

# Presentation Outline

- Profile Projector Definition
  - Profile Projector Applications
  - Profile Projector Advantages and Disadvantages
  - Profile Projector Components
  - Types of measurements
  - Types of optical systems
  - Profile Projector stepwise procedures
  - Conclusion
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# Profile Projector Definition

- An **Profile Projector** (often simply called a **optical comparator** in context) is a device that applies the principles of optics to the inspection of manufactured parts.
  - In a comparator, the magnified silhouette of a part is projected upon the screen, and the dimensions and geometry of the part are measured against prescribed limits.
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# Profile Projector Definition (cont.)

- The idea of using profile projector, which is created by James Hartness and Russell W. Porter, came from mixing optics and measurement in a device.
  - The use of the term *comparator* for metrological equipment, had existed in other forms prior to Hartness's work; but they had remained in realms of pure science (such as telescoping and microscopy) and highly specialized applied science (such as comparing master measuring standards).
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# Profile Projector Applications

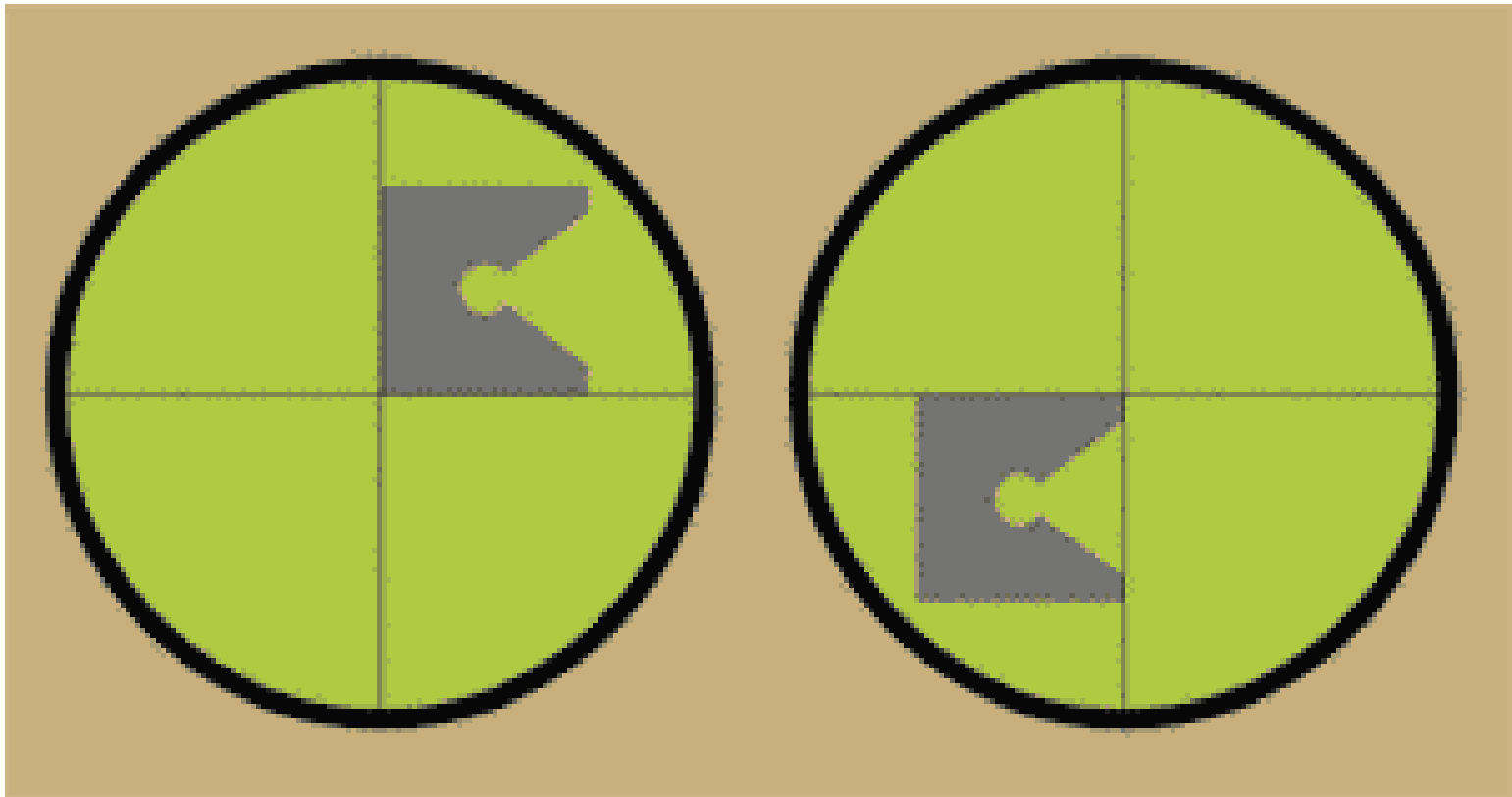
- Hartness's comparator, intended for the routine inspection of machined parts, was a natural next step in the era during which applied science became widely integrated into industrial production.
  - It's also employed for inspecting and comparing very small and complex parts, which play very significant role in system's structure, as an application of quality.
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# Profile Projector Advantages

- Profile Projector can reveal imperfections such as burrs, scratches, indentations or undesirable chamfers which both micrometers or calipers can't reveal.
  - They're able to measure in 2-D space. Unlike micrometers and calipers, which measure one dimension at a time, where comparators measure length and width simultaneously.
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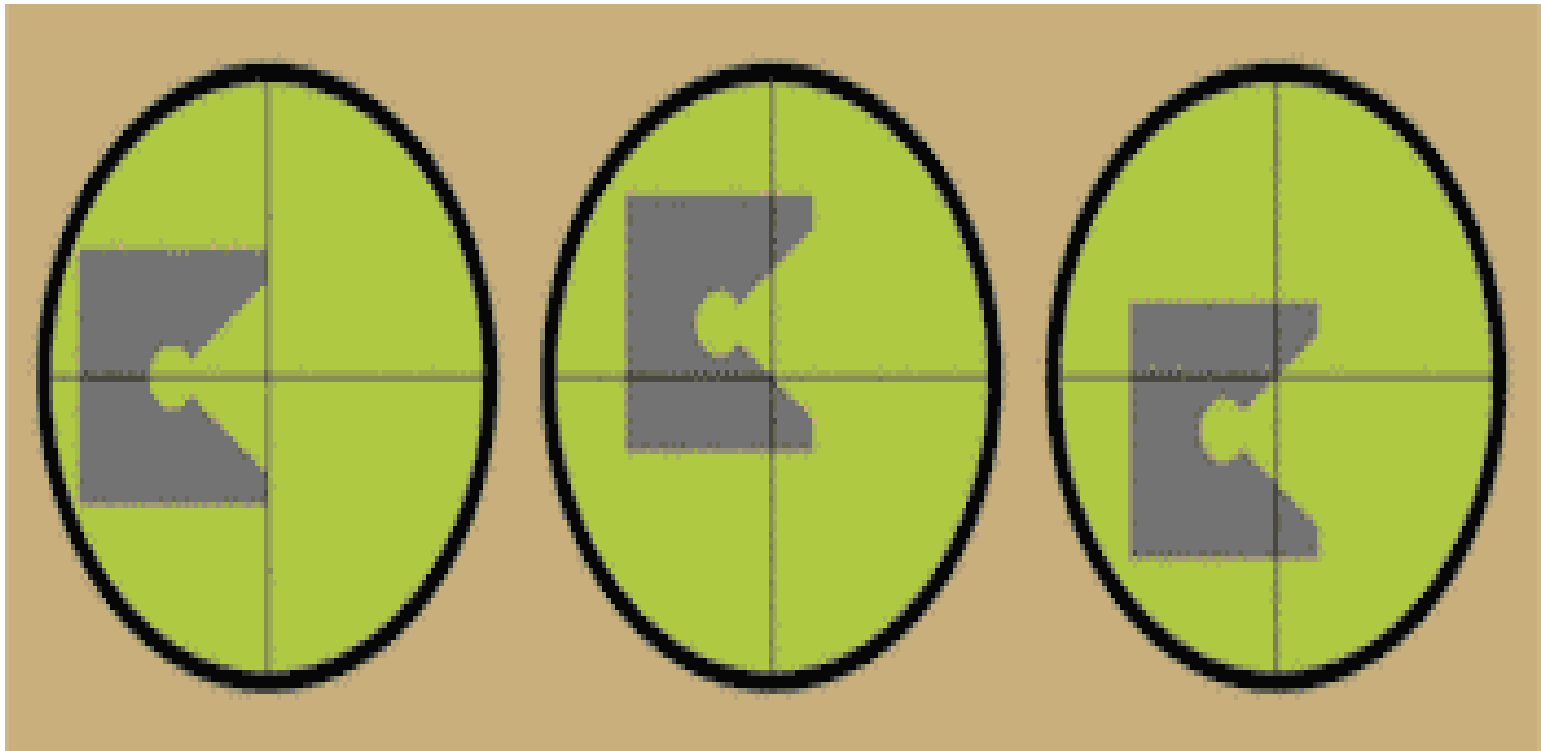
# Profile Projector Advantages (cont.)

- **Measuring Length and Width**



# Profile Projector Advantages (cont.)

- **"Points in Space" Measurement**



# Profile Projector Advantages (cont.)

- **Cost savings:**
    - Optical comparators save time. Ease-of-use factors and ergonomic designs reduce the inspection time, retraining costs and operator fatigue, all while increasing throughput.
    - Custom hard gages are subject to wear and need frequent recertification, which takes them out of service and adds an additional cost.
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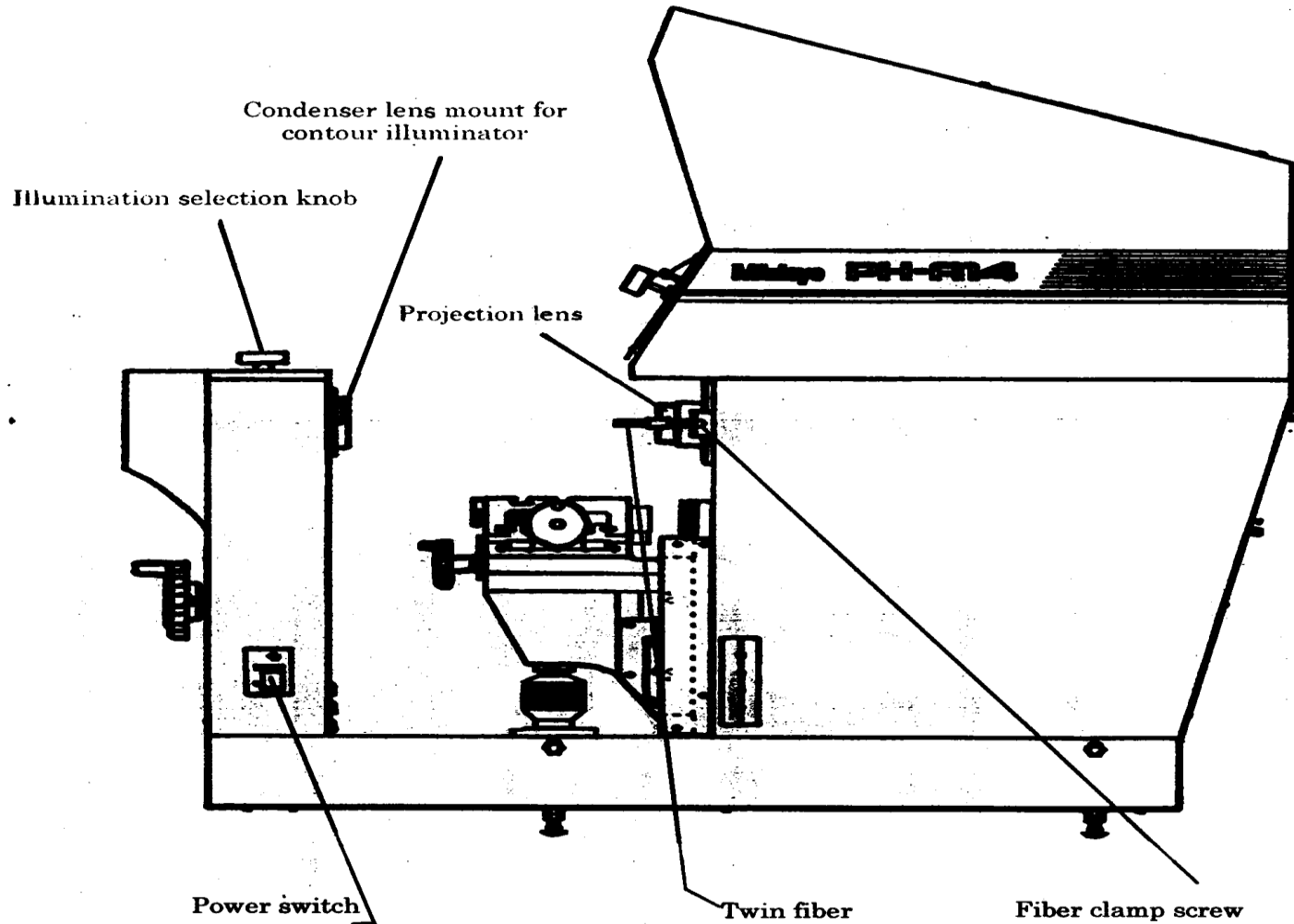
# Profile Projector Advantages (cont.)

- Dimensioning techniques designed to give more leeway to parts in relation to their true functional purpose, such as profile tolerancing and true-position tolerancing with bonuses, reduce the reject rate of good parts that might have passed had their tolerances been assigned differently.
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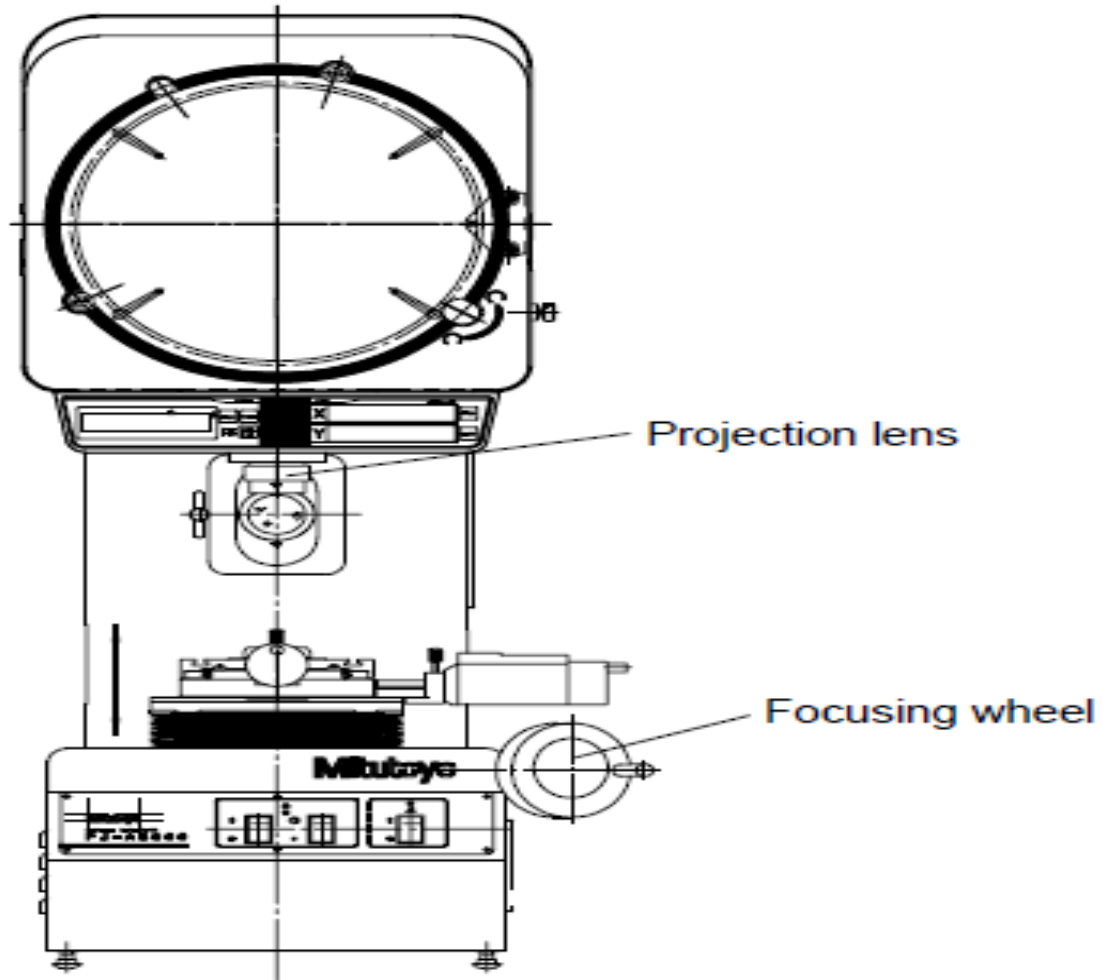
# Profile Projector Disadvantage

- The limitation of using profile projector as a fixed device forms a disadvantage of it, while instruments such micrometer or calipers can be used to reach for measuring far and joint accessible components and it is large and bulky and usually require a cart to transport from place to place, also the device requires power for operation.
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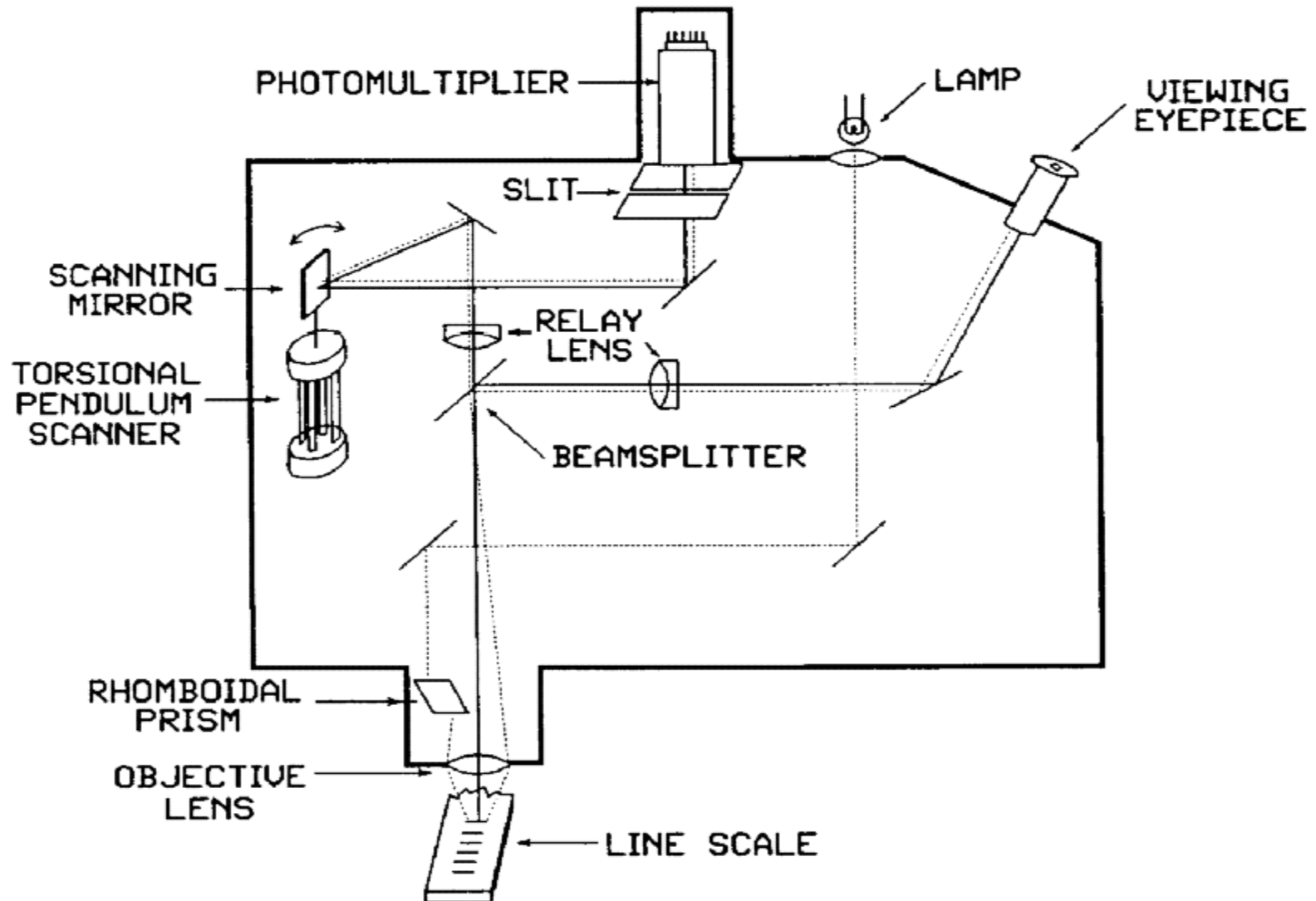
# Profile Projector Components



# Profile Projector Components (cont.)



# Profile Projector Components (cont.)



# Profile Projector Components (cont.)

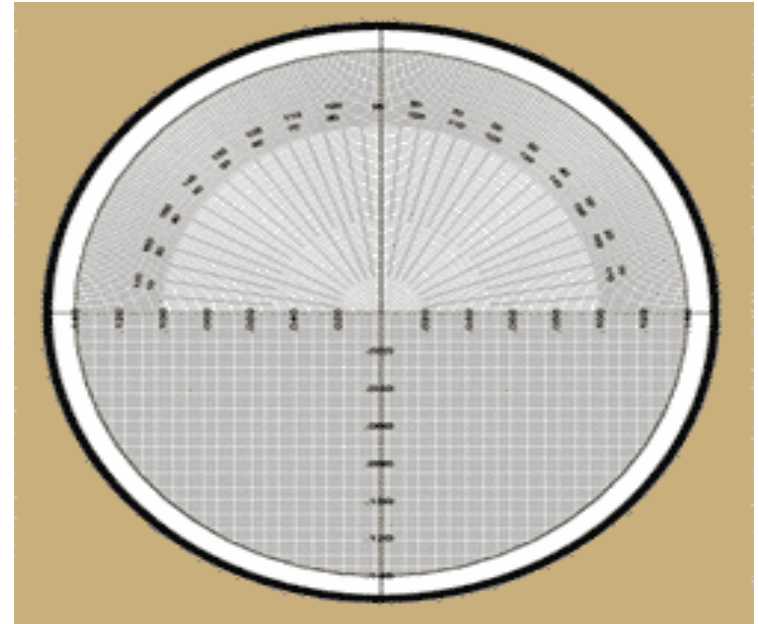


# Types of measurements

- ❑ ***Measurement by comparison:*** Part images could be compared to rulers and protractors placed across the screen.
  - Eventually, these measuring tools were incorporated into precise glass overlay screens, commonly called "chart gages." The most common chart gage is the tool room chart. It can measure angles, radii, lengths and widths.
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# Types of measurements (cont.)

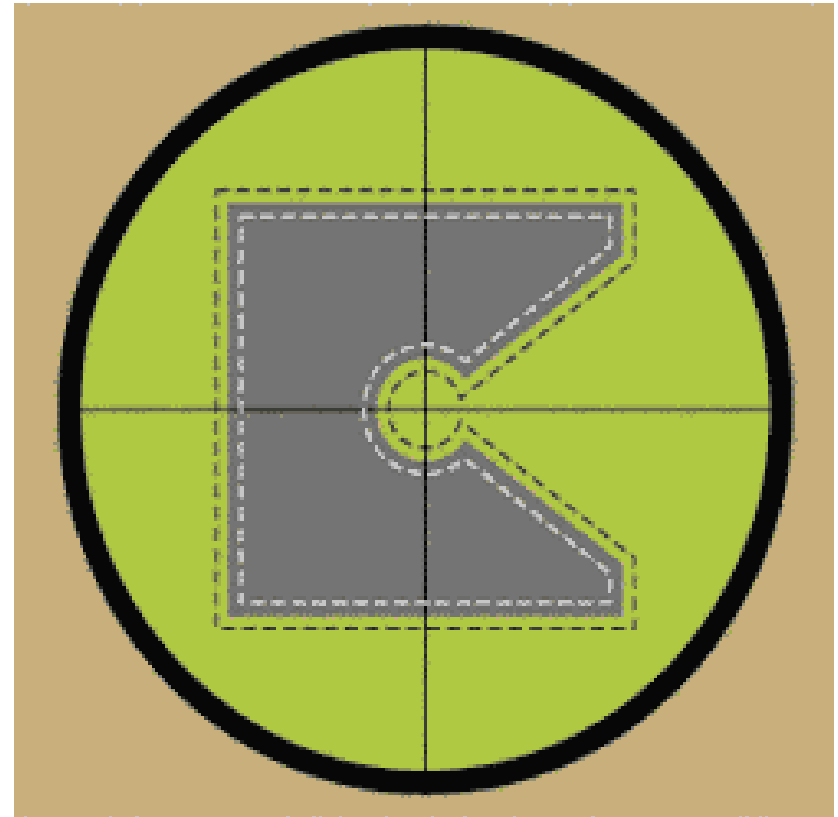
- ❑ Standard chart gages, such as toolroom charts or custom chart gages with minimum and maximum tolerance zones, can be used as go/no-go gages for quick inspection.
- ❑ using chart gages this way on an optical comparator is still one of the fastest and most cost-effective methods of measuring profile dimensions.





# Types of measurements (cont.)

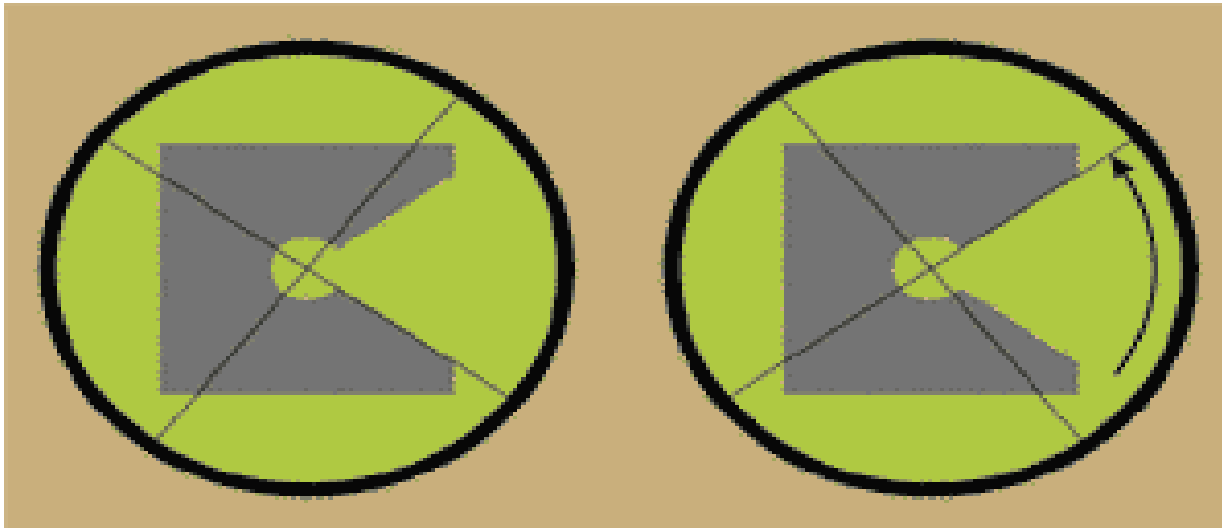
- Such dedicated charts are being replaced by electronically generated chart gages, which allows the possibility of fast and automatic measuring process, thus more economic performance.



**Using Chart Gauges for Go/No-Go Gauging**

# Types of measurements (cont.)

- *Measurement by screen rotation:* rotating the screen to measure angles.
- Vernier or digital scales are provided to the screen to measure the angle measurements when rotating the screen ring.



# Types of measurements (cont.)

- ***Measurement by motion:*** worktables are incorporated into the optical comparators to track parts' positions as they move.
    - There are two main advantages
      1. the need for a large screen and corresponding large system is eliminated.
      2. Comparators can operate in CNC mode that significantly increases productivity and accuracy and reduces operator subjectivity.
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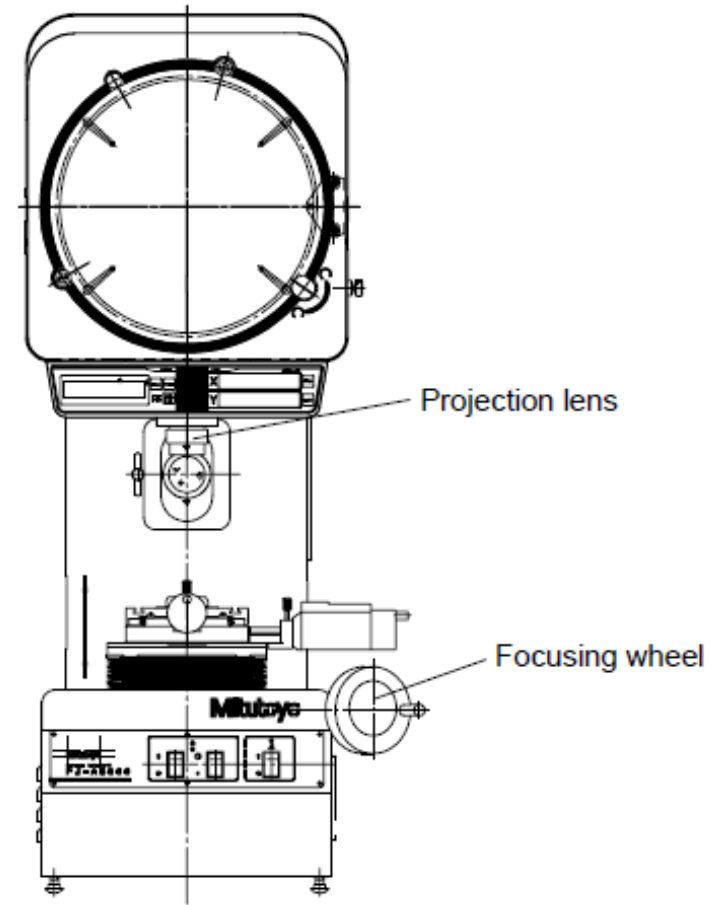
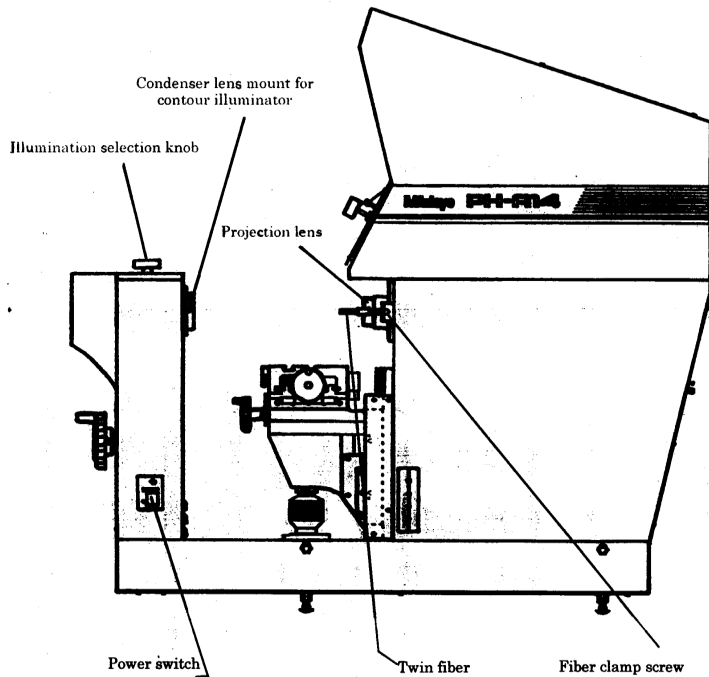
# Types of optical systems

- **Simple optics:** It incorporates a light source, a magnification lens, a main reflecting mirror and a screen. Machines with this design display images that are both upside-down and reversed.
  - **Corrected optics:** This system uses two internal mirrors to flip the image so that it's displayed right-side-up, but it's reversed on the horizontal axis.
  - **Fully corrected system:** which displays images that are both erect and unreversed.
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# Profile Projector stepwise procedures

1. Switch on the optical profile projector.
  2. Place the clean work piece on the glass of the table.
  3. Focus it properly by moving focusing wheel and moving the work table to obtain correct magnified image of the object.
  4. Horizontal (x axis) measurement can be taken by right hand side micrometer and the vertical measurement can be taken from front side micrometer.
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# Profile Projector stepwise procedures





# Conclusion

- Optical comparators are used to measure manufactured parts in a wide range of industries around the world every day. Available with numerous features and options to suit many applications, comparators can be used throughout a factory, including incoming inspection areas, R&D labs, machine shops, assembly and production floors, and final inspection areas. Their versatility, range of capabilities and return on investment make comparators indispensable and integral to any quality plan.
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