



OPERATION MANUAL

Ø400 DIGITAL MEASURING PROJECTOR



BENKWELL JT26

PROFILE PROJECTOR

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IMPORTANT SAFETY NOTICE

Please read this operation manual carefully before operating the instrument. Proper understanding of the instructions will help ensure safe operation, accurate measurement, and longer service life of the machine.

1. Applications

The BENKWELL JT26 Digital Measuring Projector is designed for accurate measurement of workpieces with complex profiles and surfaces. It is suitable for inspecting various precision components, including:

- Form milling cutters
- Gears and thread cutters
- Cams and templates
- Punched components
- Various cutting tools and precision parts

This instrument is widely used in manufacturing industries, inspection departments, workshops, and precision engineering applications.

2. Specifications

2.1 Projection Screen

Item	Specifications
Screen Diameter	Ø400 mm
Rotation Range	0° – 360°
Rotating Indicator Scale	1'
Rotating Accuracy	4'

2.2 Objective Lens

Magnification	View Field on Object	Working Distance
10X	Ø35 mm	88.376 mm
20X (Optional)	Ø17.5 mm	81.375 mm
50X (Optional)	Ø7 mm	54 mm
100X (Optional)	Ø3.5 mm	49 mm

Magnification Error : 0.08%

2.3 Worktable

Magnification	Specification
Worktable Area	450 × 150 mm
X-Axis Travel	0 – 250 mm
X-Axis Indicator Scale	0.001 mm
Y-Axis Travel	0 – 80 mm (Focusing Travel)
Z-Axis Travel	0 – 150 mm
Z-Axis Indicator Scale	0.001 mm

X and Y Axis Accuracy: $(3 + L/75) \mu\text{m}$ (L = measured length in mm)

2.4 Illumination System

Illumination Type	Specifications
Transmission Illumination	24V 150W Tungsten Halogen Lamp
Reflection Illumination	24V 150W Tungsten Halogen Lamp with Reflector

2.5 Overall Dimensions

L x W x H = 1069 x 440 x 978 mm

2.6 Total Weights

210 Kg

3. Working Principle

The working principle of the projector is shown in *Fig. 1*.

Place the workpiece (Y) on the worktable. The objective lens (5) accurately magnifies the image of the workpiece and projects it onto the projection screen (7) as image Y. The operator can directly measure image Y using a standard glass scale or compare it with a reference drawing displayed on the projection screen. By moving the worktable, the measurement values can also be displayed on the digital indicator.

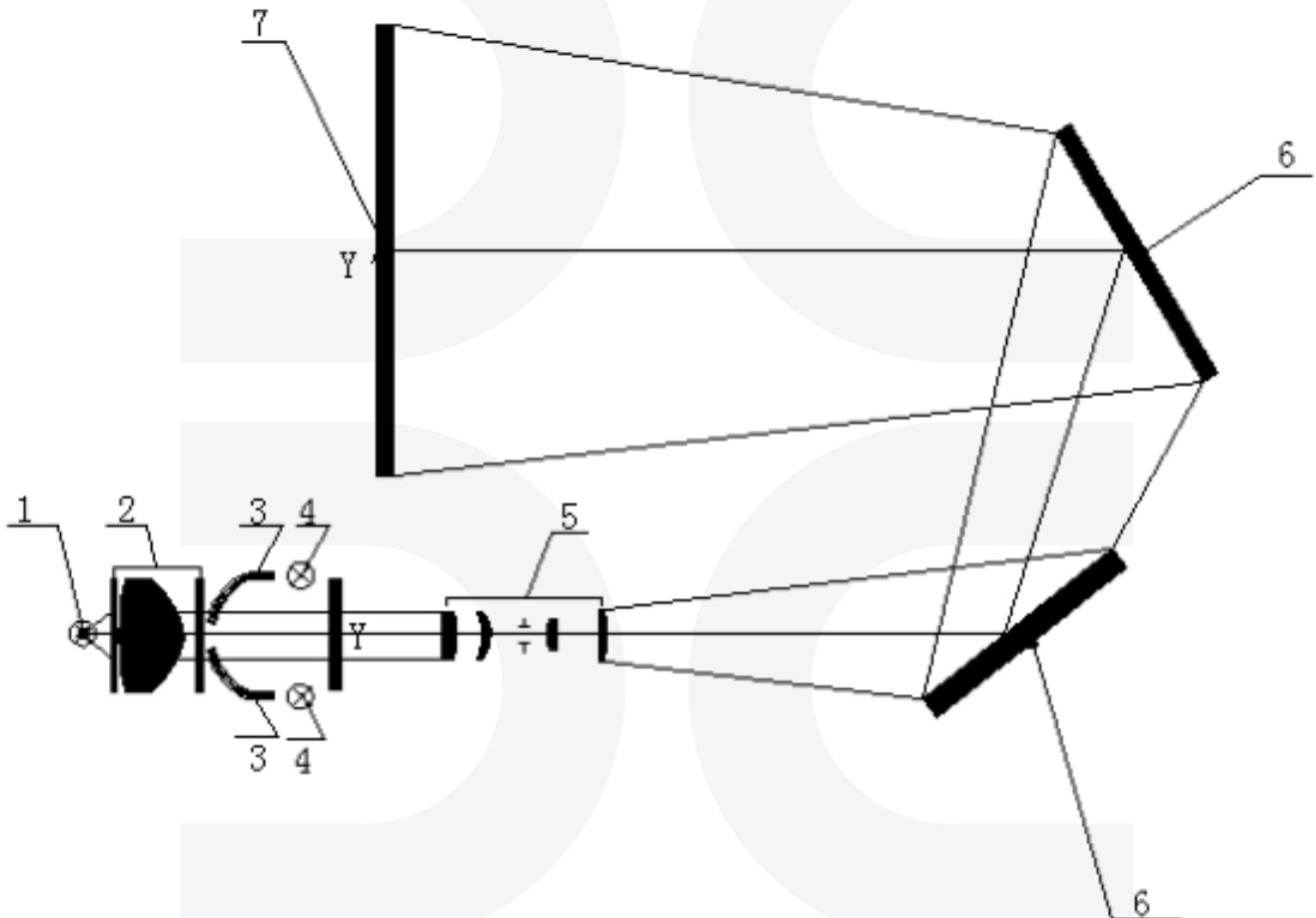


Fig.1 Optical System Drawing

- | | |
|--|----------------------|
| 1. Transmission Illumination Source | 5. Objective Lens |
| 2. Transmission Illumination Condenser | 6. Reflecting Mirror |
| 3. Reflection Illumination Fiber | 7. Projection Screen |
| 4. Reflection Illumination Source | |

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4. Machine Structure

The structure of the instrument is shown in *Fig. 2*.

The instrument mainly consists of the projection case, base, and worktable. The optical system, including the objective lens, mirror, and projection screen, is installed inside the projection case. The base supports the machine and contains the illumination and cooling systems.

The worktable can move in longitudinal, vertical, and transverse directions for accurate measurement. A built-in grating sensor provides high measurement accuracy. The projection screen can rotate 360° for angle measurement. A reference cross-line ("米" line) on the screen is used as the standard reference for length and angle measurement.

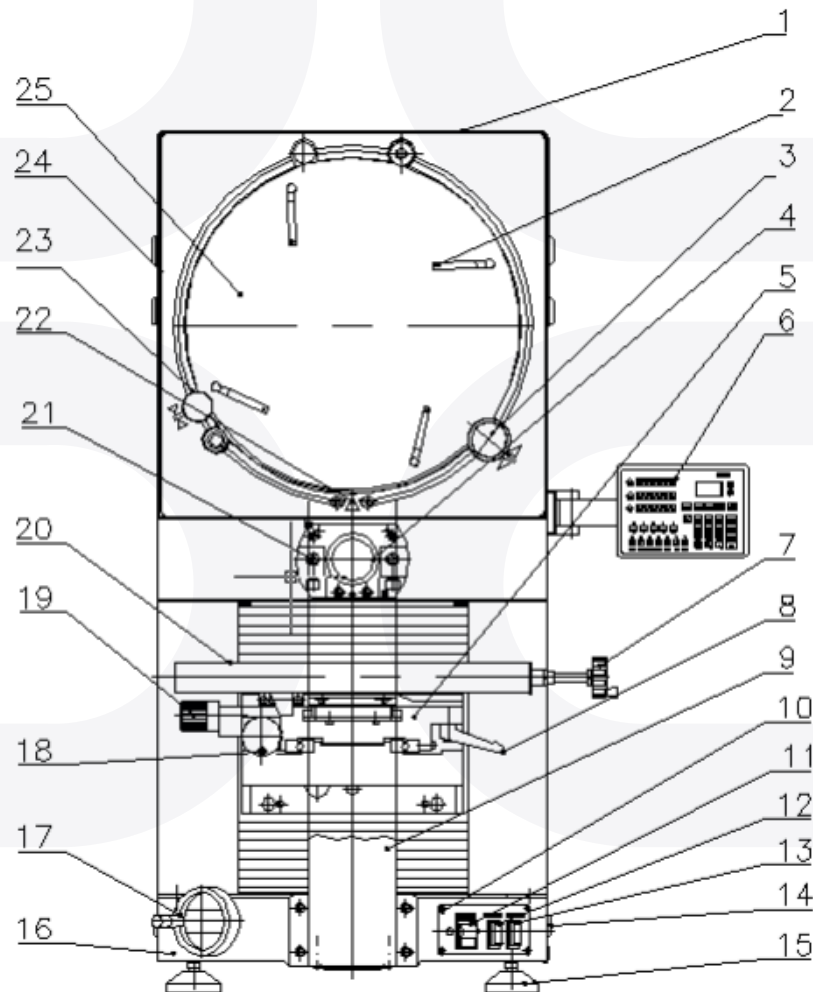


Fig.2 Machine Structure Drawing

- | | | |
|-----------------------------------|--------------------------------------|------------------------|
| 1. Shading Hood | 10. Control Panel | 19. Rotating Handwheel |
| 2. Elastic Clamp | 11. Power Supply | 20. Transducer |
| 3. Screen Rotation Handwheel | 12. Transmission Illumination Switch | 21. Reflection Fiber |
| 4. Objective Lens | 13. Reflection Illumination Switch | 22. Zero Indicator |
| 5. Worktable | 14. Carrying Pole | 23. Locking Handwheel |
| 6. Digital Readout | 15. Foot Support | 24. Projection Case |
| 7. Longitudinal Handwheel | 16. Base | 25. Projection Screen |
| 8. Worktable Locking Handle | 17. Vertical Adjustment Handwheel | |
| 9. Reflection Illumination Source | 18. Transverse Handwheel | |

5. Electrical System

The electrical system for illumination and control is shown in *Fig. 3*.

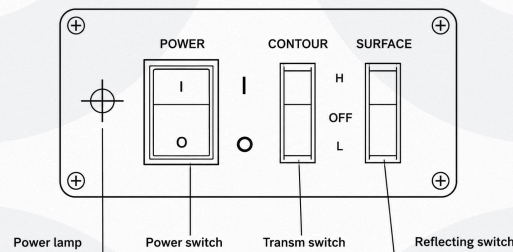
The illumination system consists of two types, **Transmission illumination and Reflection illumination**. Both systems use a shared power source. The reflection illumination uses a 24V 150W tungsten halogen lamp with a reflector cup. The transmission illumination also uses a 24V 150W tungsten halogen lamp and is cooled by an axial-flow fan. Each illumination system can be controlled independently with the following settings: **OFF → LOW → HIGH**. The operation of one illumination system does not affect the other.

6. Operation Instructions

Before operating the instrument, please read the “Instrument Structure” section to understand the basic layout and functions of the machine.

6.1 Control Panel Operation

The control panel layout is shown in the following figure.



6.2 Moving the Worktable

Move the worktable in the X or Y direction using the handwheel. The movement value will be displayed on the digital indicator. Turn handwheel (18) to adjust the worktable position for rough focusing.

6.3 Rotating the Projection Screen

Loosen locking handwheel (23), then turn handwheel (3) to rotate the projection screen (25). The screen can rotate 360° clockwise or counterclockwise. The angle value will be shown on the digital readout.

6.4 Adjusting the Illumination Bulb

This adjustment is required when replacing the bulb or checking the illumination system.

Transmission Illumination Adjustment: Open the front cover of the transmission illumination system and loosen the locking screw on the lamp holder. Adjust the bulb position until the image appears clear at the center of the projection screen, then tighten the locking screw.

Reflection Illumination Adjustment: Place the workpiece on the worktable and open the right-side cover of the machine. Loosen the locking screw on the lamp holder, then adjust the bulb and reflection fiber until the image appears clear at the center of the projection screen. After adjustment, tighten the locking screw and reinstall the cover.

6.5 Replacing the Objective Lens

Select the appropriate objective lens for the required magnification. Carefully install or remove the threaded lens when replacing it.

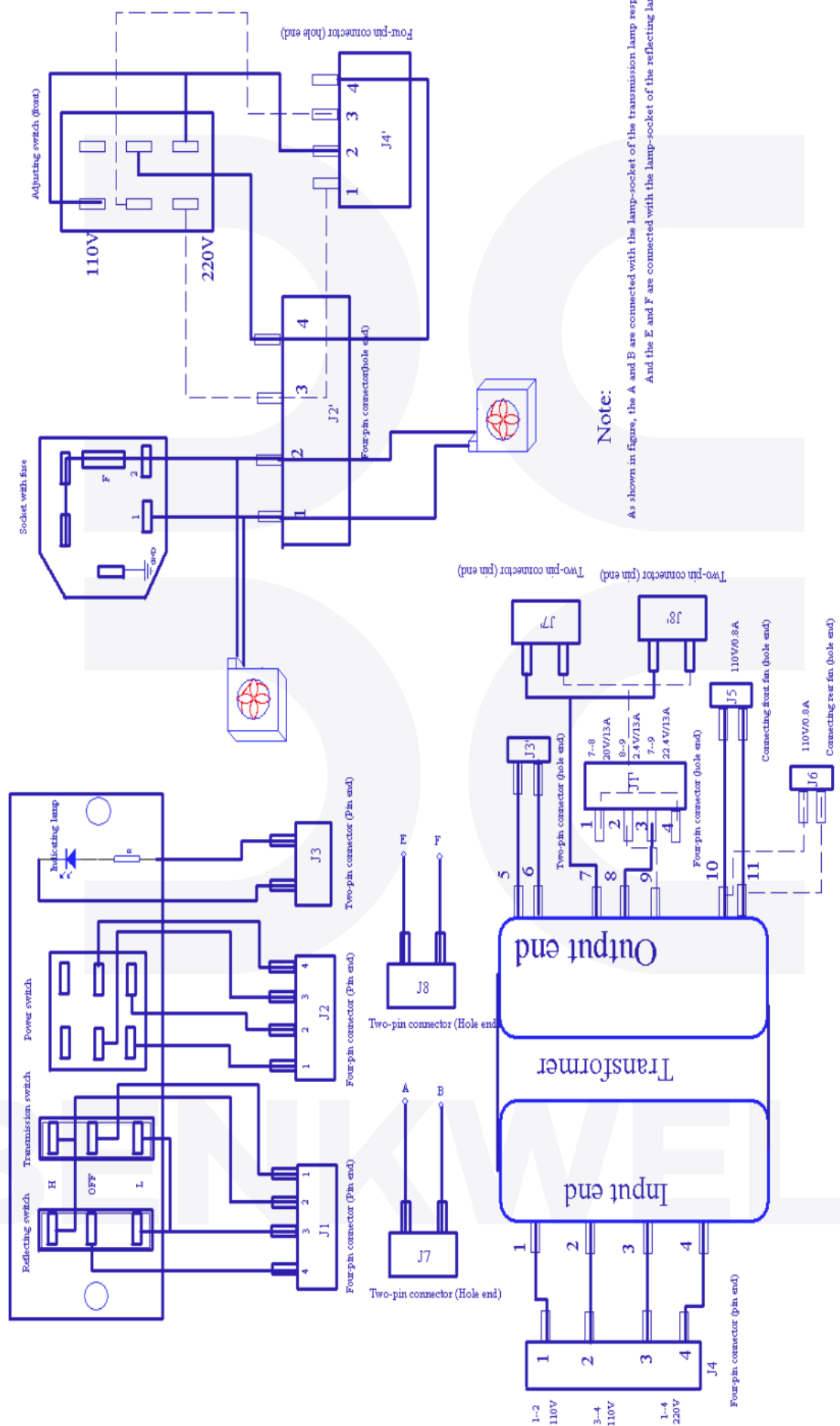


Fig.3 Electrical System

7. Measuring Methods

Before starting measurement, ensure all parts of the instrument are in the correct position and the workpiece is clean. Select the appropriate objective lens and illumination method, then switch on the illumination system before measuring.

7.1 Comparison Measurement Using a Standard Drawing

This method compares the magnified image of the workpiece with a standard drawing displayed on the projection screen. Any difference between the two indicates the measurement error. This method is commonly used for checking multiple parameters at the same time.

Procedure :

1. Select the appropriate objective lens according to the size and shape of the workpiece. Prepare a standard drawing based on the selected magnification and attach it to the projection screen using the elastic clamps.
2. Place the workpiece on the worktable and adjust the table height until the image appears clear on the projection screen.
3. Move the worktable, rotate the projection screen, or adjust the standard drawing until the workpiece image matches the standard drawing.

Any deviation can be measured directly using the glass scale or displayed on the digital readout through the longitudinal and vertical measuring system.

Tolerance limits can also be marked on the standard drawing for quick inspection of workpiece acceptance.

7.2 Measurement Using the X and Y Readout System

Align the workpiece parallel to the movement direction of the worktable. Move the table until the cross-line on the projection screen aligns with one side of the workpiece, then set the X or Y axis to zero. Move the worktable again until the cross-line aligns with the opposite side of the workpiece. The displayed X or Y value is the measured length.

7.3 Direct Measurement Using a Glass Scale

Measure the magnified image size on the projection screen using a glass scale. Divide the measured value by the objective magnification to obtain the actual size of the workpiece.

7.4 Angle Measurement Using the Projection Screen

Loosen locking handwheel (23) and rotate handwheel (3) until the reference line on the projection screen aligns with the zero indicator (22). At this position, the cross-line on the screen is parallel to the X or Y axis of the worktable.

Place the workpiece on the worktable and rotate the projection screen until the cross-line aligns with both sides of the workpiece profile. The difference between the two angle readings is the measured angle of the workpiece.

The projection screen also includes reference lines for 30°, 60°, and 90° for direct angle comparison.

8. Maintenance

The projector is a precision optical instrument. Proper maintenance is important to ensure measurement accuracy and extend the service life of the machine.

Installation Environment

Install the instrument in a clean and dry room with a recommended temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$. The relative humidity should not exceed 60% to prevent moisture damage, mold on optical components, and reduced image quality.

Cleaning Optical Parts

Keep all optical surfaces clean and avoid touching them with bare hands. If dust, oil, or dirt is found on the optical parts, clean them using a soft brush or lens paper with suitable cleaning solution such as alcohol and ether mixture. Avoid excessive rubbing to prevent damage to the optical surface.

General Maintenance

Do not operate the machine with excessive force. After use, clean all exposed metal surfaces and accessories, including:

- Center cradle
- V-cradle
- Plane worktable
- Circular worktable

Apply protective grease when necessary to prevent corrosion.

Precision Components

The objective lens, guides, and condenser are high-precision components and should not be disassembled unnecessarily. If repair is required, contact an authorized service technician or qualified repair center.

9. Unpacking and Installation

Remove the cover and the front and rear panels of the wooden case. Unscrew the four hexagonal bolts securing the base. Carefully move the instrument to the installation location and adjust the four foot screws until the machine is level. To maintain clear image quality, avoid placing the projection screen directly facing windows or strong light sources.

After positioning the machine:

- Remove the protective paper carefully
- Clean the protective grease using a soft cloth with suitable cleaning solvent
- Apply lubricant oil after cleaning

For the worktable, remove the six fixing screws and the connecting plate so the table can move freely in longitudinal and transverse directions. Finally, connect the power supply and the instrument is ready for operation.