. Working platform with strias

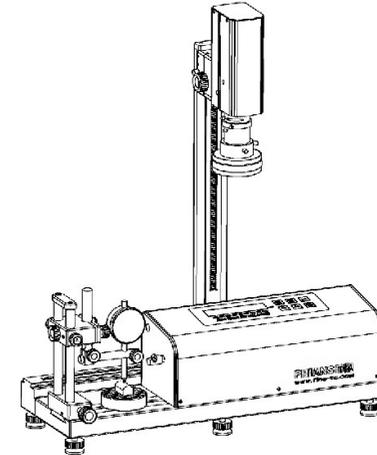


Figure 46

Place the working platform with strias in the way showed by the figure. Refer to lasted regulation of the dial gauge (JJG34-2008) for the detailed testing methods.

3. Clamping method of floating working platform

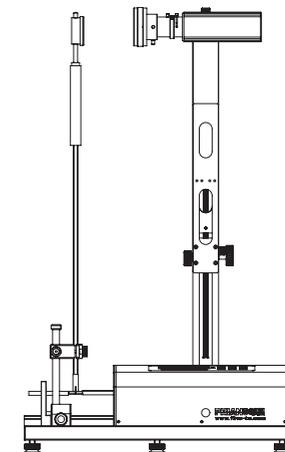


Figure 47

Install the floating working platform as showed in the figure. During installation, keep the ejector pin of floating working platform, bar head of internal dial gauge and the feeler pin of the instrument in a straight line.

Appendix D Notes on Using DV

1. Do not detach the DV without authorization. Do not detach the screws or shell in case of electric shock.
2. Do not let the metal parts drop into the instrument through slot. If it happens, shut off the power supply immediately and contact our company.
3. This instrument can only be used indoors. Do not expose the instrument to the sun for a long time or install it near the heater or air conditioner; otherwise, it may deform, discolor or be damaged.
4. When cleaning the DV, shut off the power supply and wipe it with a dry cloth. Do not wipe the body of DV with abrasive detergent. If the dirt is stubborn, it can be wiped gently with neutral detergent. Then, wipe off the leftover detergent by dry cloth; otherwise, it may cause discoloring.
5. Do not take DV against strong light since the light produced by spotlight may make the image dim (rainbow occurs around the strong light) or produce streaking (vertical lines above or below the strong light).

The testing standards for partial gauges to be tested by this instrument according to latest national regulations
Appendix E Dial gauges (reading in 0.01 mm and 0.001 mm)

Gauge	Regulation	Graduation (mm)	Measuring scope S (mm)	Testing spacing mm/t		Allowable indication error (μm)							
				Initial test	Following test	Any 0.05mm	Any 0.1mm	Any 0.2mm	Any 1mm	Any Indication error of whole course	Return error		
Pointer	JJG 34-2008	0.01	$S \leq 3$	0.1	0.2	---	5	---	10	---	14	---	3
			$3 < S \leq 5$			---	5	---	10	---	16	---	3
			$5 < S \leq 10$			---	5	---	10	---	20	---	3
		0.002	$S \leq 1$	3	---	4	---	7	---	2			
			$1 < S \leq 3$	3	---	4	---	9	---	2			
0.001	$3 < S \leq 5$	3	---	5	---	11	---	2					
	$5 < S \leq 10$	3	---	5	---	12	---	2					
	$S \leq 1$	2	---	3	---	5	---	2					
0.001		$1 < S \leq 2$	2.5	---	3	---	6	---	2				
		$2 < S \leq 3$	2.5	---	2.5	---	8	---	2.5				
		$3 < S \leq 5$	2.5	---	2.5	---	9	---	2.5				

Appendix F Wide range dial gauge (reading in 0.01 mm)

Gauge	Regulation	Graduation (mm)	Measuring scope S (mm)	Testing spacing mm/t		Allowable indication error (?m)	
				Initial test	Following test	Any 1mm	Return error of whole course
Wide range dial gauge (reading in 0.01 mm) Level 0/Level 1	JJG 379-95	0.01	0~20	0.5	10/15	25/30	5/7
			0~30	0.5	10/15	25/30	5/7
			0~50	0.5	12/15	30/40	6/8

Appendix G Internal dial gauges (reading in 0.01 mm and 0.001 mm)

Gauge	Regulation	Graduation (mm)	Measuring scope S (mm)	Testing spacing mm/t		Allowable indication error (?m)	
				Initial test	Following test	Indication error of whole course	Return error
Internal dial gauges (reading in 0.01 mm) with positioning bridge	JJF 1102-2003	0.01	[6,18]	0.1		15	8
			[18,50]			20	8
			[50,450]			25	8
Internal dial gauges (reading in 0.001 mm)		0.001	[10,400]	0.1		7	3.5

Appendix H Lever dial gauges (reading in 0.01 mm and 0.001 mm)

Gauge	Regulation	Graduation (mm)	Measuring scope S (mm)	Testing spacing mm/t		Allowable indication error (?m)	
				Initial test	Following test	Any 0.02mm	Any Indication error of whole course
Lever dial gauges (reading in 0.01 mm) Level 1/Level 2	JJG 35-2006	0.01	0~1	0.1	-/-	5/8	13/15
		0.001	0~0.4	0.02	2/4	-/-	4/6
Lever dial gauges (reading in 0.001 mm) Level 1/Level 2							2/3

Appendix I Digital display dial gauges (reading in 0.01 mm and 0.001 mm)

Gauge	Regulation	Graduation (mm)	Measuring scope S (mm)	Testing spacing mm/t		Allowable indication error (?m)			
				Initial test	Following test	Any 0.02mm	Any 0.2mm	Indication error of whole course	Return error
Digital display meter	JJG34-2008	0.01	S ≤ 10	0.2	0.2	-	10	20	10
		0.005	S ≤ 10	0.2	0.2	-	10	15	5
			S ≤ 1	0.02	0.02	2	-	3	1
		0.001	1 < S ≤ 3	0.05	0.05	2	3	5	2
3 < S ≤ 10	0.5		0.5	2	3	7	2		