New Products

Profile Projectors

PJ-H30

Refer to page J-5 for details.

Measuring Microscopes/ High-power Multi-function Measuring Microscopes

MF/MF-U

Refer to pages J-19–J-22 for details.

Video Microscope Unit

VMU

Refer to page J-32 for details.

J

Profile Projectors

Profile Projectors

Microscopes

Microscopes

Video Microscope Unit

INDEX

Mitutoyo

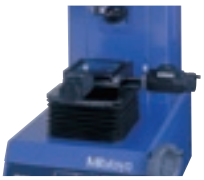
Profile Projectors

For efficient measurement, inspection and observation of very small workpieces

PJ-A3000
SERIES 302 — Profile Projectors

- The PJ-A3000 Series profile projectors are medium-size models that feature excellent versatility and easy operation.
- Easy-to-read digital XY counter is located near the projection screen to minimize eye movement.
- Digital readout protractor screen facilitates angle measurement.

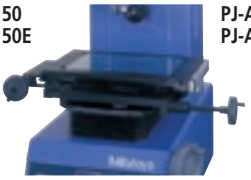
PJ-A3010F-200



PJ-A3005D-50
PJ-A3005D-50E
PJ-A3005R-50

PJ-A3010F-100
PJ-A3010F-100E

PJ-A3005F-150
PJ-A3005F-150E



PJ-A3010F-200
PJ-A3010F-200E

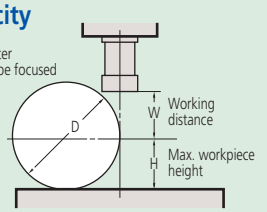
PJ-A3000

Technical Data

Projected image:	Inverted
Protractor screen	
• Effective diameter:	315mm (12.4")
• Screen material:	Fine-ground glass
• Screen rotation:	±360°, fine feed and clamp
• Angle reading:	Digital counter (LED) Resolution: 1′ or 0.01° (switchable) Range: ±370° ABS/INC mode switching, Zero Set
• Reference lines:	Cross-hairs
Projection lens:	10X (**172-202**) Optional: 20X, 50X, 100X
Magnification accuracy	
• Contour illumination:	±0.1% or better
• Surface illumination:	±0.15% or better
Maximum workpiece height:	Refer to the projection capacity (H) below.
Contour illumination	
• Light source:	Halogen bulb (24V, 150W)
• Optical system:	Telecentric system
• Functions:	2-step (High/Low) brightness switch, Heat-absorbing filter, Cooling fan
Surface illumination	
• Light source:	Halogen bulb (24V, 150W)
• Optical system:	Vertical illumination with adjustable condenser lens
• Functions:	Heat-absorbing filter, Cooling fan
Focusing:	Manual focus
Resolution:	0.001mm or .0001"/0.001mm (.00005"/0.001mm: digital head)
Power supply:	100 - 240V AC, 50/60Hz
Mass:	105kg - 140kg

Projection Capacity

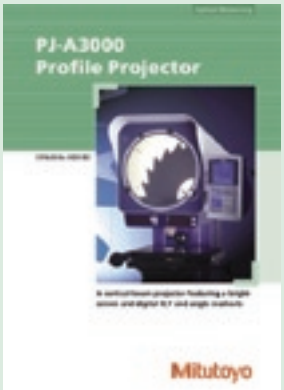
D: Max. workpiece diameter whose peripheral line can be focused on the screen center



Unit: mm

	Magnification			
	10X	20X	50X	100X
View field	ø31.5	ø15.7	ø6.3	ø3.1
W	66 (20)	32.5 (2)	12.6	5
H -50 models*	123.5	123.5	123.5	123.5
-100 models	91	91	91	91
-150 models	103.5	103.5	103.5	103.5
200 models	92.5	92.5	92.5	92.5
D -50 models*	224 (198)	87 (61)	27	10
-100 models	182	87 (61)	27	10
-150 models	207 (198)	87 (61)	27	10
200 models	185	87 (61)	27	10

( ): When using surface illumination
* Including PJ-A3000



Refer to the PJ-A3000 leaflet (E4233) for more details.

Optional Accessories

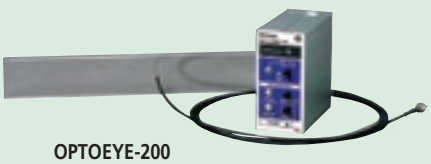
172-203: 20X projection lens set
172-204: 50X projection lens
172-207: 100X projection lens
172-229: Oblique illumination mirror for 10X lens
172-230: Oblique illumination mirror for 20X lens
172-116: Standard scale (50mm)
172-117: Standard scale (2")
172-118: Reading scale (200mm)
172-161: Reading scale (300mm)
172-119: Reading scale (8")
172-162: Reading scale (12")
932105: Overlay chart set (12 sheets)
172-160-2: Green filter (for PJ-A3000, -50 models)
172-160-3: Green filter (for -100, -150, -200 models)
512305: Halogen bulb (24V, 150W)
965012: SPC cable (2m) for angle display output

Fixture and Stage accessories (Refer to page J-16.)
176-106: Rotary table (Effective diameter: 66mm)
172-196: Rotary table (Effective diameter: 100mm)
172-198: Rotary table with fine feed wheel (Effective diameter: 96mm)
176-105: Swivel center support (Max. workpiece dia.: 70mm)
172-197: Swivel center support (Max. workpiece dia.: 80mm)
176-107: Holder with clamp
172-378: V-block with clamp (Max. workpiece dia.: 25mm)
999678: Fixture mount adapter

Availability	PJ-A3000 PJ-A3005R-50 PJ-A3005D-50/E	PJ-A3005F-150/E PJ-A3010F-100/E PJ-A3010F-200/E
176-106	✔	—
172-196	—	✔*
172-198	—	✔*
176-105	✔	✔*
172-197	—	✔*
176-107	✔	✔*
172-378	✔	✔*

* Fixture mount adapter (**999678**) is required for PJ-A3010F-200/E

QM-Data200
2-D data processing unit.
(Refer to page J-29 for more details.)



OPTOEYE-200
Edge detection system for QM-Data200
(Refer to page J-30 for more details.)

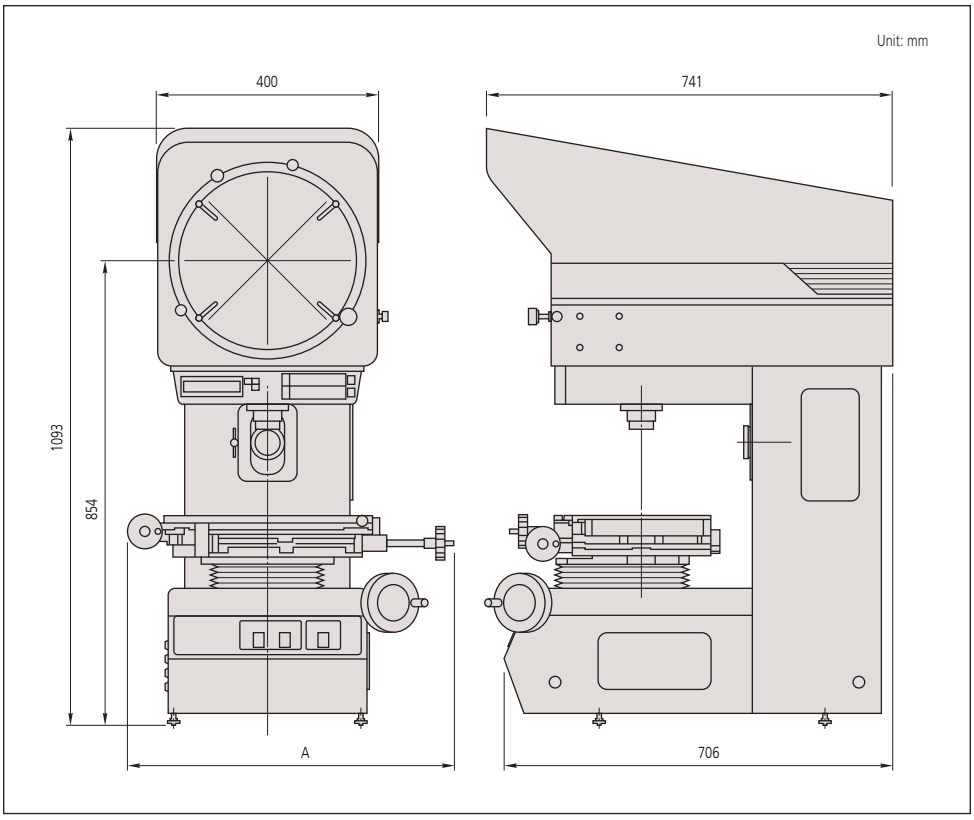
SPECIFICATIONS

Model No.	PJ-A3005R-50	PJ-A3005D-50	PJ-A3005D-50E	PJ-A3010F-100	PJ-A3010F-100E
Order No. (metric)	**302-709***	**302-704***	**302-708***	**302-703***	**302-707***
Order No. (inch/metric)	**302-719***	**302-714***	**302-718***	**302-713***	**—**
XY stage travel range	50 x 50mm	50 x 50mm	50 x 50mm	100 x 100mm	100 x 100mm
Measurement method	Analog head	Rotary encoder	Rotary encoder	Linear encoder	Linear encoder
Quick-release mechanism	—	—	—	X and Y axes	X and Y axes
XY stage table top size	152 x 152mm	152 x 152mm	152 x 152mm	250 x 250mm	250 x 250mm
XY stage effective area	82 x 82mm	82 x 82mm	82 x 82mm	142 x 142mm	142 x 142mm
Stage glass No.	**380405**	**380405**	**380405**	**12BAE041**	**12BAE041**
Swiveling function	—	—	—	—	—
Max stage loading	10kg	10kg	10kg	10kg	10kg
Remarks	w/o digital counter	—	w/o angle counter	—	w/o angle counter

Model No.	PJ-A3005F-150	PJ-A3005F-150E	PJ-A3010F-200	PJ-A3010F-200E	PJ-A3000
Order No. (metric)	**302-702***	**302-706***	**302-701***	**302-705***	**302-700***
Order No. (inch/metric)	**302-712***	**—**	**302-711***	**—**	**—**
XY stage travel range	150 x 50mm	150 x 50mm	200 x 100mm	200 x 100mm	Fixed
Measurement method	Linear encoder	Linear encoder	Linear encoder	Linear encoder	—
Quick-release mechanism	X and Y axes	X and Y axes	X and Y axes	X and Y axes	—
XY stage table top size	280 x 152mm	280 x 152mm	380 x 250mm	380 x 250mm	160 x 145mm
XY stage effective area	185 x 84mm	185 x 84mm	266 x 170mm	266 x 170mm	ø70mm
Stage glass No.	**381349**	**381349**	**382762**	**382762**	**200673**
Swiveling function	—	—	±3°	±3°	—
Max stage loading	8kg	8kg	8kg	8kg	15kg
Remarks	—	w/o angle counter	—	w/o angle counter	w/o angle counter

* To denote your AC power cable, add the following suffixes to the order No.: **A** for UL/CSA, **C** for Taiwan, **D** for CEE, **DC** for CCC, **E** for BS, **K** for EK, **No suffix** is required for JIS/100V

DIMENSIONS



J

Mitutoyo

Profile Projectors

For efficient measurement, inspection and observation of very small workpieces

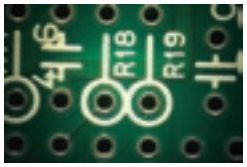
PJ-H30
SERIES 303 — Profile Projectors

By separating axial motion, and stabilizing the XY measuring stage in the vertical direction, high measuring accuracy of (3+0.02L)µm has been achieved on the PJ-H30 Series Profile Projectors. Focusing is accomplished by moving the screen head itself up and down with the hand wheel or motorized unit. Power focusing (PJ-H30D type) provides higher performance.

- Newly designed optical system with high NA lenses provide dramatically brighter and clearer screen images during surface illumination.
- The three-lens turret includes a 10X lens as standard. Four projection lenses (5X, 20X, 50X, 100X) are available.

Adjustable / oblique switchable surface illumination

Vertical illumination



Oblique illumination

PJ-H30A3017B
XY stage travel range: 300 x 170mm

Selection of XY stage by travel range

505B: 50 x 50mm

1010B: 100 x 100mm

2010B: 200 x 100mm

2017B: 200 x 170mm

Selection of machine type

Machine type	PJ-H30E	PJ-H30A	PJ-H30B	PJ-H30C	PJ-H30D
Type of screen	Fixed screen	Protractor screen	Protractor screen	Protractor screen	Protractor screen
Focus operation	Manual	Manual	Manual	Power drive	Power drive
Edge detection system	OPTOEYE (external)	OPTOEYE (external)	OPTOEYE (built-in)	—	OPTOEYE (built-in)

Technical Data

Projected image: Erect
Protractor screen
- Effective diameter: 306mm (12″)
- Screen material: Fine-ground glass
- Screen rotation: ±360°, fine feed and clamp
- Angle display: Digital counter (LED)
  Resolution: 1′ or 0.01° (switchable)
  Range: ±370°
  ABS/INC mode switching, Zero Set
- Reference lines: Cross-hairs

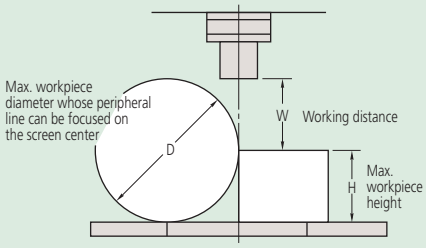
Projection lens: 10X (**172-472**)
Optional: 5X, 20X, 50X, 100X
Lens mount: 3-lens turret
Magnification accuracy
- Contour illumination: ±0.1% or better
- Surface illumination: ±0.15% or better

Maximum workpiece height: 105mm
Contour illumination
- Light source: Halogen bulb (24V, 150W)
- Optical system: Zoom Telecentric system
- Functions: Non-stepped brightness adjustment, Heat-absorbing filter, Cooling fan

Surface illumination
- Light source: Halogen bulb (24V, 150W)
- Optical system: Vertical / oblique illumination with an adjustable condenser lens
- Functions: Non-stepped brightness adjustment, Heat-absorbing filter, Cooling fan

Manual focus or Power drive
Resolution: 0.001mm or .0001″/0.001mm
Power supply: 100 - 240V AC, 50/60Hz
Mass: 176kg - 212kg

Projection Capacity



Unit: mm

	Magnification				
	5X	10X	20X	50X	100X
View field	ø61.2	ø30.6	ø15.3	ø6.12	ø3.06
H	105	105	105	105	105
W	66	70.5	56.5	50	50
D	148	197	137	114	114

Refer to the PJ-H30 leaflet (E4310) for more details.

Optional Accessories

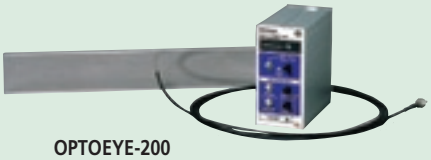
172-271: 5X projection lens
172-473: 20X projection lens
172-474: 50X projection lens
172-475: 100X projection lens
172-116: Standard scale (50mm)
172-117: Standard scale (2")
172-118: Reading scale (200mm)
172-161: Reading scale (300mm)
172-119: Reading scale (8")
172-162: Reading scale (12")
932105: Overlay chart set (12 sheets)
12AAG981: Green filter
172-269: Machine stand
515530: Halogen bulb (24V, 150W)

Fixture and Stage accessories (Refer to page J-16.)
172-198: Rotary table with fine feed wheel (Effective diameter: 96mm)
176-305: Rotary table with fine feed wheel (Effective diameter: 183mm)
176-306: Rotary table with fine feed wheel (Effective diameter: 240mm)
176-105: Swivel center support (Max. workpiece dia.: 70mm)
172-197: Swivel center support (Max. workpiece dia.: 80mm)
176-107: Holder with clamp
172-378: V-block with clamp (Max. workpiece dia.: 25mm)
176-317: Fixture mount adapter
172-378: Fixture mount adapter

Availability	Size of XY stage		
	505 1010	505 1010 2010	2017 3017
172-198	✔	✔**	✔***
176-305	—	✔**	—
176-306	—	—	✔
176-105	✔*	✔**	✔***
172-197	✔*	✔**	✔***
176-107	✔*	✔**	✔***
172-378	✔*	✔**	✔***

* Need to use with Rotary table **172-198**.
** Fixture mount adapter (**176-317**) is required.
*** Fixture mount adapter (**176-304**) is required.

QM-Data200
2-D data processing unit.
(Refer to page J-29 for more details.)



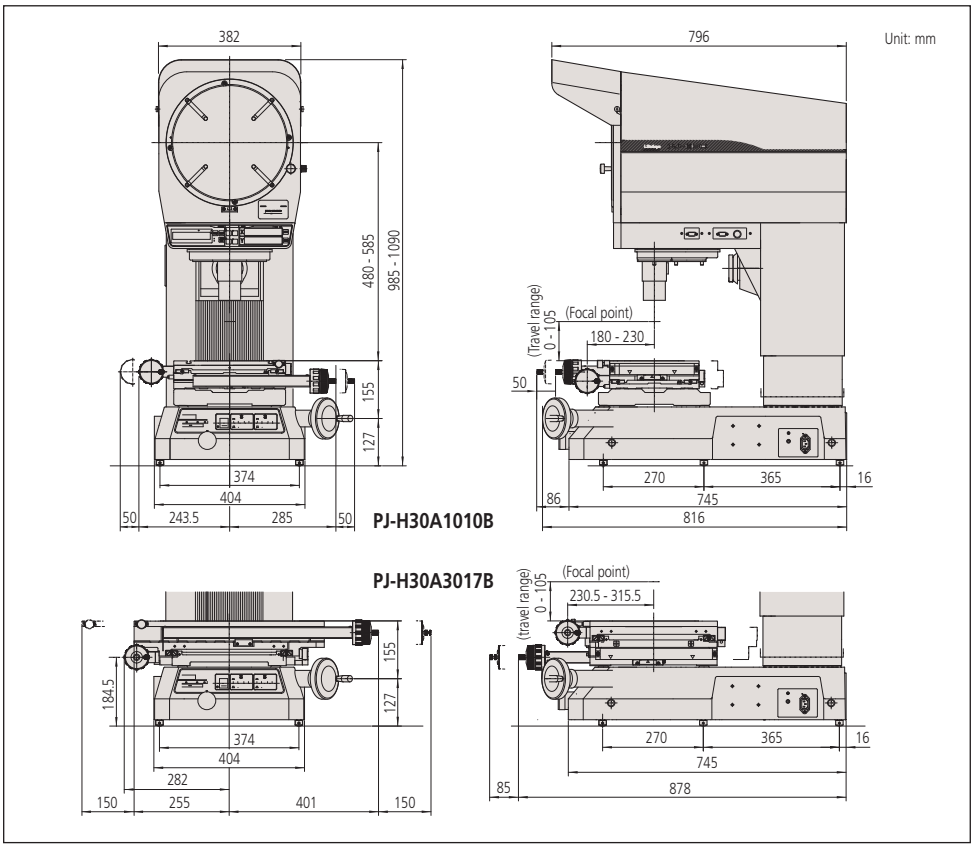
OPTOEYE-200
Edge detection system for QM-Data200
(Refer to page J-30 for more details.)

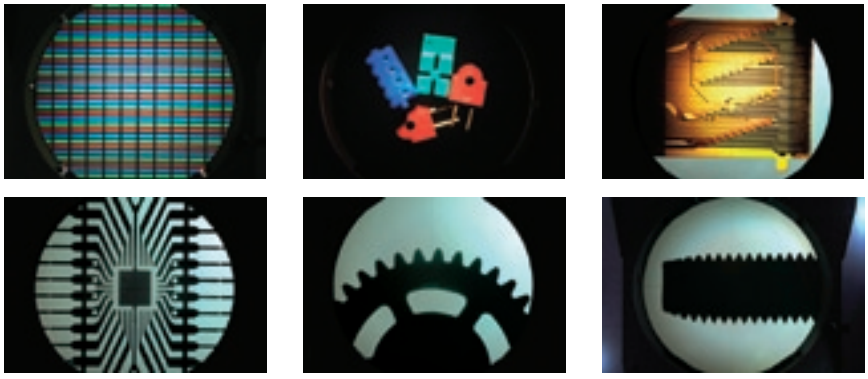
SPECIFICATIONS

Model No. (XY stage size)		505B	1010B	2010B	2017B	3017B
Order No.	PJ-H30E	**303-701***	**303-702***	**303-703***	**303-704***	**303-705***
	PJ-H30A	**303-711***	**303-712***	**303-713***	**303-714***	**303-715***
	PJ-H30B	**303-721***	**303-722***	**303-723***	**303-724***	**303-725***
	PJ-H30C	**303-741***	**303-742***	**303-743***	**303-744***	**303-745***
	PJ-H30D	**303-731***	**303-732***	**303-733***	**303-734***	**303-735***
XY stage travel range		50 x 50mm	100 x 100mm	200 x 100mm	200 x 170mm	300 x 170mm
Accuracy (at 20°C)		(3+0.02L)μm, L = Measured length (mm)				
Measurement method		Linear encoder	Linear encoder	Linear encoder	Linear encoder	Linear encoder
Quick-release mechanism		X and Y axes	X and Y axes	X and Y axes	X and Y axes	X and Y axes
XY stage table top size		300 x 240mm	300 x 240mm	350 x 280mm	410 x 342mm	510 x 342mm
XY stage effective area		180 x 150mm	180 x 150mm	250 x 150mm	270 x 240mm	370 x 240mm
Stage glass No.		**380412**	**380412**	**382762**	**12BAD363**	**12BAD330**
Swiveling function		±3°	±3°	±3°	±5°	±5°
Max stage loading		10kg	10kg	10kg	20kg	20kg
Remarks		E type: with fixed screen A type: with protractor screen B type: with protractor screen and built-in OPTOEYE-200 edge sensor C type: with protractor screen and power focus D type: with protractor screen, built-in OPTOEYE-200 edge sensor and Power focus				

* To denote your AC power cable, add the following suffixes to the order No.: **A** for UL/CSA, **C** for Taiwan, **D** for CEE, **DC** for CCC, **E** for BS, **K** for EK, **No suffix** is required for JIS/100V

DIMENSIONS





Profile Projectors

For efficient measurement, inspection and observation of very small workpieces

PV-5110
SERIES 304 — Profile Projectors

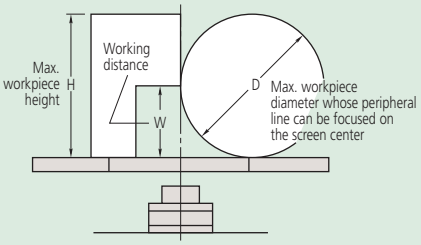
- Floor-standing model using overhead illumination which allows a large, conveniently positioned screen so that projected images can be easily traced or compared with a template.
- Digital readout protractor screen (including zero-setting, ABS/INC coordinate switching functions) for easy and error-free angle measurement.
- The optional oblique surface illumination unit (**172-419**) provides clear and bright images, allowing easy inspection of non-reflective workpieces such as plastic parts or printed materials.

PV-5110
with optional KA counter

Technical Data

Projected image:	Inverted
Protractor screen	
• Effective diameter:	508mm (20")
• Screen material:	Fine-ground glass
• Screen rotation:	±360°, fine feed and clamp
• Angle reading:	Digital counter (LED) Resolution: 1′ or 0.01° (switchable) Range: ±370° ABS/INC mode switching, Zero Set
• Reference lines:	Cross-hairs
Projection lens:	10X (**172-402**) Optional: 5X, 20X, 50X, 100X
Magnification accuracy	
• Contour illumination:	±0.1% or better
• Surface illumination:	±0.15% or better
Maximum workpiece height:	Refer to the projection capacity (H) below.
Contour illumination	
• Light source:	Halogen bulb (24V, 150W)
• Optical system:	Zoom Telecentric system
• Functions:	2-step (High/Low) brightness switch, Heat-absorbing filter, Cooling fan
Surface illumination	
• Light source:	Halogen bulb (24V, 150W)
• Optical system:	Vertical illumination
• Functions:	Adjustable condenser lens, Oblique illumination (for 5X, 10X and 20X), Heat-absorbing filter, Cooling fan
Focusing:	Manual focus
Resolution:	0.001mm or .0001"/0.001mm (using optional KA counter)
Power supply:	100 - 240V AC, 50/60Hz
Mass:	210kg

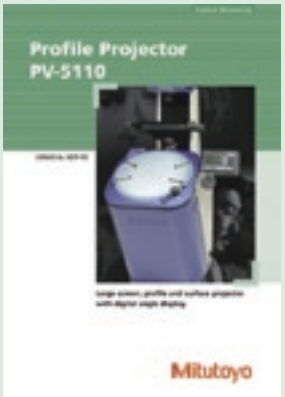
Projection Capacity



Unit: mm

	Magnification				
	5X	10X	20X	50X	100X
View field	ø101.6	ø50.8	ø25.4	ø10.16	ø5.08
H	125	181	206	87	87
W	60 (27)	60	60	32.4	22.5
D	120	120	120	64.8	45

( ): When using surface illumination



Refer to the Linear Gage leaflet (E4174) for more details.

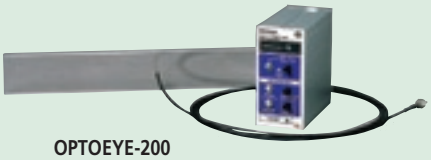
Optional Accessories

172-280: 5X projection lens
172-401: 5X projection lens set)
172-402: 10X projection lens set
172-403: 20X projection lens set
172-404: 50X projection lens set
172-405: 100X projection lens set
172-419: Surface illumination unit
172-116: Standard scale (50mm)
172-330: Standard scale (80mm)
172-117: Standard scale (2")
172-161: Reading scale (300mm)
172-329: Reading scale (600mm)
172-162: Reading scale (12")
12AAF182: Digital counter stand
172-160-2: Green filter
172-319: Canopy
515530: Halogen bulb (24V, 150W)

Fixture and Stage accessories (Refer to page J-16.)
172-198: Rotary table with fine feed wheel* (Effective diameter: 96mm)
172-197: Swivel center support* (Max. workpiece dia.: 80mm)
176-107: Holder with clamp*
172-378: V-block with clamp* (Max. workpiece dia.: 25mm)
999678: Fixture mount adapter
* Fixture mount adapter (**999678**) is required.

KA Counter
(Refer to page H-13 for more details.)
12AAF182: Counter stand

QM-Data200
2-D data processing unit.
(Refer to page J-29 for more details.)

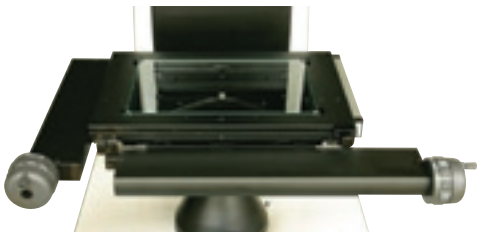


OPTOEYE-200
Edge detection system for QM-Data200
(Refer to page J-30 for more details.)

SPECIFICATIONS

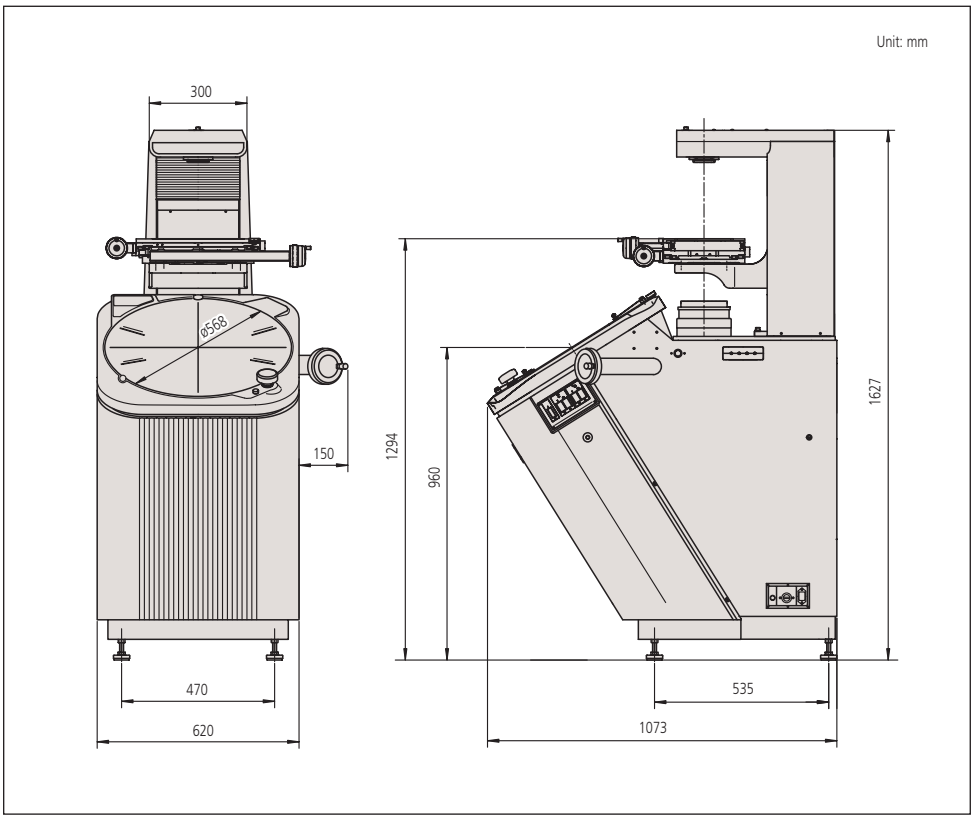
Model No.	PV-5110
Order No.	**304-909***
XY stage travel range	200 x 100mm
Quick-release mechanism	X and Y axes
Measurement method	Linear encoder
XY stage table top size	380 x 250mm
XY stage effective area	266 x 170mm
Stage glass No.	**382762**
Swiveling function	±3°
Max stage loading	5kg
Remarks	—

* To denote your AC power cable, add the following suffixes to the order No.:
A for UL/CSA, **C** for Taiwan, **D** for CEE, **DC** for CCC, **E** for BS, **K** for EK,
No suffix is required for JIS/100V



XY stage

DIMENSIONS



Profile Projectors

For efficient measurement, inspection and observation of very small workpieces

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

- Bench-top model that uses horizontal optical system.
- Suitable for thread pitch measurements—blurred or distorted images will not be produced when workpiece is angled.
- Erect image* on the day-bright screen (*inverted: PH-A14).
- 353mm (356mm: PH-A14) diameter protractor screen with cross-hairs and staggered lines for easy alignment.
- Digital angle measurement to 1' or 0.01° (PH-3515F).
- Heavy-duty workpiece table incorporates linear scales for fast, accurate measurement.

PH-3515F

PH-A14

Technical Data

Projected image: Erect (inverted: PH-A14)
Protractor screen (optional)
- Effective diameter: 353 (13.9″)mm 356mm (14″)**
- Screen material: Fine-ground glass
- Screen rotation: ±360°, fine feed and clamp
- Angle reading: Digital counter (LED)*
  Resolution: 1′ or 0.01° (switchable)
  Range: ±370°
  ABS/INC mode switching, Zero Set
  [*Vernier (graduation: 1′): PH-A14]
- Reference line: Cross-hairs

Projection lens: 10X [**172-184** (**172-011**: PH-A14)]
Optional: 5X, 20X, 50X, 100X
(20X, 50X, 100X: PH-A14)

Magnification accuracy
- Contour illumination: ±0.1% or better
- Surface illumination: ±0.15% or better

Maximum workpiece height: Refer to the projection capacity (H) below.

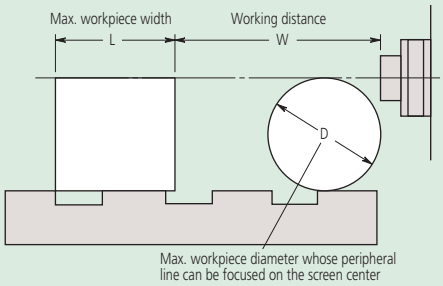
Contour illumination
- Light source: Halogen bulb (24V, 150W)
- Optical system: Telecentric system
- Functions: 2-step (High/Low) brightness switch, (Lit together with main power activation: PH-A14)
  Heat-absorbing filter, Cooling fan

Surface illumination
- Light source: Halogen bulb (24V, 200W)
  (24V 150W, common to the contour illumination: PH-A14)
- Optical system: Vertical illumination
- Functions: Adjustable condenser lens, Vertical/ blique surface illumination selectable
  (Lit together with main power activation: PH-A14)
  Heat-absorbing filter, Cooling fan

Focusing: Manual focus
Resolution: 0.001mm or .0001″/0.001mm (using optional KA counter)
Power supply: 100 - 240V AC, 50/60Hz
Mass: 150kg (140kg: PH-A14)

** only for PH-A14

Projection Capacity



PH-3515F Unit: mm

	Magnification				
	5X	10X	20X	50X	100X
View field	70.6	35.3	17.65	7.06	3.5
L	175	235	235	80	109
W	160 (64)	93 (35)	40	14.6	9.5
D	152.4	152.4	116	30.4	19

( ): When using surface illumination

PH-A14 Unit: mm

	Magnification			
	10X	20X	50X	100X
View field	35.6	17.3	7.12	3.56
L	235	235	80	109
W	93	40	14.6	9.5
D	130	116	30.4	19

Optional Accessories

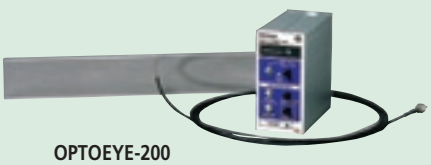
172-145: 5X projection lens set*
172-173: 20X projection lens set*
172-165: 50X projection lens set*
172-166: 100X projection lens set*
172-012: 20X projection lens set**
172-013: 50X projection lens set**
172-014: 100X projection lens set**
172-133: Vertical surface illumination unit*
172-116: Standard scale (50mm)
172-117: Standard scale (2")
172-118: Reading scale (200mm)
172-161: Reading scale (300mm)
172-119: Reading scale (8")
172-162: Reading scale (12")
932105: Overlay chart set (12 sheets)
172-286: Green filter
515530: Halogen bulb (24V, 150W)*
512305: Halogen bulb (24V, 150W)**
12BAA637: Halogen bulb (24V, 200W)*

Fixture and Stage accessories (Refer to page J-16.)
172-142: Center support
172-143: Center support riser
172-144: Rotary vise (Max. workpiece dia.: 60mm)
172-234: V-block with clamp (Max. workpiece dia.: 50mm)
172-132: Vertical holder
172-001: Tipped-saw support stand
172-002: Cutter support stand

* only for PH-3515F
** only for PH-A14

KA Counter
(Refer to page H-13 for more details.)
12AAF182: Counter stand

QM-Data200
2-D data processing unit.
(Refer to page J-29 for more details.)



OPTOEYE-200
Edge detection system for QM-Data200
(Refer to page J-30 for more details.)

SPECIFICATIONS

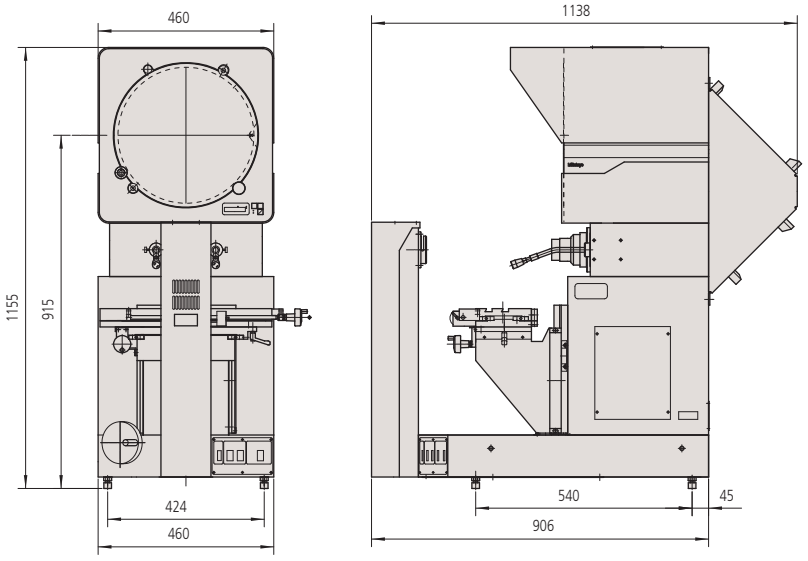
Model No.	PH-3515F	PH-A14
Order No.	**172-858***	**172-810-10****
XY stage travel range	254 x 152mm	200 x 100mm
Measurement method	Linear encoder	Linear encoder
Quick-release mechanism	X axis	—
XY stage table top size	450 x 146mm	407 x 152.4mm
Swiveling function	±10°	—
Max stage loading	45kg	45kg
Remarks	—	—

* To denote your AC power cable, add the following suffixes to the order No.: **A** for UL/CSA, **CED** for CEE, **CEE** for BS, **D** for CEE, **DC** for CCC, **E** for BS, **K** for EK, **No suffix** is required for JIS/100V
Note) **D** and **E** are not compatible with CE
** 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 EK, **No suffix** is required for JIS/100V

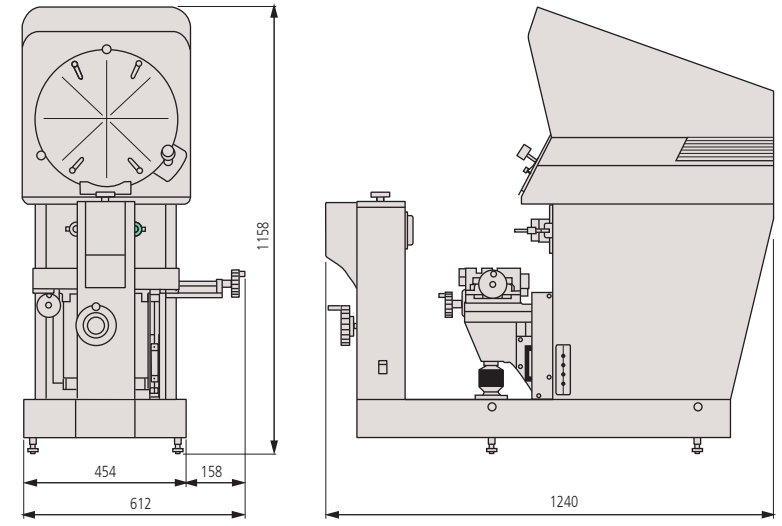
DIMENSIONS

PH-3515F

Unit: mm



PH-A14



J

Profile Projectors

For efficient measurement, inspection and observation of very small workpieces

Accessories for Profile Projectors
SERIES 172 — Profile Projector

Standard Scales

• Used for checking magnification accuracy.

172-116

SPECIFICATIONS

Metric

Graduation	Range	Order No.	Accuracy (20°C)*
0.1mm	50mm	**172-116**	(3+5L/1000)µm
0.1mm	80mm	**172-330**	(3+5L/1000)µm

* L = Measured length (mm)

Inch

Graduation	Range	Order No.	Accuracy (20°C)
.01"	2"	**172-117**	.00013"

Reading Scales

172-161

172-118

• Specially designed for inspecting the magnified image of a standard scale on the projection screen.

SPECIFICATIONS

Metric

Graduation	Range	Order No.	Accuracy (20°C)*
0.5mm	200mm	**172-118**	(15+15L/1000L)µm
0.5mm	300mm	**172-161**	(15+15L/1000L)µm
0.5mm	600mm	**172-329**	(15+15L/1000L)µm

* L = Measured length (mm)

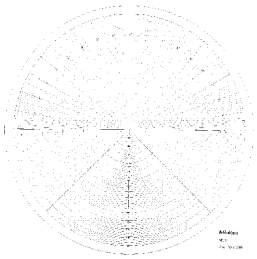
Inch

Graduation	Range	Order No.	Accuracy (20°C)*
.02"	8"	**172-119**	.00071"
.02"	2"	**172-162**	.00077"

Overlay Chart Set

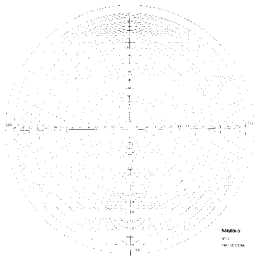
- Makes inspection of projected images an easy process.
- Twelve different patterns are available in the set.
- Designed for use with profile projectors whose screen diameter is 300mm or larger.

Overlay chart set (12 sheets)
Order No.: 932105

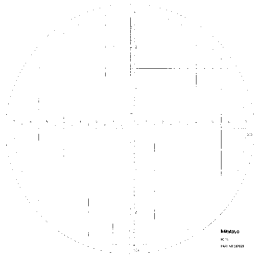


512066
Protractor (1°-grad. radial index) and radius (1mm-radius increment concentric semicircles)

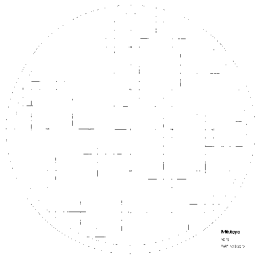
512067
Radius (0.1cm-reading scales and 5mm-radius increment concentric circles)



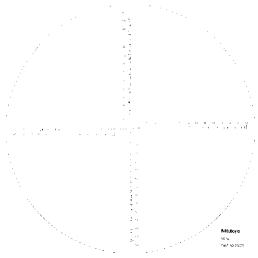
512068
Radius (1X, 10X, 20X, 50X)



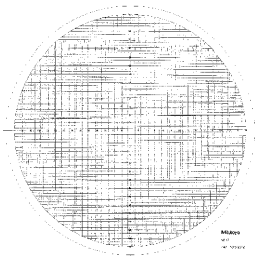
512069
1mm-reading scales (20X, 50X)



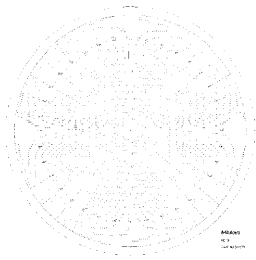
512070
10x10mm sections



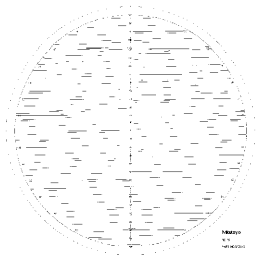
512071
0.5mm-reading scales



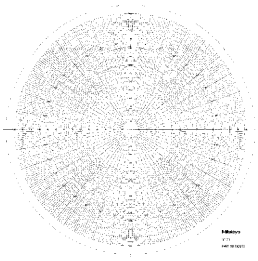
512072
1x1mm sections



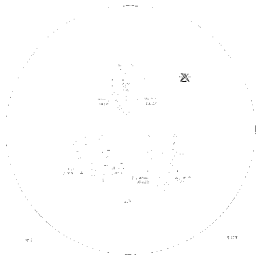
512073
Protractor (1°-grad. diametral index)



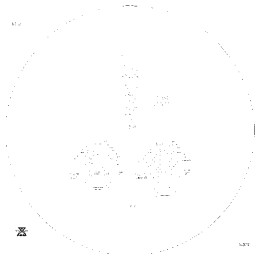
512074
1mm-reading vertical scale



512075
Protractor (1°-grad. diametral index) and radius (1mm-radius increment concentric circles)



512076
Metric, Unified, and Whitworth screw threads (20X)



512077
Metric screw thread (100X) and 20° and 14.5° gear teeth (20X)

Mitutoyo

Profile Projectors

For efficient measurement, inspection and observation of very small workpieces

Micrometer Heads for Profile Projectors and Toolmaker's Microscopes

Micrometer Heads for XY Stages

152-390, **152-389**, **152-391**, **152-392**

- Non-rotating spindle device is provided.
- The thimble reading can be zero-set at any spindle position (floating sleeve).
- Black and red figures of the bidirectional graduation allow easy reading in both directions.
- Clamping stem diameter: 18mm

152-401, **152-402**

- The adjustable sleeve can be rotated under the thimble clamped at any reading, allowing easy reference point setting.
- The spherical measuring face is carbide-tipped.
- Clamping stem diameter: 18mm

152-390

Technical Data

Graduations: 0.005mm, 0.001mm* or .0001"
*vernier reading
Spindle pitch: 1mm
Spindle face: Flat (hardened) or spherical with carbide tip (more than HRA90), lapped surface
Scale surface: White anodized aluminum

SPECIFICATIONS

Metric

Graduation	Range	Order No.	Accuracy	Remarks
0.005mm	25mm	**152-390**	±2µm	for X-axis
0.005mm	25mm	**152-389**	±2µm	for Y-axis

Inch

Graduation	Range	Order No.	Accuracy	Remarks
.0001"	1"	**152-391**	±.0001"	for X-axis
.0001"	1"	**152-392**	±.0001"	for Y-axis

SPECIFICATIONS

Metric

Graduation	Range	Order No.	Accuracy	Remarks
0.001mm*	25mm	**152-402**	±2µm	for X-axis
0.001mm*	25mm	**152-401**	±2µm	for Y-axis

* Obtained by using vernier.

Digimatic Micrometer Heads

- Large LCD digits for error-free reading.
- The display rotates 330° for easy viewing.
- The spindle does not rotate.
- With SPC data output.

164-163

Technical Data

Resolution: 0.001mm or .00005"/0.001mm
Display: LCD
Battery: SR44 (2 pcs.), **938882**
Battery life: Approx. 1.8 years in normal use

Function

Zero-setting, Data hold, Data output, Preset, inch/mm conversion (inch/mm models)
Alarm: Low voltage, Counting value composition error

Optional Accessories

959149: SPC cable (1m)
959150: SPC cable (2m)

SPECIFICATIONS

Metric

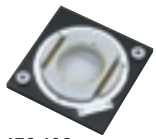
Resolution	Range	Order No.	Accuracy
0.001mm	50mm	**164-163**	±3µm

Inch/Metric

Resolution	Range	Order No.	Accuracy
.00005"/0.001mm	2" (50mm)	**164-164**	±.00015"

Workpiece Fixtures for Profile Projectors and Measuring Microscopes

Rotary Tables


176-106

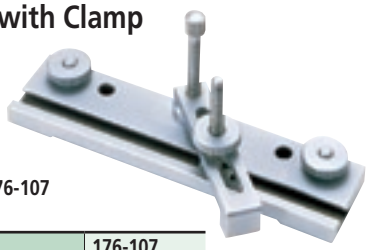

172-198


176-305


176-306

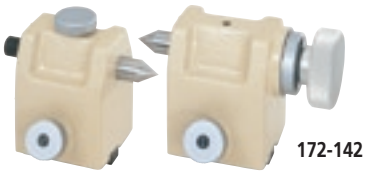
Order No.	176-106	172-198	176-305	176-306
Effective glass dia.	66mm	96mm	182mm	238mm
Angular resolution	6˚	2˚	—	—
Fine feed	—	Available	Available	Available
Mass	1.7kg	2.4kg	5.5kg	6.5kg

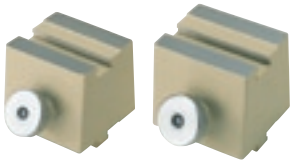
Holder with Clamp


176-107

Order No.	176-107
Max. workpiece height	35mm
Mass	0.42kg

Center Support


172-142

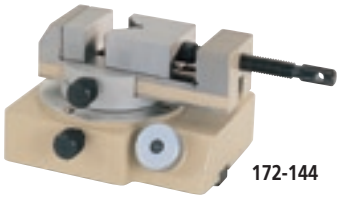

172-143

SPECIFICATIONS

Order No.	172-142
Max. workpiece height	120mm (240mm)*
Mass	3.3kg

* When using a center support riser (**172-143**)

Rotary Vise


172-144

SPECIFICATIONS

Order No.	172-144
Rotation range	360˚
Max. workpiece height	60mm
Width of jaws	40mm
Angle graduations	5°
Mass	2.8kg

Swivel Center Supports


176-105


172-197

Order No.	176-105	172-197
Max. workpiece dia.	70mm (45mm)*	80mm(65mm)*
Max. workpiece length	140mm	140mm
Swivel range	±10°	±10°
Mass	2.4kg	2.5kg

* When swiveled 10°

V-Block with Clamp

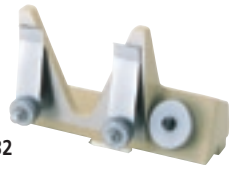

172-234


172-378

SPECIFICATIONS

Order No.	172-234	172-378
Max. workpiece dia.	50mm	25mm
Width of block	60mm	41mm
Mass	1.24kg	0.8kg

Vertical Holder

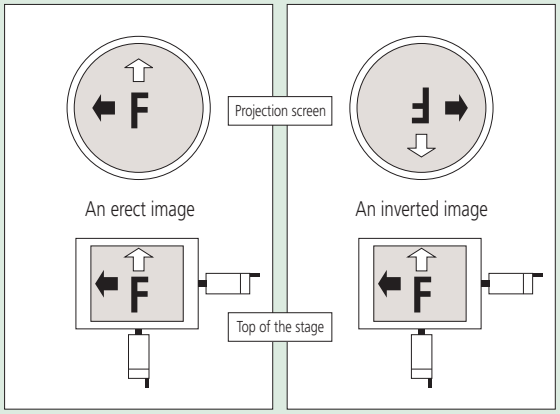

172-132

SPECIFICATIONS

Order No.	172-132
Mass	1.3kg

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, which is probably more accurate).



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

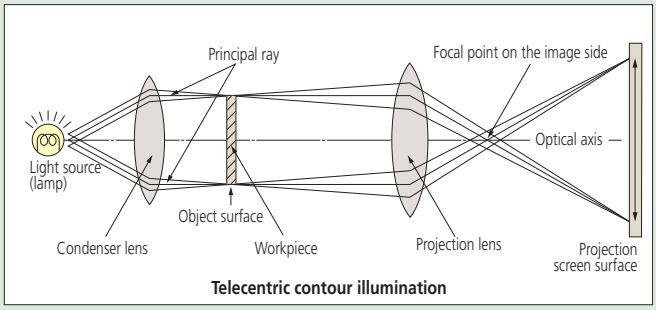
Type of Illumination

- 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 the 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. Models in the PJ-H30 series are supplied with an oblique mirror.)

Telecentric Optical System

An optical system based on the principle that the principal ray is 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 though the image blurs as the object is shifted along the optical axis.

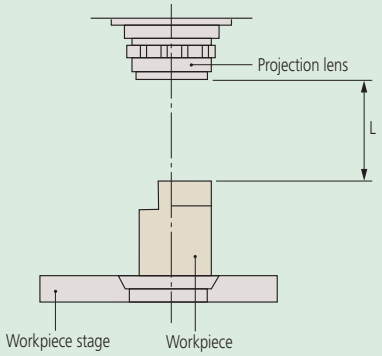
For measuring projectors and measuring microscopes, an identical effect is obtained by placing a lamp filament at the focal point of a condenser lens instead of a lens stop so that the object is illuminated with parallel beams. (See the figure below.)



Telecentric contour illumination

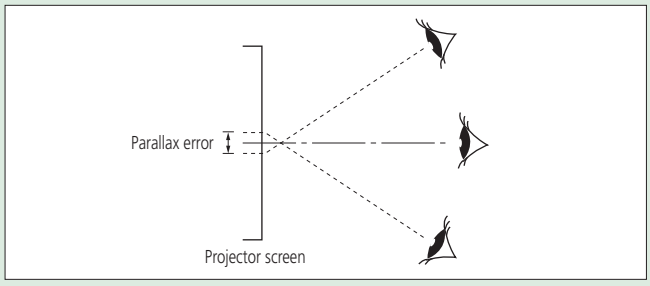
Working distance

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.



Field of view diameter

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

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

Example: If a 5X magnification lens is used for a projector with a screen of ø500mm:
Field of view diameter is given by $\frac{500\text{mm}}{5} = 100\text{mm}$