New Products

Profile projectors
PJ-PLUS Series
Refer to page J-3 for details.

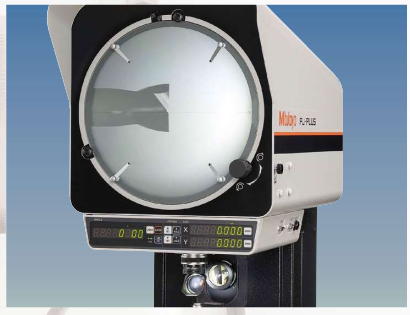
Motor-Driven Z-axis Measuring Microscopes
MF-J/MF-UJ/MF-UK Series
Refer to pages J-6, J-8 for details.

Varifocal Lens
TAGLENS
Refer to page J-15 for details.

J

Profile Projectors

Horizontal / Vertical Profile Projectors



Microscopes

Measuring Microscopes

Video Microscope Units

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Mitutoyo

Profile Projectors

For efficient measurement, inspection and observation of very small workpieces

MeasurLink® ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

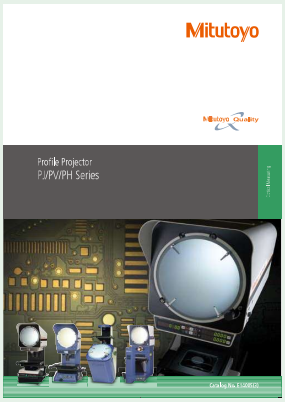
PJ-PLUS Series
SERIES 302 — Premium Benchtop Series

- The profile projector that "can be operated intuitively" even by inexperienced operators and also has excellent durability and energy saving performance thanks to adoption of an "LED illumination source" and "fan-less cooling system".
- Provides stable dimension and angle measurements in harsher environments, such as manufacturing and processing lines, than can be handled by conventional models.
- Stepless illumination has been adopted so as to allow precise adjustment of lighting to suit the surface texture and color of the workpiece.

PJ-P2010A

SPECIFICATIONS

Model No.		PJ-P1010A		PJ-P2010A	
Order No.		302-801-10	302-801-20	302-802-10	302-802-20
Unit system for the counter unit		mm/in	mm	mm/in	mm
Projected image		Inverted-reversed			
Protractor screen	Effective diameter	ø315 mm (12.4 in)			
	Screen rotation	±360° (±370° for display)			
	Angle display	Digital counter (ABS/INC mode switching, Zero Set)			
	Resolution	1′ or 0.01° (switchable)			
	Cross-hairs	90° (solid lines)			
Projection lens	Magnification	10X (standard accessory), 20X, 50X, 100X 10X, 20X (equipped with an external half-mirror for coaxial surface illumination)			
	Lens mount	Bayonet mount			
Illumination	Contour illumination	White LED light source, Telecentric, Variable brightness adjustment			
	Surface illumination	White LED light source, With an adjustable condenser lens, Variable brightness adjustment			
Resolution for X/Y counter		0.001 mm or 0.0001 in/0.001 mm			
Measuring unit		Digital scale			
Measuring range (X×Y)		100×100 mm		200×100 mm	



Refer to the Profile Projector Brochure (**E14005**) for more details.

MeasurLink® ENABLED
Data Management Software by Mitutoyo

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PJ-H30
SERIES 303 — Premium Benchtop Series

- Conforms to JIS B 7184: 1999 "Profile projectors".
- High-end model that achieves accuracy of (3.0 + 0.02L) µm
- ø306 mm screen makes erect-unreversed images more visible.
- The largest measuring range in the class, up to 300×170 mm.
- Quick-release handle and 3-lens parfocal turret enables efficient measurement.
- Elevating shaft mechanism for the screen head reduces operator fatigue.
- Unique model equipped with a highly accurate edge detector (OPTOEYE) and motorized up/down drive is available.

PJ-H30D3017B

SPECIFICATIONS

Protractor screen	Model No.	PJ-H30A1010B	PJ-H30A2010B	PJ-H30A2017B	PJ-H30A3017B
	Order No.	303-712-1*1	303-713-1*1	303-714-1*1	303-715-1*1
Protractor screen, OPTOEYE (built-in), Electromotive focusing	Model No.	PJ-H30D1010B	PJ-H30D2010B	PJ-H30D2017B	PJ-H30D3017B
	Order No.	303-732-1*1	303-733-1*1	303-734-1*1	303-735-1*1
Projected image		Erect			
Protractor screen	Effective diameter	ø306 mm (12 in)			
	Screen rotation	±360° (±370° for display)			
	Angle display	Digital counter (ABS/INC mode switching, Zero Set)			
	Resolution	1′ or 0.01° (switchable)			
	Mechanism	Fine feed and clamp			
	Cross-hairs	90° (solid lines)			
Projection lens	Magnification	10X (standard accessory), 5X, 20X, 50X, 100X, All lens have the same focus. Half-mirror for the coaxial surface illumination are built-in and movable.			
	Lens mount	Bayonet mount, 3-lens mount turret type			
Illumination	Contour illumination	Halogen bulb (24 V, 150 W, 50 hours) (**515530**), Variable Illumination angle (Coaxial surface/Oblique reflected, Beam concentration and adjustment), Built-in heat-absorbing filter, Built-in cooling fan, Stepless brightness adjustment, Soft lighting (inrush current reduction)			
	Surface illumination	Halogen bulb (24 V, 150 W, 50 hours) (**515530**) Zoom Telecentric system, Heat absorbing filter, Built-in cooling fan, Stepless brightness adjustment, Soft lighting (inrush current reduction), Bulb sliding mechanism			
Resolution for X/Y counter *2		0.001 mm/0.0001 in			
Measuring unit		High-accuracy digital scale			
Measuring range (X×Y)		100×100 mm	200×100 mm	200×170 mm	300×170 mm
Measuring accuracy *3		(3 + 0.02L) µm L=Measured length (mm)			

*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix is required for PSE.
*2 0.5 µm or 0.1 µm resolution is also available. Please contact Mitutoyo Techno Service Business Division.
*3 Measuring method complies with JIS B 7184.

Mitutoyo reserves the right to change any or all aspects of any product specification, including prices, designs and service content, without notice.

MeasurLink ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PV-5110
SERIES 304 — Profile Projectors

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- Floor-standing projector with a vertical axis and a unique forward-sloping screen.
- The large 500 mm diameter screen enables the whole of a 100 mm diameter workpiece to be inspected using a 5X projection lens without needing to move the workpiece.
- The sloping screen design enables the operator to maintain a comfortable operational posture for long periods of time while making comparative measurements or tracing a projected image.

PV-5110

SPECIFICATIONS

Model No.		PV-5110
Order No.		**304-919**[*1]
Projected image		Inverted-reversed
Protractor screen	Effective diameter	ø508 mm (20 in)
	Screen rotation	±360° (±370° for display)
	Angle display	Digital counter (ABS/INC mode switching, Zero Set)
	Resolution	1′ or 0.01° (switchable)
	Mechanism	Fine feed and clamp
	Cross-hairs	90° (solid lines)
	Zero-base index	Built-in, With a LED back light
Projection lens	Magnification	10X (standard accessory), 5X, 20X, 50X, 100X
Illumination	Contour illumination	Halogen bulb (24 V, 150 W, 500 hours) (**512305**), 2-step (High/Low) brightness switch, Combination use with a color filter available
	Surface illumination	Double-lighting oblique surface illumination unit (optional), Halogen bulb (24 V, 150 W, 500 hours) (**512305**), 2-step (High/Low) brightness switch
Resolution for X / Y counter[*2]		—
Measuring unit		Digital scale
Measuring range (X×Y)		200×100 mm (164×68 mm[*3])

*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix is required for PSE.
*2 X and Y counters are not built into the **PV-5110** main unit. If a counter display is required, it is recommended that a **QM-Data200** or **KA-212** is purchased separately.
*3 The range where no shading is observed using a 5X projection lens with contour illumination.

MeasurLink ENABLED
Data Management Software by Mitutoyo

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PH-3515F, PH-A14
SERIES 172 — Profile Projector

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- Standard models as used in the machine tool industry. Best for observation and measurement of cutting tools (end mills, lathe tools).
- The stage has a higher loading capacity (45 kg) than any other type of projector.
- Unique projector employing horizontal optical system. The optical axis and the stage are parallel, and the workpiece can be easily removed.

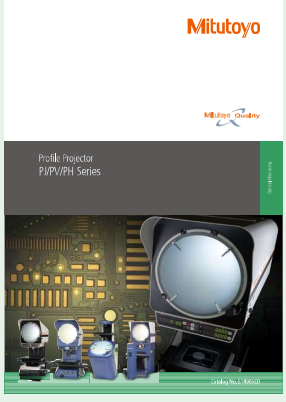
PH-3515F

PH-A14

SPECIFICATIONS

Model No.		PH-3515F	PH-A14
Order No.		**172-868**[*1]	**172-810**[*2]
Projected image		Erect-reversed	Inverted-reversed
Protractor screen	Effective diameter	ø353 mm (13.9 in)	ø356 mm (14 in)
	Screen rotation	±360° (±370° for display)	
	Angle display	Digital counter (ABS/INC mode switching), Zero Set	Vernier
	Resolution	1′ or 0.01° (switchable)	2′ (graduation)
	Mechanism	Fine feed and clamp	
	Cross-hairs	90° (solid lines)	
Projection lens	Magnification	10X (standard accessory), 5X (**PH-3515F** only), 20X, 50X, 100X	
Illumination[*3]	Contour illumination	Halogen bulb (24 V, 150 W, 500 hours) (**515530**), 2-step (High/Low) brightness switch, Combination use with a color filter available	
	Surface illumination (oblique)	Parabolic halogen bulb (24 V, 200 W, 50 hours) (**12BAA637**) Beam concentration and adjustment available, Heat-absorbing filter, Built-in cooling fan	
Resolution for X/Y counter[*4]		—	
Measuring unit		Digital scale	
Measuring range (X×Y)		254×152 mm	200×100 mm

*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix is required for PSE.
*2 To denote your AC power cable add the following suffixes to the order No.: -10A for UL/CSA, -20D for CEE, -20DC for CCC, -20E for BS, -20K for KC.
*3 For the **PH-A14**, a light source (24 V, 150 W), which is common to the Contour illumination and Surface illumination, is used. It is not possible to regulate brightness.
*4 XY counter is not built in the main unit of the **PH-3515F** or **PH-A14**.
If a counter display is required, it is recommended to purchase the **QM-Data200** or a counter (**KA-212**) separately.
Note: Depending on the angle of illumination, measurement results may be smaller than actual values.



Refer to the Profile Projector Brochure (**E14005**) for more details.

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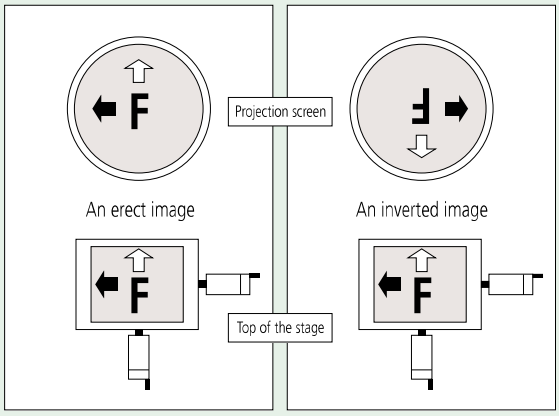
Erect Image and Inverted Image

An image of an object projected onto a screen is erect if it is orientated the same way as the object on the stage. If the image is reversed top to bottom, left to right and by movement with respect to the object on the stage (as shown in the figure below) it is referred to as an inverted image (also known as a reversed image).



F Workpiece
⬅ X-axis movement
⇦ Y-axis movement

Magnification Accuracy

The magnification accuracy of a projector when using a certain lens is established by projecting an image of a reference object and comparing the size of the image of this object, as measured on the screen, with the expected size (calculated from the lens magnification, as marked) to produce a percentage magnification accuracy figure, as illustrated below. The reference object is often in the form of a small, graduated glass scale called a `stage micrometer' or `standard scale', and the projected image of this is measured with a larger glass scale known as a `reading scale'.

(Note: That magnification accuracy is not the same as measuring accuracy.)

$$\Delta M\,(\%) = \frac{L - \ell M}{\ell M} \times 100$$

ΔM (%): Magnification accuracy expressed as a percentage of the nominal lens magnification
L : Length of the projected image of the reference object measured on the screen
ℓ : Length of the reference object
M : Magnification of the projection lens

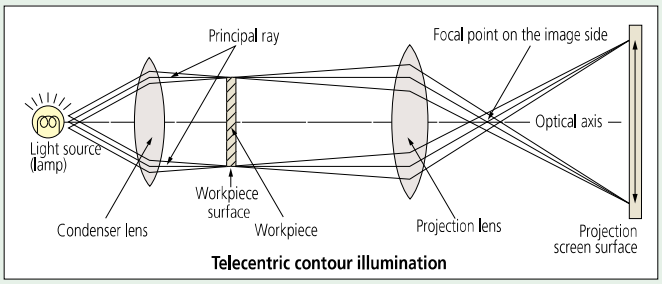
Type of Illumination

- Contour illumination: An illumination method to observe a workpiece by transmitted light and is used mainly for measuring the magnified contour image of a workpiece.
- Coaxial surface illumination: An illumination method whereby a workpiece is illuminated by light transmitted coaxially to the lens for the observation/measurement of a surface. (A half-mirror or a projection lens with a built-in half-mirror is needed.)
- Oblique surface illumination: A method of illumination by obliquely illuminating the workpiece surface. This method provides an image of enhanced contrast, allowing it to be observed three-dimensionally and clearly. However, note that an error is apt to occur in dimensional measurement with this method of illumination.
  (An oblique mirror is needed. **PJ-H30** models are supplied with an oblique mirror.)

Telecentric Optical System

An optical system based on the principle that the primary rays are aligned parallel to the optical axis by placing a lens stop on the focal point on the image side. Its functional feature is that the image will not vary in size even though the image blurs as the object is shifted along the optical axis.

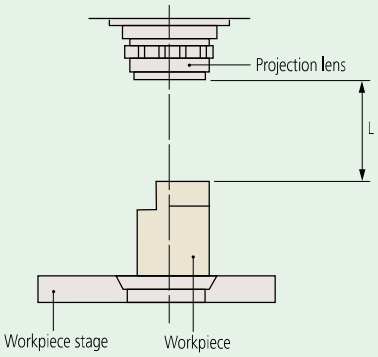
For measuring projectors and measuring microscopes, an identical effect is obtained by placing a lamp filament at the focal point of a condenser lens instead of a lens stop so that the object is illuminated with parallel beams. (See the figure below.)



Telecentric contour illumination

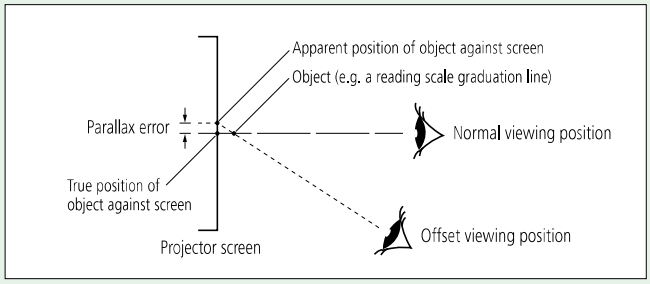
Working distance

Refers to the distance from the face of the projection lens to the surface of a workpiece in focus. It is represented by L in the diagram below.



Parallax error

This is the displacement of an object against a fixed background caused by a change in the observer's position and a finite separation of the object and background planes. Can cause a reading error on a projector screen.



Field of view diameter

The maximum diameter of the workpiece that can be projected using a particular lens.

$$\text{Field of view diameter (mm)} = \frac{\text{Screen diameter of profile projector (mm)}}{\text{Magnification of projection lens used}}$$

Example: If a 5X magnification lens is used for a projector with a screen of ø500 mm:
Field of view diameter is given by $\frac{500\text{ mm}}{5} = 100\text{ mm}$