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1 Instrument usage

PV series Φ300mm digital measuring projector is a precise and excellent effective measuring instrument integrating optic, mechanic and electricity. Used broadly in the trade of mechanic, meter, electronics and light industry, as well as the laboratories, metric room and workshop of the academes, research institutions, measurement-inspecting department etc. This instrument can sufficiently inspect various kinds of surface and outline of complicated work-piece. Such as template, cam, tread and gear, perform milling cutter including machine tools and parts.

2 Instrument Specification:

2.1 Projective screen

2.1.1 Screen size (mm)：Φ312，used range＞Φ300

2.1.2 Screen rotary range：0～360°

2.1.3 Resolution：1′ or 0.01°

2.2 Lens (L、H、D please see Fig.1) (Size unit: mm)

Magnification	10X(optional)	20X(optional)	50X(optional)	100X(optional)
Object view	Φ30	Φ15	Φ6	Φ3
Working distance L	77.7	44.3	38.4	25.3
Maximum height H	80	80	80	80
Maximum diameter D	160	130	110	55

2.3 Worktable (Size unit: mm)

Model	PV-3015 PV-3015E	PV-3010 PV-3010E	PV-3007 PV-3007E
X axis travel	150	100	75
Y axis travel	50	50	50
Metal table size	340×152	306×152	260×152
Glass table size	196×96	175×100	125×100
Resolution	0.001	0.001	0.001
Z axis travel	90	90	90

2.4 Illumination

2.4.1 The illumination of transmission and reflection are 24V、150W-halogen lamp.

2.4.2 Refrigeration：By 3 fans

2.5 Power

110V/220V(AC)，50/60HZ，total power: 400W

2.6 Dimensions: (mm)

(D ×W ×H):770 ×550×1100

2.7 Weight

Net weight: 110~130Kg，

Gross weight:160~180Kg

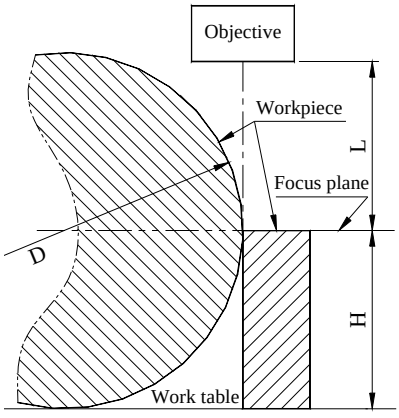


Fig.1 largest work piece instruction

3 Instrument working principle

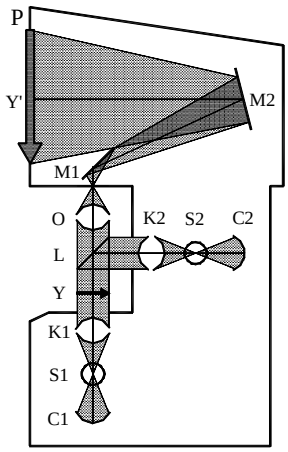


Fig.2 working principle

The working principle of the profile projector showed as Fig. 2. Work-piece for measuring **Y** is put on the worktable. Under the illumination of transmission or reflection, it is magnified by lens **O** and imaging **Y'** (up side down with **Y**) while reflects through $\mathbf{M_1}$ and $\mathbf{M_2}$ onto the granulate plane of the projective screen **P**. When the reflective mirror $\mathbf{M_1}$ is turned to the redirecting system, **Y'** will be up-side-up with **Y**. This would be more convenient for users to measure because the **Y'** is exactly the same position as the work-piece. CPJ-30xxZ is called "positive image" projector.

Y' can be measured by the standard glass ruler on the screen. And also can be measured comparably with a magnified standard pre-set picture. The measured data divided by the magnification is the size of the work-piece. Further more, you can use the table to measure **Y** by the digital measuring system. Or you can use the angle measuring system to measure the angle of the work-piece.

S1 is the transmission source while the **S2** is the reflective source. And **K1** is transmission condenser while the **K2** is the reflective condenser. They can be used both separately or simultaneity depends on the nature of the work piece. Usually, The semi-reflective mirror **L** can be only used while using reflective illumination.

4 Construction and function

4.1 The main construction of the instrument (Fig. 3)

It is composed mostly of the projection box(See 4),main body (See 23)and work table(See 10).

4.1.1 Projection box：including the lens(See 8)，reflective mirror M_1 and M_2 (Fig. 2) projective screen(See1)which is imaging-system and DC-3000 multi-functional data processing system(See 30). The rotating system of the projective screen is installed with the angle encoder.

4.1.2 Main body：Except to support the projection box and the work table，it is also installed the illumination system of the instrument, electronic control system and refrigerate fan.

4.1.3 Work table：Including the horizontal travel(X axis), vertical travel(Y axis) which is for coordinate measurement and erect travel (Z axis) which is for focus adjusting. The X axis and the Y axis are installed with the linear grating scale which with the resolution of 0.001mm(15 &16).

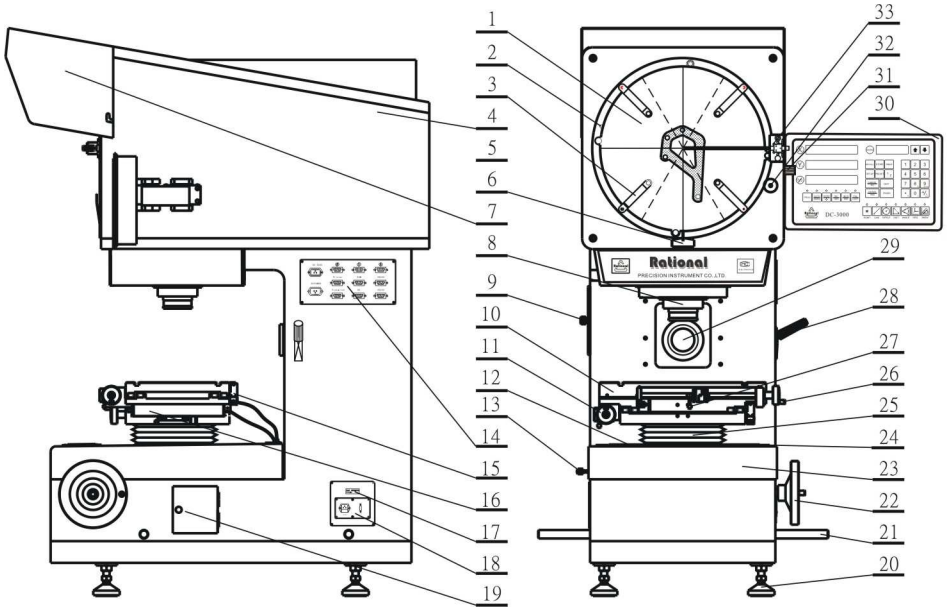
4.2 The function of electronic control boards

4.2.1 Operating panel (24). (See Fig 4).

4.2.2 Power board. (18). (See Fig 5).

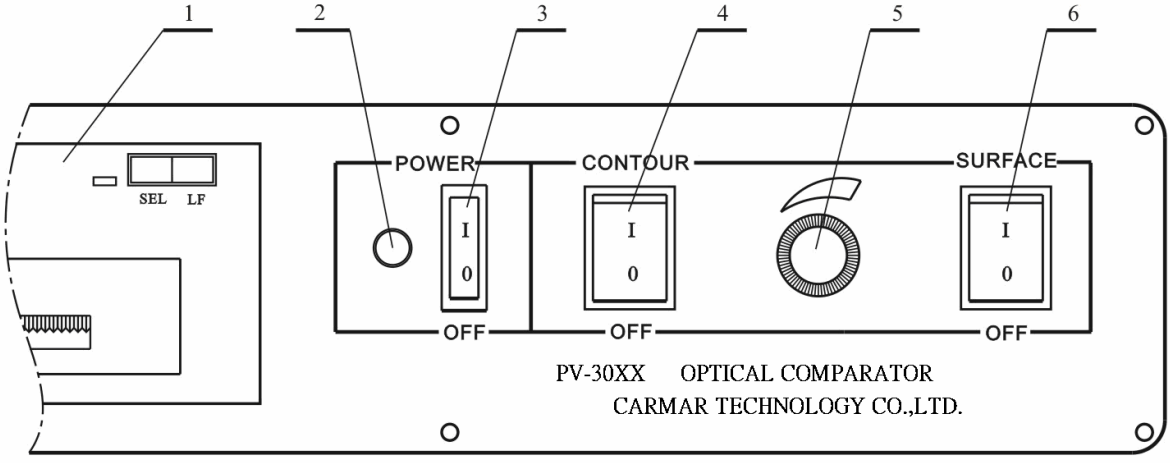
4.2.3 The transition board of the signaling wire as Fig. 6.

4.2.3 Multi-functional data processing unit（30）. Please see DC-3000 operating manual.



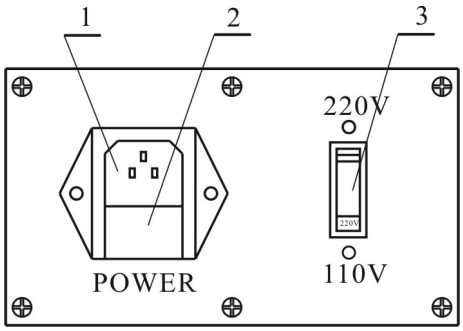
1. Projection screen 2. Screen twirling handle 3. Spring fixture 4. Projection box
5. Zero calibration board 6. Screen zero mark 7. Light cloak 8. Lens 9. Small door
10. Work table 11. Y axis hand wheel 12.microprinter 13. Transmission illumination pusher
14. Signal exchange board 15. X axis linear scale 16. Y axis linear scale
17. Series number of instrument 18. Power board 19. Big door
20. Horizontal adjusting bolt 21. Convey hand wheel 22. Lift hand wheel
23. Main body 24. Operating panel 25.Dustproof cover 26. X axis hand wheel
27. X axis fast hand wheel 28. Adjusting hand wheel for reflective light
29. Reflective condenser 30. DC-3000 Multi-functional data processing system
31. The screen-locking handle wheel 32. Micro-hand wheel 33. Edge detector

Fig. 3 The construction



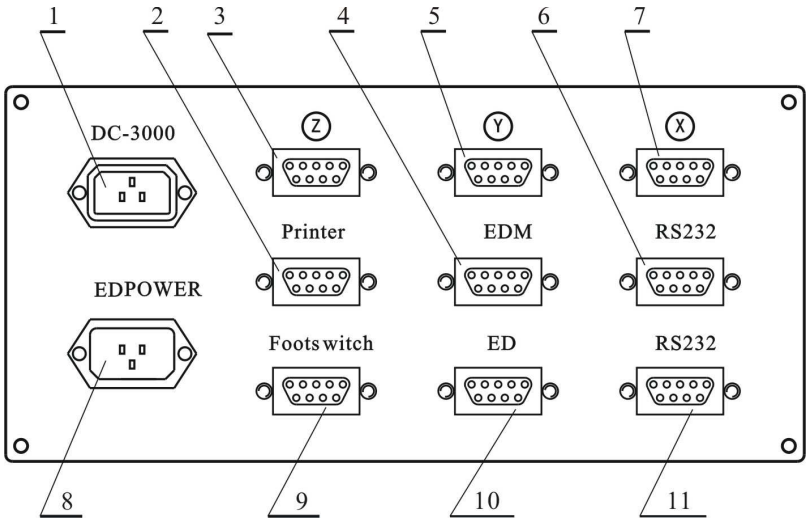
1.Mini-printer 2. Power signal 3. Power main switch 4. Transmission light switch
5.Knob for adjusting the light 6. Reflective light switch

Fig.4 Operating panel



1. Main power plug 2. Fuse of power
3. Voltage switch of 220V/110V

Fig.5 Power supply



1. DC-3000 power 2. Printer connector 3. Angle encoder connector
4. DC-3000 footswitch connector 5. Y Linear scale connector 6. RS232 connector
7. X Linear scale connector 8. Edge-detector power 9. Foot switch connector
10. Edge detector connector 11. Computer RS232 connector

Fig.6 Signal exchange board

1. Light group fixing bolt
2;7. Light set adjusting bolt
3. Light set adjusting shelf
4. Light set
5. Light set fixing bolt
6. Pottery light set
8. Bulb
9. Concave reflective mirror

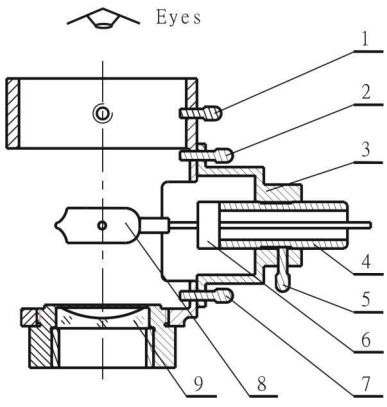


Fig.7 Illumination group

5 Uncover and fixing

5.1 Unclose all of the packages, take out the instruction of the instrument and read this chapter before operating.
5.2 Unscrew the four fixing bolts of the baseboard. Move the instrument to the pre-set work stage. The stage must be very sturdy for the instrument is as weight as 110kg or so.
5.3 Put on screw and adjust the four screws. Make sure that the instrument must be horizontal. All these can be tested level which is put on the work table.
5.4 The orientation of the instrument has to avoid windows or strong light source for fear decreasing the contrast of the screen.
5.5 Take out the connector board on the work table which is for fixing between the X axis and Y axis. So that the work table can be moved by both the hand wheel and the handgrip.
5.6 The power supply can be adjusted as 220V/110V depends on the local voltage. Adjust the voltage and chose the switch before connect the power supply. Otherwise the electricity system will be destroyed or the instrument can't work normally. As you obeying all the above mentioned. The instrument can be used subsequently.

6 Instrument operation

Instruction must be read before you operate the instrument. Especially the chapter of "The construction and function of the instrument", for that can help you to further understand the instrument.

6.1 Replace and adjust the illumination bulb

This can only work when replacing or adjusting the bulbs and checking the instrument regularly. The bulbs need to re-adjust because the original adjustment of the bulbs sometimes will change when delivering or moving. This is called re-adjust.

Caution: This can only be done after make sure that the illuminator is cold down. Otherwise it would be dangerous of hurting for the illuminator is of high temperature.

6.1.1 Re-adjusting
6.1.1.1 Take out the lens, turn on the transmission light. If the glower's image is illegibility or dose not concentrate on the screen center. Please do as:
6.1.1.2 Open the big door on the right of the instrument（19），Unscrew the (1) as Fig.7, move the whole set of the illumination set up and down. On the screen, the glower's image will change form illegibility to clear.
6.1.1.3 When the filament is almost clear (it needn't be too clear) and is on the center of the screen, please fix the screw (1) and put on the lens. All the re-adjust is completed.
6.1.2 Method of replacing the bulb (See Fig. 7)
6.1.2.1 Open the big door（19） on the right of the instrument.
6.1.2.2 Unscrew the screw (1) and take out the whole illumination set.
6.1.2.3 Take out the halogen bulb (8).
6.1.2.4 Put on the new bulb (Please use the soft cloth to touch the bulb).
6.1.2.5 Test by eyes from the top to see whether the glower's image by the concave reflective mirror (9) and itself is overlap, if not please do as:
6.1.2.6 Draw the lamp holder (4) side to side. Make the glower and its image overlap at the right-and-left way. Then screw the screw (5).
6.1.2.7 Unscrew the screw (2) and (7). Make the adjusting shelf (3) to be the vertical way of

the paper, and then move it parallel or obliquely. Until the glower filament and its image overlap at the vertical way on the paper. Then screw the screws (2) and (7).

6.1.2.8 Re-fix the whole illumination set back to the instrument. The adjustment following is the same as 6.1.1.

Actually, the bulbs replacing need not to follow the steps as this. Only 6.1.2.1and 6.1.2.3 and 6.1.2.4 steps are available. For all the lights are pre-adjusted by the producer. The glower will not be departure form the optical-axis obviously if the specification of the bulb is correct.

6.1.3 The adjustment of the reflective illumination (See Fig. 8)

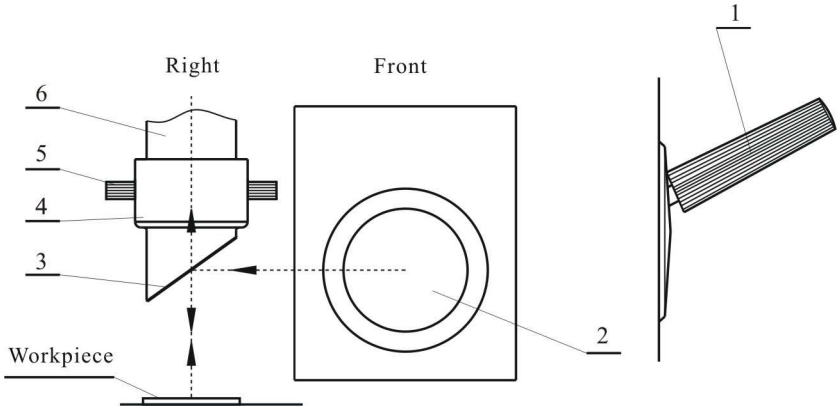
6.1.3.1 The method of replacing the bulbs is the same as 6.1.2

6.1.3.2 Take the semi-reflective mirror-holder（4）install on the lens（6）. Let the mirror faces the reflected condenser (2). Then turn on the reflective illumination.

6.1.3.3 Counter-clockwise, please unscrew the handle (1). Make the reflective condenser (2) move up and down. Then screw the handle (1) at the clockwise way when (2) is as high as semi-reflective mirror (3).

6.1.3.4 Put the work piece onto the work table. Make sure it is within the reflective illumination range. The image of the work piece appears on the screen after focus.

6.1.3.5 You can rotate the drawtube of the reflective condenser（2）according to the size of the work piece to change the area of the light range. The image of the work piece becomes lighter as the light range becomes smaller.



1. Adjusting handle of condenser 2. Reflection condenser
3. Semi-reflection mirror 4. Mirror holder
5. Fixing screw of the mirror holder 6. Lens

Fig.8 Instruction of reflection illumination

6.2 Replacement of the lens and condenser

6.2.1 There is only one lens connector of the instrument. Different lens should be replaced separately.

6.2.2 The choose of lens' magnification must be based on the precision request and the size of the work piece. Usually speaking, the outline measurement will be more precise with the higher magnification of the lens. So dose the aim precision of the coordinate measurement.

6.2.3 Please turn down the work table before you replace the lens. For that would be enough space for replacing the lens.

6.2.4 The transmission illumination should be re-adjust correspondingly when use 10×-20×, or 50×-100× lens. There is a correspond mark on the pole (13) of Fig.3. Therefore, When the pole of the 10×-20× is pushed in meanwhile the pole of 50×-100× is pushed out.

6.2.5 Please don't put the semi-reflective mirror (See 4 of Fig.8) on the lens when you use the transmission light to measure. Otherwise the outline measurement precision and the brightness of the screen would be therefore unfavorably affected. This should be especially

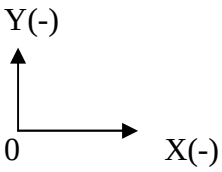
cautious for that would affect the result if you just care for the temporary convenient.

After all the above mentioned are completed. The instrument can work well only need to adjust the focus to the work piece.

6.3 Work table operation

6.3.1 After turn on the main power. On the multi-functional data processing system DC-3000 (See the 30 of Fig. 3), appears the value of coordinate of X axis and Y axis. The value changes when moving of the worktable.

6.3.2 The positive and the negative value of he X、Y coordinate can be set through the DC-3000 which the users can previously set it up. If you want to measure one work piece in the first quadrant, please do as following:



6.3.3 The movement of X and Y coordinates: except hand wheel moving, X and Y coordinate can also be moved speedy by the hand haulm (See 12 of Fig.3). While the hand wheel is used for focusing and lifting the work table. (See 16 of Fig.3).

6.3.4 Please move the handle wheel when using the X and Y coordinates to measure.
And please be sure to move it smoothly and softly.

6.3.5 When you use the X and Y coordinates to measure. Usually you should move the worktable side to side for several times after you have the focusing. That would be more convenient to measure because the work table is running into measuring format from the stillness format.

6.3.6 Please return the X and Y worktable to the symmetrical position after measuring.

6.4 Projector screen operation

6.4.1 After turn on the main power. The circling angle value of the screen will appear on the DC-3000 as well (See the 30 of the Fig. 3). You can pre-set the transition to angle value through the DC-3000 previously. For instance: 3° 36’<=> 3.60° .

6.4.2 When the locking screw is unscrewed (See 31 of the Fig. 3). The screen can be move circle-wise quickly by the small handle (See 2 of Fig. 3). Or be moved slowly by the micro-hand wheel (See 32 of Fig. 3). And slowly movement should be used when measure angles.

6.4.3 The four spring fixtures on the projective screen (See the 3 of Fig. 3) can be used to nip the magnified standard picture or the glass ruler, which is for the outline comparison measurement.

6.4.4 When the white line on the stand of the screen aims at zero mark (See 5 of Fig.3). The level line on the screen is parallel with the X coordinate. Please adjust the work piece edge to parallel with the level line so that you can take the X coordinate measurement now.

6.4.5 There are 30°,60°, 90°……or 45°,90°……on the screen for standard graduation line. For that can be used to measure these special angles comparably. Therefore you can take the angle measuring system to measure the angles just by counting the deviation between them.

6.5 RS232 connector operation

RS232 connector showed as 2 of Fig.6. Communicating between the instrument and computer. It can process the data automatically and draw out the outline of parts through the special software. The report of measurement result and drawings can be printed out through the printer.

6.6 Edge detector operation (optional accessories)

Edge detector can be used for opt-electronic aim sample automatically. It can get rid off the incorrectness that caused by personal eyes and also can upgrade the measuring efficiency. Details please see the instruction of edge detector.

7 Measurement method

There are two measurement methods of the projector: Outline measurement and coordinate measurement

7.1 Outline measurement

7.1.1 Measure by comparing with the “magnified standard picture”.

This method is suitable for the large amount or complicated situation. Please take the following steps：

7.1.1.1 Choose the lens basing on the size of the work piece. Design a magnified picture as the same magnified-times as the lens. Please use the transparent plastic material with little contractibility. On the picture you can draw out the limit of tolerance. For instance, if the size of work piece is Φ25, you can choose the 10X lens and draw a picture with the proportion of 10:1. The following standard magnified pictures are available: circle-arcs, angles, gears, screws and grids.

7.1.1.2 Nip the standard magnified picture on the screen by the four spring fixtures.

7.1.1.3 Put the work piece onto the worktable. Then focus it. Move the X-Y axes table to make sure that the work piece overlaps the standard magnified picture.

7.1.1.4 It is qualified if the deviation between the image and the picture is within the limit of tolerance. Otherwise it is unqualified. The deviation can be measured by the X –Y coordinate.

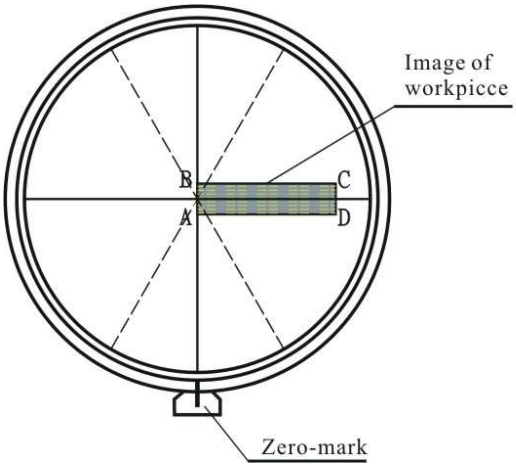


Fig.9 One-dimensional measuring

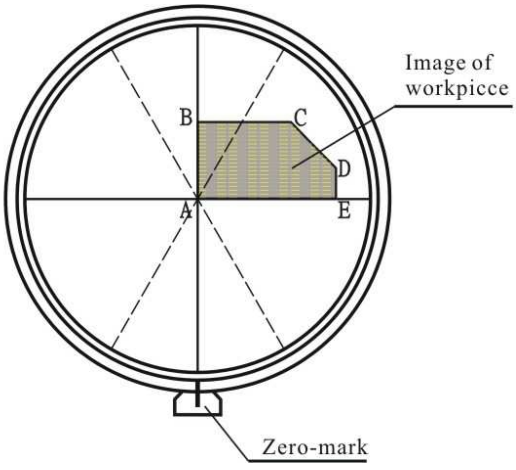


Fig.10 Two-dimensional measuring

7.1.2 Use the glass ruler (optional) with the resolution of 0.5mm to measure the image of the work piece on the screen directly, the data which is smaller then 0.5mm can also be measured

by the X-Y coordinate. Then divided by the magnified times of the lens. The last result is the size of the work piece.

7.2 Coordinate measurement

One-dimensional measuring

7.2.1.1 Put the work piece onto the work table and focus it after chose the suitable lens.

7.2.1.2 Turn the projective screen to the zero mark, the white line of the screen holder aim at the zero mark.

7.2.1.3 Adjust the work piece parallel with the measuring axis. (See Fig.9) BC is parallel with X axis.

7.2.1.4 Move the work table, make the measuring edge AB aim at the vertical graduation line of the screen. The value of the X coordinate is set zero.

7.2.1.5 Move the X axis. Make the other edge of the work piece CD aim at the vertical graduation line of screen. What X axis shows is the size of AD edge.

7.2.2 Two-dimensional measuring

7.2.2.1 Aim the zero line of the projective screen at the zero mark.

7.2.2.2 Put the work piece onto the work table. Please choose a bigger times of the lens and adjust the focus.

7.2.2.3 Adjust the measuring edge to be parallel respectively with X axis and Y axis.

See AE // X， AB // Y of the Fig. 10.

7.2.2.4 Move the X-Y work table. Aim the image point A of work piece on the cross graduation point of the screen. The value of X axis and Y axis is set zero.

7.2.2.5 Move the work table again. Aim the image point C or D on the cross graduation points. Now the value of the X axis is the measurement value of BC or AE. while the value appears on the Y axis is the value of AB or DE.

7.2.2.6 Use the **SKEW** function of the multi-functional data processing system DC-3000. The position of the work piece can be put arbitrarily without any precise adjustment. Only need to move the worktable to aim the A, B, C or D on the cross graduation point respectively. You can measure out the length concerned. This operation is a time-saved and efficient way. The details can be seen in DC-3000 manual.

7.2.2.7 Connecting the RS232 port with computer. It can process the data automatically by the double coordinate measurement and draw out the outline of parts through the special software M2D (optional). The result of measurement report and drawings can be printed out through the printer. And the work piece can be put on the table arbitrarily without any precise adjustment. These can enhance the quality and upgrade the effect of the measurement.

7.2.3 Angle measurement

7.2.3.1 Put the work piece onto the worktable. choose the lens base on the size of the work piece then focus it.

7.2.3.2 Adjust the tip of the angle into the graduated center of the screen (See Fig. 11).

7.2.3.3 Turn the screen and aim at one edge of the measuring angle with a random line.

7.2.3.4 Turn the screen again. Aim the line at the other edge of the measuring angle. Now the value displayed is the value of the measured angle θ .

7.2.3.5 With the lines on the screen which show 30°, 60°, 90° ……or 45°, 90° ……(the precision is 1′).

You can take the measurement comparing with these special angle value.

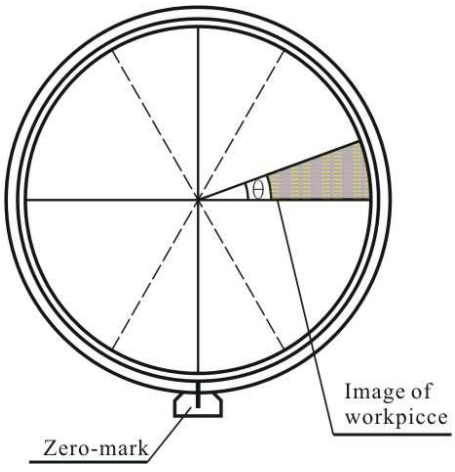


Fig.11 Angle measurement

8 Instrument maintenance

Digital measuring projector is a precise instrument integrating optic, mechanic, electricity and computing technical. It should be maintained properly and frequently. Well-maintained instrument can prolong the longevity by preserving the precision.

8.1 The instrument should be placed in the desiccative and clean room with the temperature of 20℃±5℃ and the moisture of 60%. For fear the precision of instrument and the optic system being unfavorably affected. Users should avoid the surface of the optic parts being moldy and obviate the metal parts being rusted. Nor the rail can be dusty.

8.2 The surface of optic parts should be keep clean and mustn't be touched by finger. Surface dust can be cleaned by soft brush. If the there is too much dirtiness that affect the normal operation, please wipe it softly by the defatted cotton, or the lens-cleaning paper dip with some toluene or dip with the mixture of ethanol and ether.

8.3 Please don't touch the projective screen while operating because it is granulate panel. It would be unclear because the surface will be covered by dust and oil after long-time used. Users can wipe the whole screen by the clean wet gauze dip with some neutral detergent. Subsequently, you should wipe the screen with clean wet gauze for several times to get rid off the detergent. Be cautious please don't dip with too much water for fear that would drop down to the worktable which would cause rusted of the metal. Or you can cover a plastic pellicle on the worktable previously. The suppler should be called to manage the above work if it is much difficult for users to do.

8.4 Regarding the exposed metal of the instrument, it should be cloaked with the rust-proof grease and wiped by the aviation gasoline regularly or after used to avoid being rusted.

8.5 The lens, the work table and the other accessories of the instrument are of high fixing precision. Users can't unclose all the adjusting screw and tightening screw without supplier's permission. You can ask for inspection by the suppler if the instrument is out of order. The malfunction or the lose-precision of the instrument would not be considered as warranty if that is resulted from the users unclosing it without any permission.

8.6 Whether the cold fans work properly count for much to both the properly functioned and the longevity of bulbs. Users should pay closed attention to such a problem and contact the suppler at once when the instrument is out of order.

8.7 Regarding the work table precision, It has already been made the error compensation by the data processing system DC-3000 within the producing process. Users can't change the error compensation and other preset value without any permission. Otherwise that would cause the malfunction and incorrect precision of the instrument.

8.8 Please turn off the light power of the instrument after use. Except the reflection and transmission light, please don't turn on all the lights powers simultaneously if isn't necessary. Except saving the resource, all the mentioned above can also prolong the longevity of the lights and maintain the well state of the instrument.

9 Instrument electrical system

The power supply, illumination, refrigeration and the digitizer electro-circuit are as the Fig.12 shows. For instance:

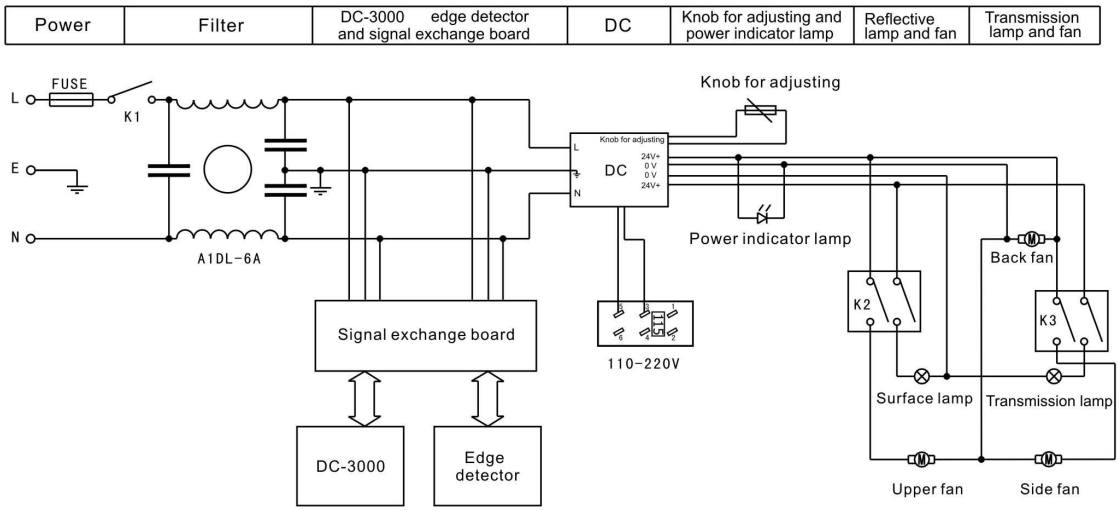


Fig.12 Electricity method

10 Instrument consistency

No	Standard	Qua	No	Option	Qua
1	Main body	1Pcs	1	4A/Φ5×20 Fuse	5Pcs
2	Lens(Can choose any one of four lens)	1Pcs	2	24V150 W Halogen bulb	2Pcs
3	Corresponding semi-Reflective mirror (Equipped with the lens)	1Pcs			
4	Spring Fixture of screen	4Pcs			
5	2m Power wire	1Pcs			
6	Operation manual	1Pcs			
7	Certification	1Pcs			
8	Packing list	1Pcs			
No	Option				
1	10× Lens		7	50×.100×Semi-reflective mirror	
2	10× semi-reflective mirror		8	Rotary table	
3	20× Lens		9	Over-lay chart (Φ300mm)	
4	20× semi-reflective mirror		10	400mm measuring glass	
5	50× Lens		11	M2D-CPJ	
6	100× Lens		12	ED-101 edge detector	