

Mitutoyo

Mitutoyo Quality

Profile Projector PJ/PV/PH Series

Optical Measuring



Bulletin No. 2300

Projector PJ/PV/PH Series

Each Mitutoyo profile projector measuring machine efficiently performs measurements, inspections and observations by projecting an image of a test workpiece on the stage onto a viewing screen under accurate magnification. The inherently non-contact measurement method of profile projectors makes this type of instrument highly suitable for measuring small parts that are unmeasurable with general-purpose contact instruments or plastic parts that are easily deformed. A profile projector can also be used to observe the surface profiles of workpieces or inspect minute assemblies with surface illumination. Additionally, a wide selection of accessories allows advanced measurement and inspection of various types of workpieces. These machines can be installed and used in a wide range of environments from inspection rooms to manufacturing and processing sites.

Provides reliable measurements in manufacturing site environments.



PJ-PLUS Series



PJ-H30 Series



PV-5110 Series

PJ Series

Screen diameter
300mm / 11.81"

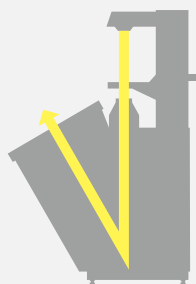
- Available in 2 types: PJ-PLUS (white LED light source) and PJ-H30 (high accuracy)
- Broad lineup of stages for handling minute parts to large workpieces
- Controls centered at the front for better operability



PV Series

Screen diameter
508mm / 20"

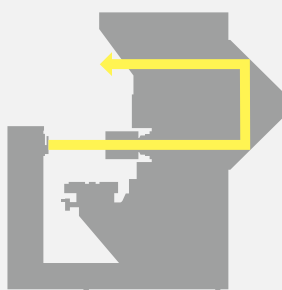
- Equipped with a large forward-tilted screen
- Perfect for comparative measurements with enlarged drawings and tracing of projected images
- Recommended for precision and minute parts such as watch and electronic components



PH Series

Screen diameter
353mm / 14"

- Standard model in the edged tool industry. Perfect for observation and measurement of cutting tools (end mills, cutters, and tipped saws)
- Equipped with a high-rigidity stage boasting maximum load of 45kg / 100lbs
- Horizontal beam design makes loading/unloading the stage very easy



PH-3515F

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PJ-PLUS



This profile projector can be operated intuitively, even by inexperienced users, and has excellent durability and energy saving performance thanks to the adoption of an LED illumination source and fan-less cooling system. This provides stable dimension and angle measurements in harsher environments that conventional models can't handle, such as manufacturing and processing lines.

Features (high durability and energy savings)



PJ-P2010A
302-802-10

Thanks to the LED light source, lamp burnout is greatly reduced.



Halogen bulb

LED

Compared with a halogen bulb

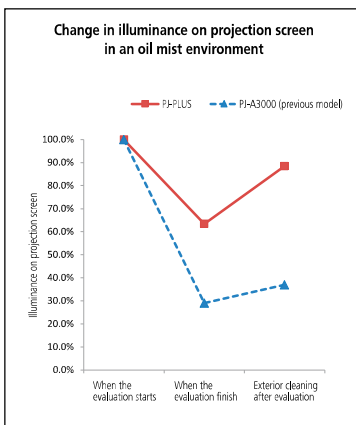
- Long service life
- Low power consumption (main unit):
Approx. 85% lower (400 W → 60 W)

Thanks to the fan-less system, oil mist or dust won't enter the main unit.



Fan

Improved durability



Adoption of the LED illumination source has eliminated the need for a cooling fan into the main unit of the measuring instrument and has drastically decreased the entry of oil mist, dust, etc. via the cooling fan into the instrument body.

This also drastically reduces adhesion of oil and dust to the internal mirror, lens, and light source. The graph on the left shows changes in illuminance on the projection screen in case of long-term installation together with a conventional model (the projector with a fan) in a misty processing site. As compared with the conventional model, the LED light source type improves the rate of decline in illuminance by about 50%. It maintains high optical performance by preventing the entry of mist into the main unit even in the harsh environment of a processing line.

The unit has excellent durability and requires less frequent maintenance, resulting in lower maintenance costs.

Note 1: Exterior cleaning of the projection lens surface, stage glass top, etc. is easy.

Note 2: The graph data shows measurement examples, and measured values may vary according to the installation environment and so on.

Observation light source

Stepless illumination adjustment

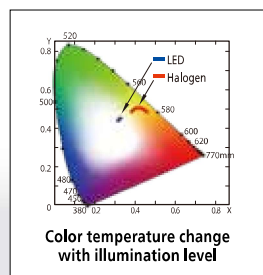


The conventional 2-step illumination adjustment has been changed to stepless control so the level of illumination can be precisely set to suit the surface texture and color of the workpiece.



LED (White)

No color change in projected image with changes in illumination intensity.



Color temperature varies significantly with the level of halogen illumination but not so much with LED illumination, so the appearance of the image varies a lot less as the LED level is adjusted. Also, the projected image under LED illumination is sharper and easier on the operator's eyes, which contributes to a reduction in fatigue and therefore more efficient inspection and measurement.

LED Circular Illuminator for PJ-PLUS Optional



Example of attaching the LED circular illuminator on PJ-PLUS



LED illumination can increase contrast and provide sharper images of the workpiece. Projected image can be observed at high color reproducibility, Low power consumption: 17.4 W, and long operating life: 30,000 hours.

■ Specifications

| Order No. | 172-502 |
|----------------------|--|
| Compatible model | PJ-PLUS (Projection lens 10X and 20X)* |
| Illumination source | White LED |
| Power consumption | 12 V / 17.4 W |
| LED life (reference) | 30,000 H |

*The optional accessory (12AAX044) is necessary to attach this product to the PJ-PLUS 20X projection lens.

PJ-PLUS

Features (Operability)

High visibility digital display



Since the digital counter (XY axes and angle) built into all models as standard uses a high-intensity LED and a large character display, it secures high visibility unaffected by the environment. In addition to zero-setting and direction change, the data output of each counter value adopts the highly versatile RS-232C.

Resolution: 0.0001 in / 0.001 mm

Main unit side panel (output connectors)



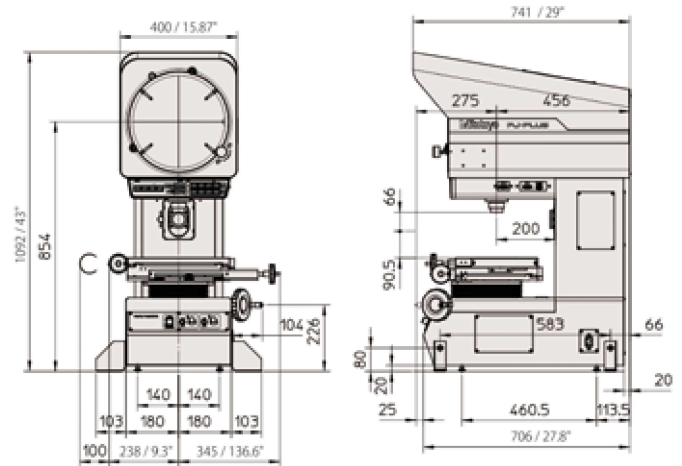
Technical Data

| | | |
|----------------------------|---|--|
| Projected image | Inverted | |
| Protractor screen | Effective diameter | ø315mm / 12.4" |
| | Screen rotation | ±360° (The counter displays up to ±370°) |
| | Angle reading | 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 External half-reflecting mirror for surface illumination (only for 10X, 20X) |
| | Lens mount | Bayonet mount |
| Magnification accuracy* | Contour illumination | ±0.1 % or less of nominal magnification |
| | Surface illumination | ±0.15 % or less of nominal magnification |
| Maximum workpiece height | Refer to the projection lenses L ₁ right | |
| 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 | 0.0001 in / 0.001 mm | |
| Power supply | 100 V to 240 V AC, 50/60 Hz | |
| Mass | 114kg / 251lbs (PJ-P1010A), 118 kg / 260lbs (PJ-P2010A) | |
| Power consumption | 60 W | |

* Our magnification accuracy standard only checks contour illumination (that it is ±0.1 % or less). (If the magnification accuracy under contour illumination is a permissible value, that under surface illumination is also guaranteed to be within ±0.15 % of our standard.)
Note: For the stage specification, refer to page 16.

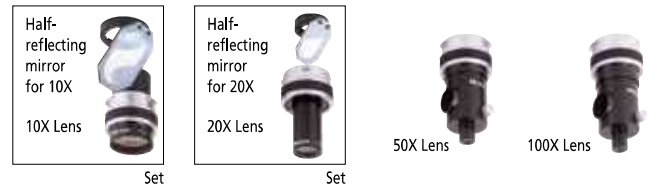
Dimensions

(Unit: mm/inch)



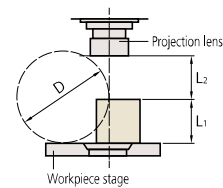
PJ-P2010A

Projection lenses (10X is a standard accessory)



(Unit: mm)

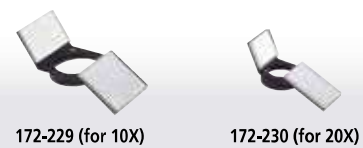
| | Contour illumination | | | | Surface illumination | | | |
|------------------|----------------------|------|------|------|----------------------|------|-----|------|
| | 10X | 20X | 50X | 100X | 10X | 20X | 50X | 100X |
| Magnification | 10X | 20X | 50X | 100X | 10X | 20X | 50X | 100X |
| View field | 31.5 | 15.7 | 6.3 | 3.1 | 31.5 | 15.7 | 6.3 | 3.1 |
| Working distance | L ₂ | 66 | 32.5 | 12.6 | 5 | 20 | 2 | 12.6 |
| | L ₁ | 91 | | | | | | |
| PJ-P1010A | D | 182 | 87 | 27 | 10 | 182 | 61 | 27 |
| | L ₁ | 90.5 | | | | | | |
| PJ-P2010A | D | 181 | 87 | 27 | 10 | 181 | 61 | 27 |



L₁: Max. height where focusing is available
L₂: Max. step where focusing is available (working distance)
D: Max. diameter when a cylinder generatrix is projected on the center line of the screen

Oblique reflection mirror

This is used for observing low-reflectivity workpieces, such as plastic parts, and the surfaces of parts with high surface roughness.

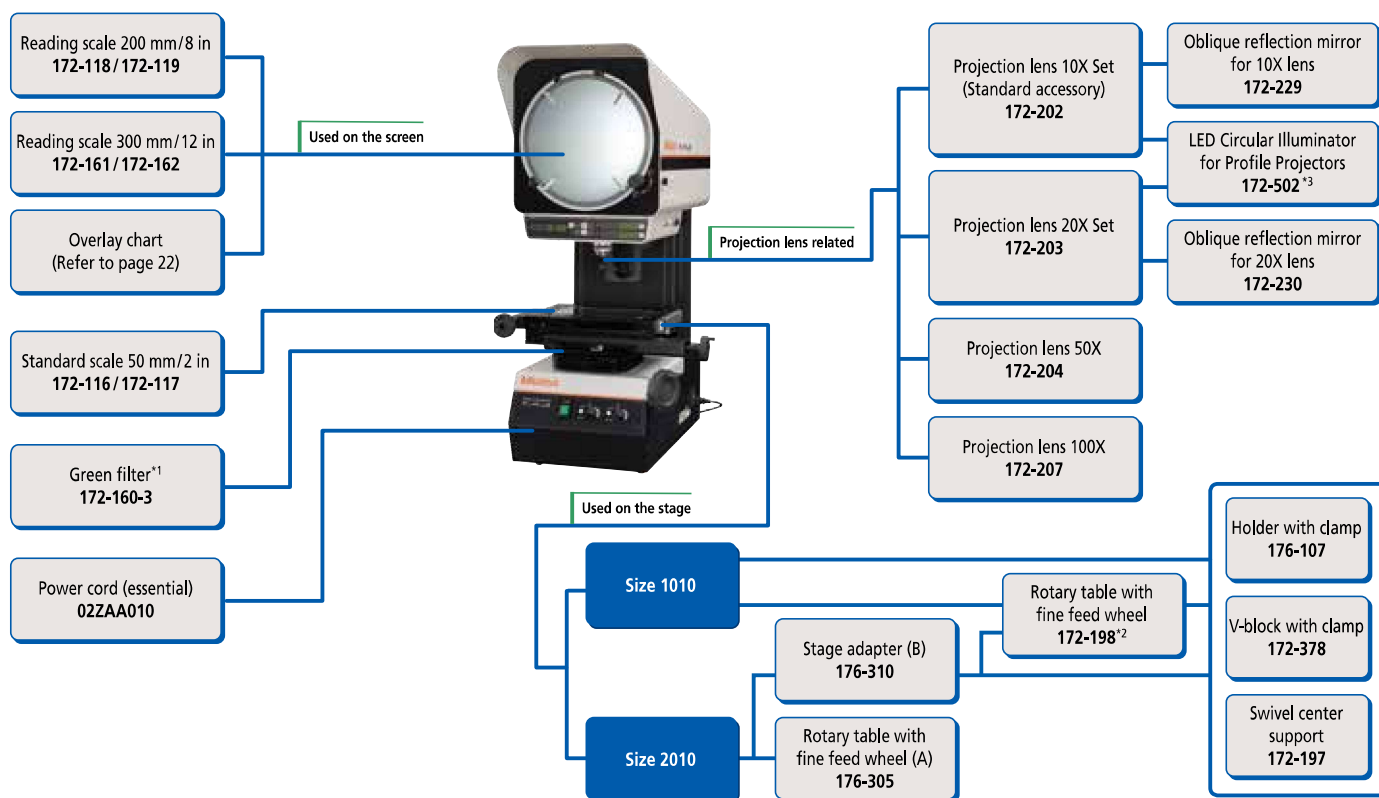


172-229 (for 10X)

172-230 (for 20X)

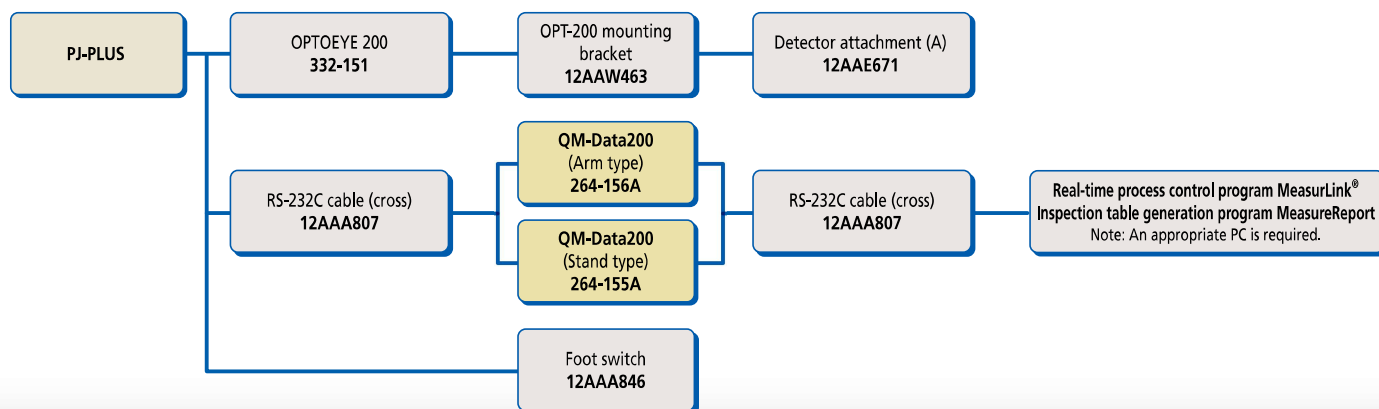
| Order No. | 172-229 | 172-230 |
|-------------------|-----------------|--------------------|
| Applicable models | PJ-PLUS | |
| Mass | 0.3 kg / .66lbs | 0.07 kg / 0.15 lbs |

System Diagram



*1 This is inserted beside the stage adapter during use.
 *2 172-197 (swivel center support) cannot mount on 172-198 (rotary table with fine feed wheel).
 *3 The optional accessory (12AAX044) is necessary when this product is attached to the PJ-Plus 20x lens.
 Note: If an optional unit is installed on the stage, the L₁ (Max. workpiece height) length is reduced by the optional unit height.
 Stand for PJ-Plus is 64PMI167

Data Processing System Diagram



For details, refer to the QM-Data200 and Vision Unit brochure.

PJ-PLUS

PJ-H30

High-end model of PJ series that realizes the ultimate in bright, sharp projected images. High-rigidity main unit equipped with a linear scale for realizing high-accuracy measurements. Lineup of 8 models, derived from combinations of 4 stage types (100mm x 100mm / 4" x 4" to 300mm x 170mm / 12" x 6.8") and manual focusing / motor-driven focusing models. Adopts a quick-release handle that allows you to switch feed between fine and coarse remotely. Realizes smooth measurements, together with a turret structure, for easy lens changing.

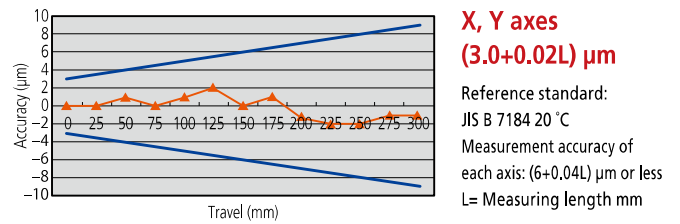
PJ-H30



PJ-H30A2010B
303-713-1A

Features (Measuring accuracy)

Pursuit of measurement accuracy



Red graph shows measured X-axis accuracy for a randomly selected projector.

The profile projector must maintain a high level of performance, not only in terms of optical performance, but also comprehensive measurement accuracy. The PJ-H30 Series, which performs not only contour observation and comparative inspection but also two-dimensional measurement with high accuracy, has achieved the above measurement accuracy in all stage sizes.*

Having achieved both long-stroke measurement and high accuracy, it is helpful in every measurement setting.

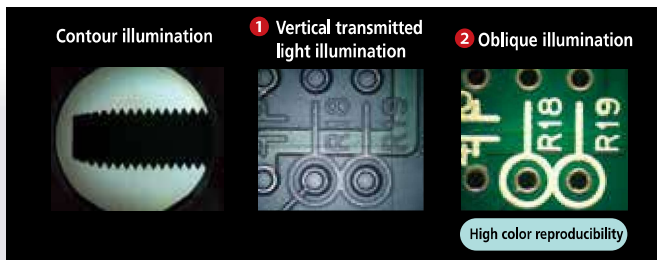
* Compliant with JIS B 7184, measurement method for each of the XY axes

Features (Bright, clear observation)

Also equipped with oblique reflected illumination with good color reproducibility as standard

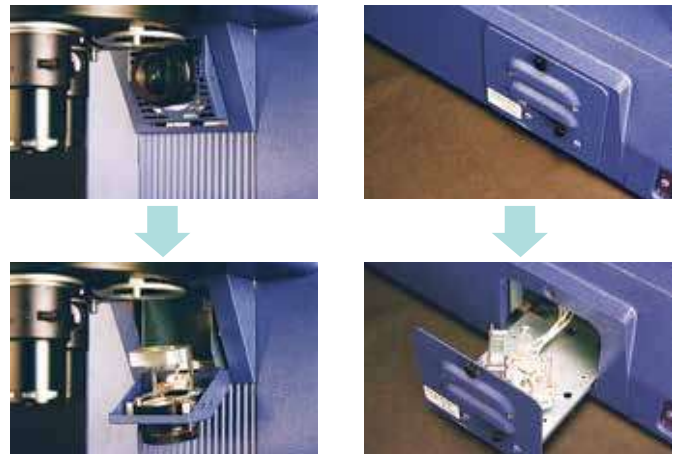


The reflected illumination comprises vertical illumination which goes through the projection lens, and oblique illumination, with changeable angle of illumination emitter as standard. It is effective in three-dimensional observation with enhanced color reproducibility.



Features (Maintainability)

Easy-to-replace lamp housing design



Having a halogen lamp burn out during use causes issues and down time. Immediately after a lamp burns out, it is too hot to be replaced. The PJ-H30 Series has a slide change mechanism, which allows you to change lamps from outside of the machine. Even if the lamp burns out suddenly, you can continue inspection and measurement without issues (for transmitted illumination only). The housing can be pulled out just by loosening the screw, making it very easy to replace the lamp. Furthermore, it is safe to pull out the housing because no electricity is flowing.

Features (Operability)

All models equipped with turrets as standard

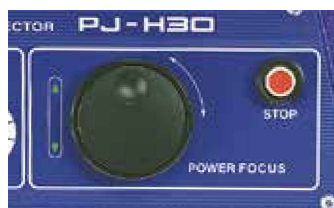


The turret of the PJ-H30 Series uses low-friction bearings for smooth and rapid rotary motion and to bring different projection lenses into the light path to change magnification. The turret body uses bayonet mounts to aid quick attachment and detachment of lenses.

Focusing with high operability



Manual focusing handle of PJ-H30A



PJ-H30D (motor-driven focusing) front panel

To place a test workpiece on the stage and focus swiftly, an easy-to-grip handle and handle position are very important. Therefore, the PJ-H30 Series has an oblique manual focusing handle that lets you operate in a natural position, whether standing or sitting, without awkwardness. Moreover, a high-operability jog shuttle with motor-driven focusing is also available, and its smooth movement contributes to less fatigue in observation and measurement.

Note: PJ-H30D (with motor-driven focusing) does not come with a manual focusing handle.

Stepless illumination adjustment



Stepless illumination adjustment has been adopted to provide moderate illuminance according to the surface texture and color of the workpiece. Illumination strength ranges from weak to strong, and this method is also effective in extending the halogen lamp life, which is enhanced by using a soft start feature to limit input surge current.

Projection Lens 10X with C mount Optional



Example of attaching the Projection Lens 10X with C mount on PJ-H30



The projection lens is equipped with a C mount, therefore a compatible digital camera can be attached. A workpiece can be observed on the large-size projection screen, and simultaneously the color image can be saved on the camera and observed on the monitor.

■ Specifications

| | |
|------------------------|----------------------|
| Order No. | 172-500 |
| Camera Projected Image | Inverted |
| Compatible Sensor Size | Four Thirds 4/3 type |
| Camera Mount | C mount |
| Mountable Mass | 0.9 kg or less |

The magnification accuracy of the camera is not guaranteed
 Vignetting occurs on the four corners of a camera image under contour illumination
 Turret can only rotate 120 degrees while mounted
 Camera may interfere with turret rotation
 Surface illumination will not work with this projection lens, ring light is suggested

LED Circular Illuminator for PJ-H30 Optional



LED illumination can increase the contrast of the projected image and provide sharp on-screen images. The projected image will have higher color reproducibility when compared to halogen illumination. Low power consumption: 17.4 W and longer operating life: 30,000 hours.

■ Specifications

| | |
|----------------------|--|
| Order No. | 172-501 |
| Compatible model | PJ-H30 (10X Projection Lens with C mount, Projection lens 10X and 20X) |
| Illumination source | White LED |
| Power consumption | 12 V / 17.4 W |
| LED life (reference) | 30,000 H |

Features (Operability)

High visibility digital display



Since the digital counter (XY axes and angle) built into all models as standard uses a high-intensity LED and a large-character display, it secures high visibility unaffected by the environment. In addition to zero-setting and direction change, the data output of each counter value adopts the highly versatile RS-232C.

Resolution: 0.0001 in / 0.001 mm*

* 0.5 μm or 0.1 μm readings can also be equipped. Please ask our Techno Service.

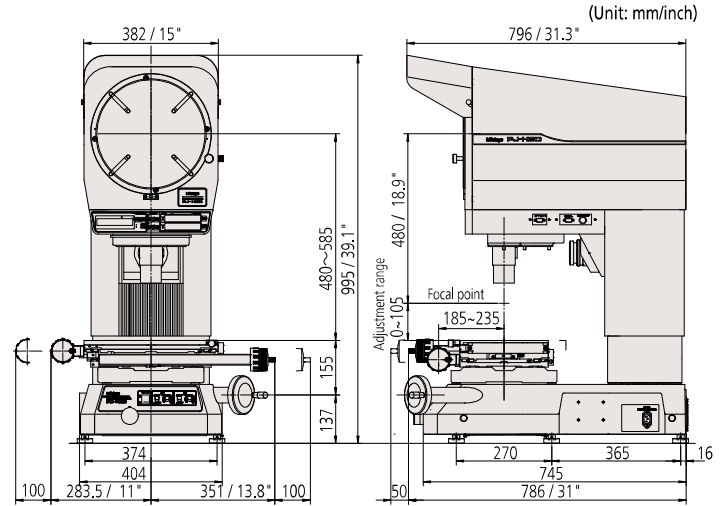
Technical Data

| | | |
|----------------------------|---|---|
| Projected image | Erect | |
| Protractor screen | Effective diameter | 306mm / 12.04" |
| | Screen rotation | ±360° (The counter displays up to ±370°) |
| | Angle reading | Digital counter (ABS/INC mode switching), Zero Set |
| | Resolution | 1° or 0.01° (switchable) |
| Projection lens | Cross-hairs | Solid lines |
| | Magnification | 10X (Standard accessory), 5X, 20X, 50X, 100X Parfocal lens Half-reflecting mirror for surface illumination |
| | Lens mount | Bayonet mount (registered utility model), 3-mount turret |
| Magnification accuracy*1 | Contour illumination | ±0.1 % or less of nominal magnification |
| | Surface illumination | ±0.15 % or less of nominal magnification |
| Maximum workpiece height | 105mm / 4.1"±2 | |
| Contour illumination | 24 V, 150 W 50 h Halogen bulb (515530) Zoom Telecentric, Heat-absorbing filter Cooling fan, Non-stepped brightness adjustment Soft lighting function (reduced inrush current) Lamp mount switching system | |
| | 24 V, 150 W, 50h Halogen bulb (515530) Vertical/oblique illumination with an adjustable condenser lens Heat-absorbing filter, Cooling fan, Non-stepped brightness adjustment, Soft lighting function (reduced inrush current) | |
| Surface illumination | 24 V, 150 W, 50h Halogen bulb (515530) Vertical/oblique illumination with an adjustable condenser lens Heat-absorbing filter, Cooling fan, Non-stepped brightness adjustment, Soft lighting function (reduced inrush current) | |
| Focusing | Projection screen head driving PJ-H30A (manual), PJ-H30D (power drive) | |
| Resolution for X/Y counter | 0.0001 in / 0.001 mm* * You can specify 0.5 μm or 0.1 μm resolution. (Available on request.) | |
| Power supply | ON/OFF switch, 100 to 240 V AC (unnecessary switching voltage), GND terminal, 50/60 Hz, Power cord (2 m) | |
| Mass | 167 kg / 387.2 lbs to 212 kg / 466.4 lbs | |
| Power consumption | Approx. 420 W | |

*1 Our magnification accuracy standard only checks contour illumination (that it is ±0.1 % or less). (If the magnification accuracy under contour illumination is a permissible value, that under surface illumination will also be guaranteed to be within ±0.15 % of our standard.)

*2 For the stage specification, refer to page 16.

Dimensions



PJ-H30A2010B

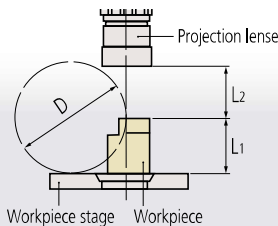
Main unit side panel



Projection lenses (10X is a standard accessory)



| Order No. | View field (mm) | L1 (mm) | L2 (mm) | D (mm) |
|---|-----------------|---------|---------|--------|
| 5X Lens 172-271 | 61.2 | 105 | 66 | 148 |
| 10X Lens (Standard accessory) 172-472 | 30.6 | 105 | 70.5 | 197 |
| 20X Lens 172-473 | 15.3 | 105 | 56.5 | 137 |
| 50X Lens 172-474 | 6.12 | 105 | 50 | 114 |
| 100X Lens 172-475 | 3.06 | 105 | 50 | 114 |



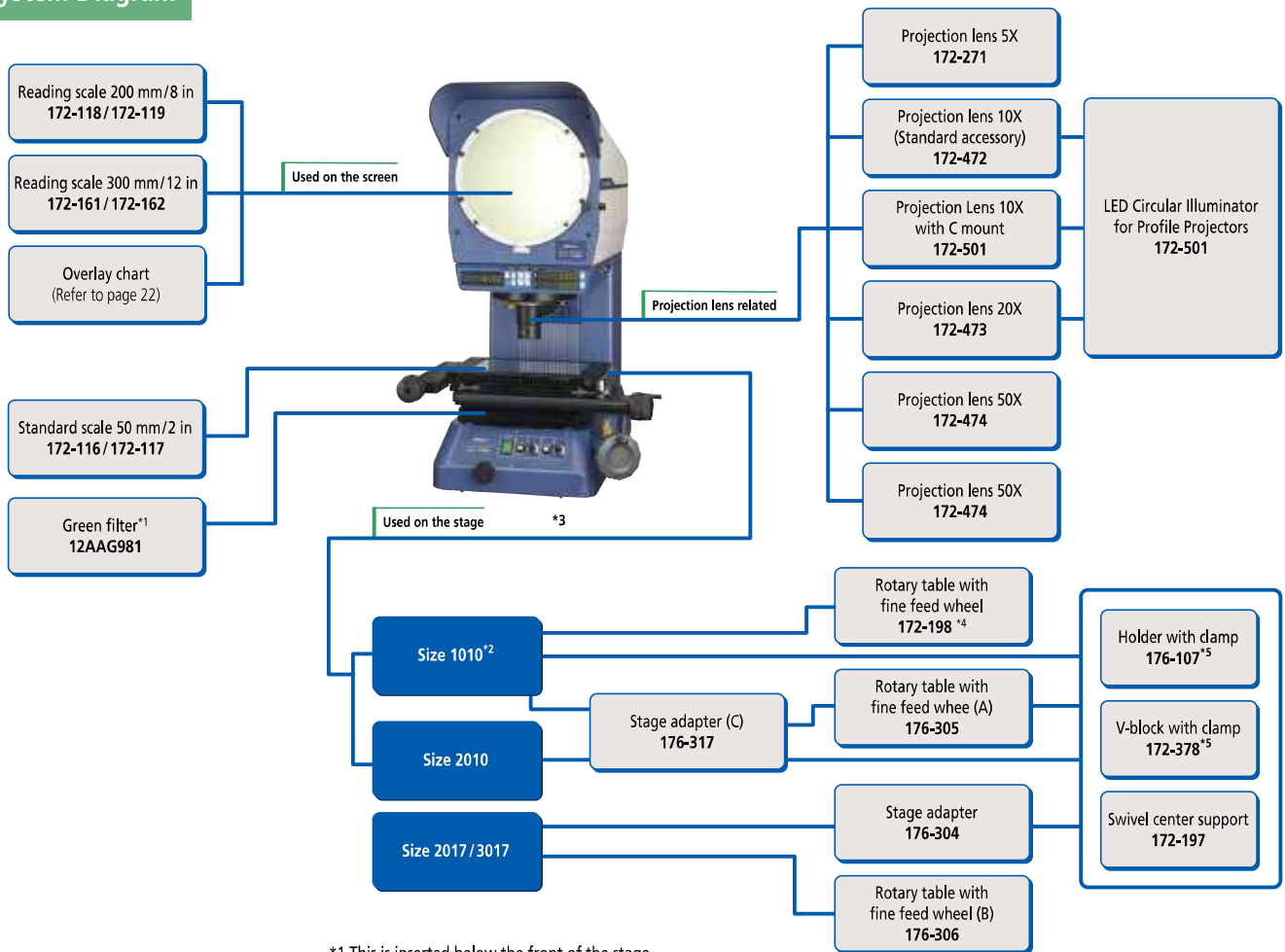
Note: When rotary table is not mounted.

L1: Max. height where focusing is available

L2: Max. step where focusing is available (working distance)

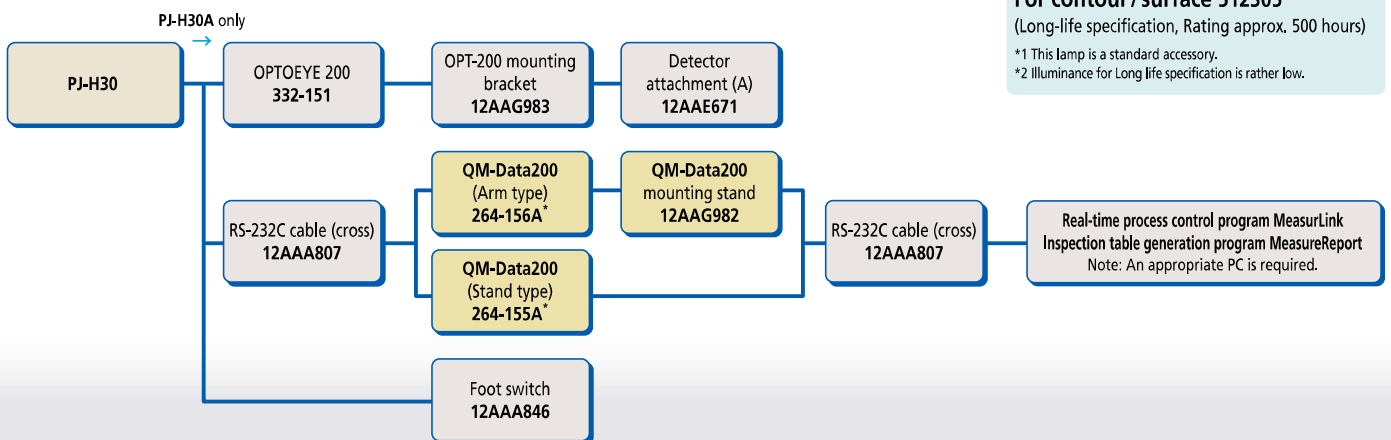
D: Max. diameter when a cylinder generatrix is projected on the center line of the screen

System Diagram



- *1 This is inserted below the front of the stage.
 - *2 For the 1010 size, it is also possible to directly attach the "holder with clamp (176-107)", "V-block with clamp (172-378)", and "swivel center support (172-197)", bypassing the "stage adapter C (176-317)."
 - *3 Machine Stand is part number 172-269
 - *4 172-198 requires 176-317 to connect to -2010 stage and it requires adapter 176-304 to connect to -2017/-3017 stage.
 - *5 176-107 and 172-378 can mount on 172-198
- Note: If an optional unit is installed on the stage, the H (Max. workpiece height) length is reduced by the optional unit height.

Data Processing System Diagram



◆ Lamp replacement ◆
For contour/surface 515530^{*1}
For contour/surface 512305^{*2}
 (Long-life specification, Rating approx. 500 hours)
^{*1} This lamp is a standard accessory.
^{*2} Illuminance for Long life specification is rather low.

For details, refer to the QM-Data200 and Vision Unit brochure.

* 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 are required for PSE.

PJ-H30

PV-5110

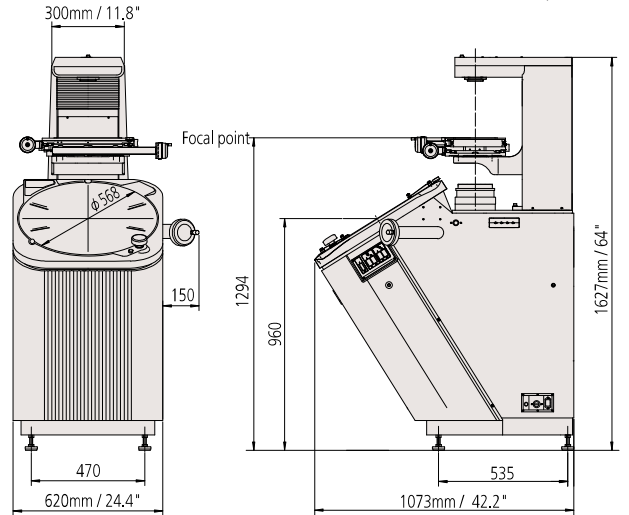
Equipped with a 500mm / 19.6" forward-tilted screen, the PV-5110 is perfect for comparative measurements with enlarged drawings and tracing of projected images. This model increases inspection efficiency of mass-production precision parts.



PV-5110
304-919A

Dimensions

(Unit: mm/inch)



Note: To mount the counter (KA-212) and counter stand, approximately 300mm / 11.8" space is required on the right-hand side of the main unit.

PV-5110

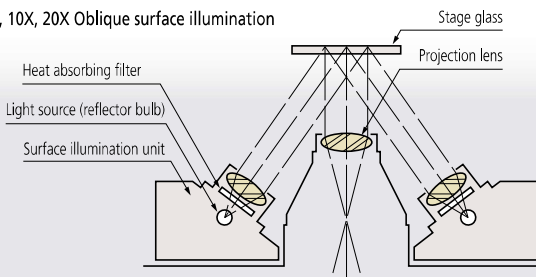
Technical Data

| | | |
|--------------------------|--|--|
| Projected image | Inverted | |
| Protractor screen | Effective diameter | 508mm / 20" |
| | Screen material | Fine-ground glass |
| | Screen rotation | ±360° (The counter displays up to ±370°) |
| | Angle reading | Digital counter (ABS/INC mode switching), Zero Set |
| | Resolution | 1' or 0.01" (switchable) |
| | Cross-hairs | 90° solid lines |
| | 0 Line (Index) | Built-in, With a LED back light |
| Projection lens | Magnification | 5X, 10X (Standard accessory), 20X, 50X, 100X |
| | Lens mount | Insert type mount |
| Magnification accuracy* | Contour illumination | ±0.1 % or less of nominal magnification |
| | Surface illumination | ±0.15 % or less of nominal magnification |
| Maximum workpiece height | Refer to projection lens table | |
| Contour illumination | 24 V, 150 W, 500 h Halogen bulb (512305) | |
| | Mount switching system | |
| | Telecentric, Heat-absorbing filter | |
| | Cooling fan, 2-step (High/Low) brightness switch | |
| Surface illumination | Can be used in conjunction with color filter | |
| | 24 V, 150 W, 500 h Halogen bulb (512305) | |
| | Heat-absorbing filter, Adjustable condenser lens | |
| | Oblique illumination (for 5X, 10X and 20X) | |
| Focusing | Cooling fan, 2-step (High/Low) brightness switch | |
| | Stage part drive | |
| Power supply | Manual | |
| | 100 V, 110 V, 120 V, 220 V, 230 V, 240 V AC external switching | |
| Mass | Approx. 210 kg / 462lbs (including X-Y stage) | |
| Power consumption | Approx. 560 W | |

* Our magnification accuracy standard only checks contour illumination (that it is ±0.1 % or less). (If the magnification accuracy under contour illumination is a permissible value, that under surface illumination will also be guaranteed to be within ±0.15 % of our standard.)

Note: For the stage specification, refer to page 17.

● 5X, 10X, 20X Oblique surface illumination



Projection lenses (10X is a standard accessory)

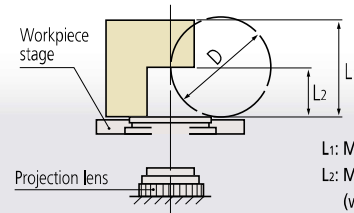


| Order No. | View field (mm) | L ₁ (mm) | L ₂ (mm) | D (mm) |
|---|-----------------|---------------------|---------------------|--------|
| 5X Lens Set 172-401 | 101.6 | 125 | 60 (27) | 120 |
| 10X Lens Set (Standard accessory) 172-402 | 50.8 | 181 | 60 | 120 |
| 20X Lens Set 172-403 | 25.4 | 206 | 60 | 120 |
| 50X Lens Set 172-404 | 10.16 | 87 | 32.4 | 64.8 |
| 100X Lens Set 172-405 | 5.08 | 87 | 22.5 | 45 |

Note 1: () : When using surface illumination

Note 2: Each lens set contains the condenser lenses for illumination.

Note 3: D is for the case of contour illumination.

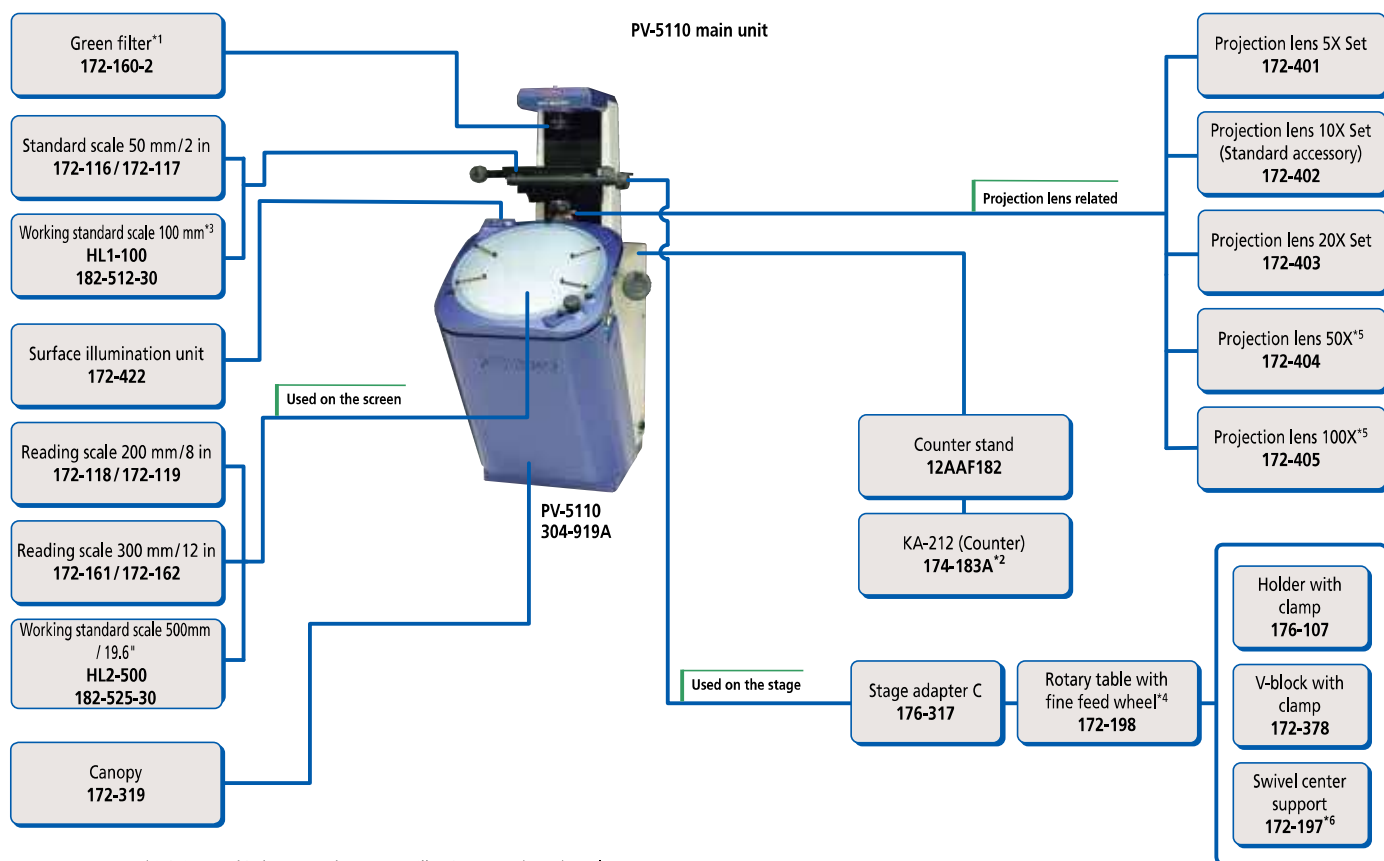


L₁: Max. height where focusing is available

L₂: Max. step where focusing is available (working distance)

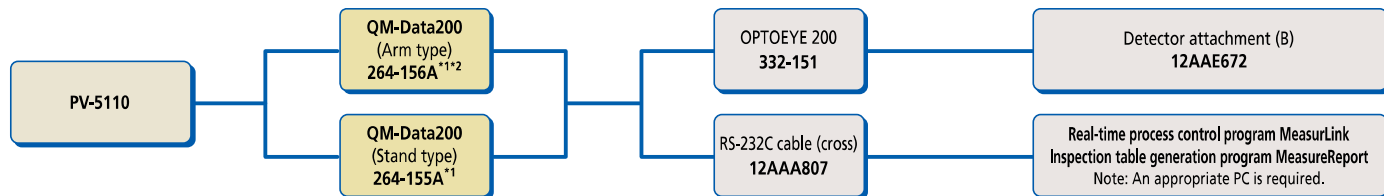
D: Max. diameter when a cylinder generatrix is projected on the center line of the screen

System Diagram



- *1 This is inserted in between the contour illuminator and condenser lens.
 - *2 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 are required for PSE.
 - *3 Used on the stage. It is projected onto the screen to check the magnification accuracy with a reading scale.
 - *4 Since the rotary stage section is small, if it is used for a large stage, some restrictions may be imposed on the measuring range.
 - *5 When using a 50X or a 100X projection lens, you need to remove the stage glass in order to prevent a collision between the stage glass for the X/Y stage and the projection lens. 172-197 cannot mount to 172-198. 172-197 can connect directly to 176-317.
 - *6 172-197 cannot mount to 172-198. 172-197 can connect directly to 176-317.
 - *7 rotary stage 176-305 can mount to stage adapter C 176-317. 176-107, 172-378, and 172-197 can all mount to 176-305 or they can mount directly to 176-317.
- Note: If an optional unit is installed on the stage, the H (Max. workpiece height) length is reduced by the optional unit height.

Data Processing System Diagram



◆Lamp replacement◆
For contour / surface 512305

For details, refer to the QM-Data200 and Vision Unit brochure.

- *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 are required for PSE.
- *2 The arm type cannot be used concurrently with a counter stand.

PV-5110

PH-3515F

The PH-3515 is the standard in the edged tool industry. This model is perfect for contour observation and measurement of edged tools (such as end mills, cutters, and tipped saws), screws, springs, and the like. It is equipped with a high-rigidity stage with a long stroke of 254 x 152 mm / 10" x 6" and a load-carrying capacity of 45 kg / 100 lbs, supporting even long, heavy workpieces.



Technical Data

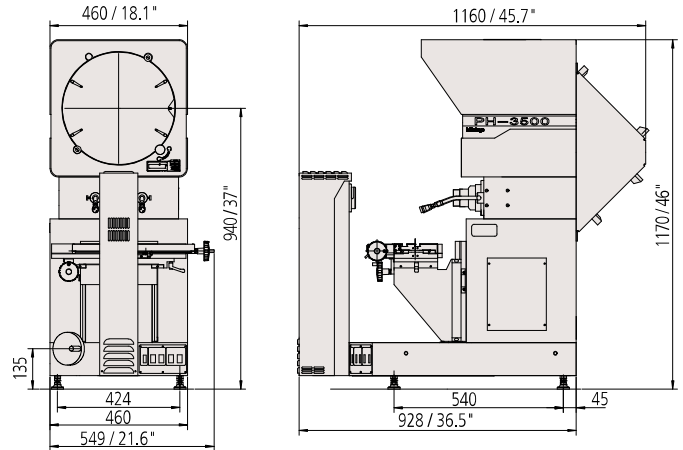
| | | |
|--------------------------|--|---|
| Projected image | Erect*1 (PH-3515F), Inverted (PH-A14) | |
| Protractor screen | Effective diameter | ø353 (13.9 in) mm (PH-3515F), ø356 (14 in) mm (PH-A14) |
| | Screen material | Fine-ground glass |
| | Screen rotation | ±360° (The counter displays up to ±370°) |
| | Angle reading | (PH-3515F) Digital counter (ABS/INC mode switching), Zero Set (PH-A14) vernier scale |
| | Resolution | 1" or 0.01" (switchable) (PH-3515F) |
| | Cross-hairs | 90° solid lines |
| Projection lens | Magnification | 10X (Standard accessory) 5X (PH-3515 only), 20X, 50X, 100X |
| | Lens mount | Screw mount |
| Magnification accuracy*2 | Contour illumination | ±0.1 % or less of nominal magnification |
| | Surface illumination | ±0.15 % or less of nominal magnification |
| Maximum workpiece height | Refer to the projection lenses L1 right. | |
| Contour illumination | Contour illumination | 24 V, 150 W, 500 h Halogen bulb (515530) Telecentric, Heat-absorbing filter Cooling fan, 2-step (High/Low) brightness switch: PH-3515F, (Lit together with main power activation: PH-A14) Can be used in conjunction with color filter |
| | Surface illumination | 24 V, 200 W, 500 h Parabolic halogen bulb (12BAA637): PH-3515F, (24V 150W, common to the contour illumination: PH-A14) Adjustable condenser lens, Heat-absorbing filter Cooling fan |
| Focusing | Stage part drive Manual | |
| Power supply | Power supply | 100 V, 110 V, 120 V, 220 V, 240 V AC external switching (PH-3515F) 100 V, 120 V, 130 V, 220 V, 230 V, 240 V AC external switching (PH-A14) 50/60 Hz Power cord (2 m) |
| | Mass | 150 kg / 330 lbs (PH-3515F), 140 kg / 308 lbs (PH-A14) |
| Power consumption | Approx. 410 W (PH-3515F), 200 W (PH-A14) | |

*1 The projected image of the workpiece is erect but reversed, which means that the vertical orientation and displacement direction of the image is the same as on the workpiece side, but the horizontal orientation and displacement direction are reversed.
*2 Our magnification accuracy standard only checks contour illumination (that it is ±0.1 % or less). (If the magnification accuracy under contour illumination is a permissible value, that under surface illumination will also be guaranteed to be within ±0.15 % of our standard.)
Note 1: X and Y counters are not built into the projector main unit. If a counter display is required, it is recommended that a QM-Data200 or KA-212 is purchased separately.
Note 2: The indicated value of a measurement may be slightly smaller than the actual value due to optical distortion caused by the illumination conditions.
Note 3: For the stage specification, refer to page 17.

Dimensions

PH-3515F

(Unit: mm/inch)



Note 1: To mount the optional counter (KA-212) and counter stand, approximately 300 mm / 11.8" space is required on the right-hand side of the main unit.
Note 2: Refer to page 17 for the dimensions of PH-A14.

Projection lenses (10X is a standard accessory)

PH-3515F

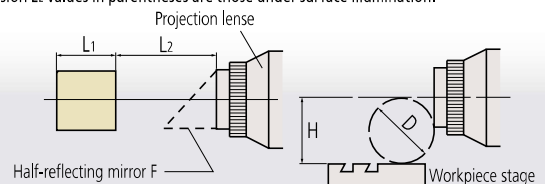
| Order No. | View field (mm) | L1 (mm) | L2*2 (mm) | D (mm) | H (mm) |
|---|-----------------|---------|-------------|--------|--------|
| 5X Lens Set 172-145 | 70.6 | 175 | 160 (64) | 152.4 | 152.4 |
| 10X Lens Set (Standard accessory)*1 172-184 | 35.3 | 235 | 93 (41) | 152.4 | 152.4 |
| 20X Lens Set 172-173 | 17.65 | 235 | 40 (40) | 116 | 152.4 |
| 50X Lens Set 172-165 | 7.06 | 80 | 14.6 (14.6) | 30.4 | 152.4 |
| 100X Lens Set 172-166 | 3.5 | 109 | 9.5 (9.5) | 19 | 152.4 |

*1 The 10x lens set includes half-reflecting mirror (172-295) for the 10x lens.
*2 Dimension L2 values in parentheses are those under surface illumination.

PH-A14

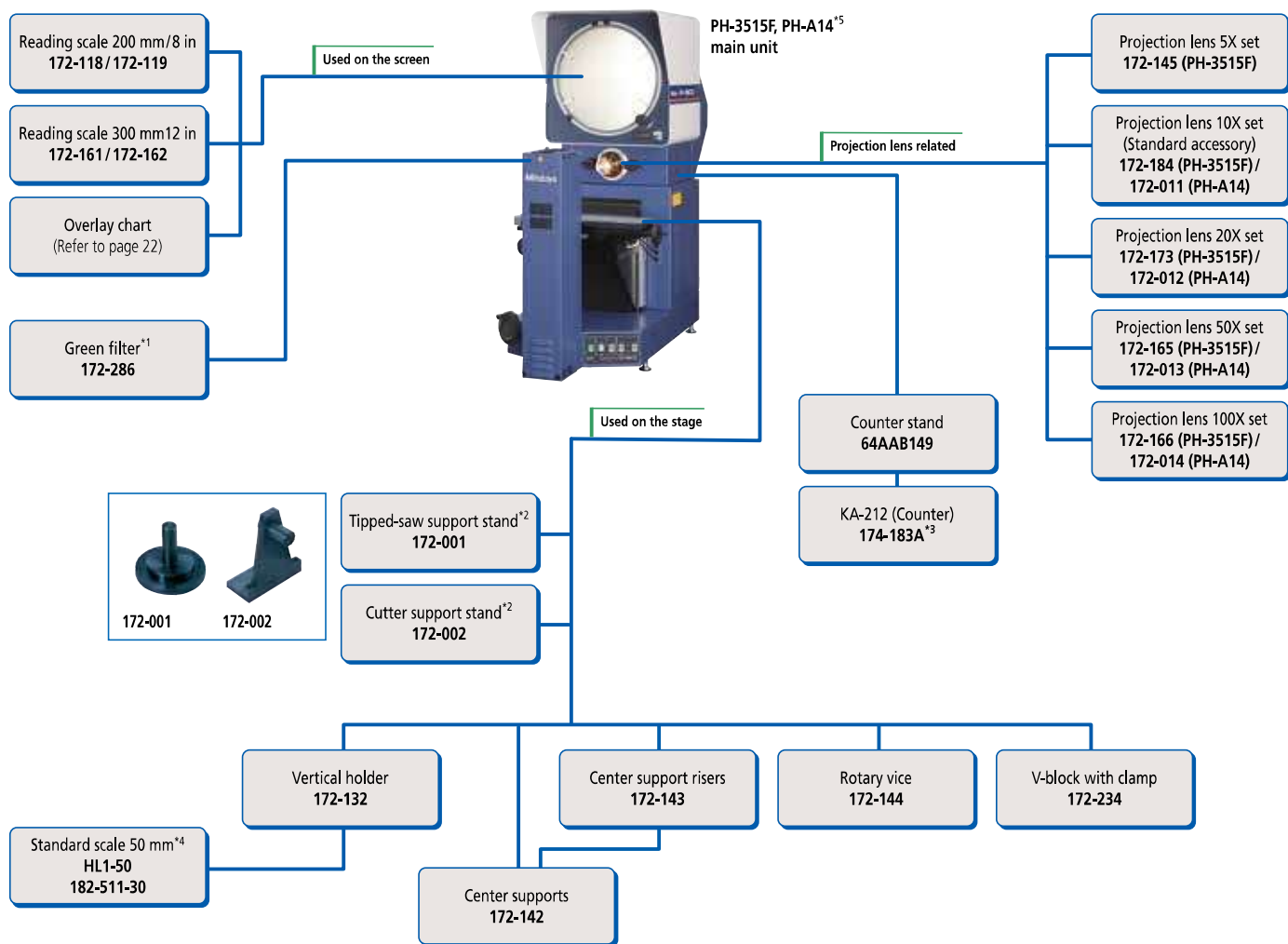
| Order No. | View field (mm) | L1 (mm) | L2*2 (mm) | D (mm) | H (mm) |
|---|-----------------|---------|-----------|--------|--------|
| 10X Lens Set (Standard accessory) 172-011 | 35.6 | 235 | 93 | 130 | 102 |
| 20X Lens Set 172-012 | 17.8 | 235 | 40 | 116 | 102 |
| 50X Lens Set 172-013 | 7.12 | 109 | 14.6 | 31.3 | 102 |
| 100X Lens Set 172-014 | 3.56 | 109 | 9.5 | 19.2 | 102 |

* Dimension L2 values in parentheses are those under surface illumination.



L1: Max. height where focusing is available
 L2: Max. step where focusing is available (working distance)
 D: Max. diameter when a cylinder generatrix is projected on the center line of the screen
 H: Max. size from optical axis and workpiece stage surface

System Diagram



*1 This is inserted in the contour light source section during use.

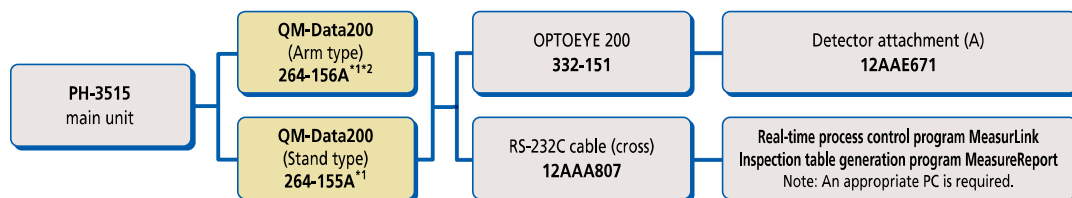
*2 The tipped-saw and cutter support stands support a center hole diameter of 25.4 mm.

*3 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 are required for PSE.

*4 Reference scale for checking the magnification accuracy. It is fixed on the stage with a vertical holder and projected on the screen to check the magnification with HL.

*5 Machine stand for PH-3515 is 64AAB176. Machine stand for PH-A14 is 64AAA129B.

Data Processing System Diagram



◆ Lamp replacement ◆

For contour / surface 515530^{*1}

For contour / surface 512305^{*2}

(Long-life specification, Rating approx. 500 hours)

For oblique reflection / reflection 12BAA637^{*1}

*1 This lamp is a standard accessory.

*2 Illuminance for Long Life specification is rather low.



For details, refer to the QM-Data200 and Vision Unit brochure.

*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 are required for PSE.

*2 The arm type cannot be used concurrently with a counter stand.

PH-3515F

Stage

| PJ-PLUS | |  |  |
|----------------------------------|----------------------------|---|---|
| | | XY range | 100 x 100 mm / 4" x 4" |
| PJ-PLUS main unit | Model | PJ-P1010A | PJ-P2010A |
| | Order No. | 302-801-10 | 302-802-10 |
| Unit system for the counter unit | mm/in | | |
| Measuring unit | Digital scale | | |
| Quick-release mechanism | X and Y axes | | |
| Top surface size | 250 x 250 mm / 9.8" x 9.8" | 350 x 280 mm / 13.8" x 11" | |
| Effective size of stage glass | 142 x 142 mm / 5.6" x 5.6" | 240 x 140 mm / 9.4" x 5.5" | |
| Stage glass thickness | 5mm / .19" | 8 mm / .31" | |
| Stage glass | 12BAE041 | 12BAD760 | |
| Swivel adjustment range | — | | |
| Maximum loading | 10 kg / 22 lbs | 8 kg / 17.6 lbs | |

| PJ-H30 | |  |  |  |  |
|--|---|---|---|---|---|
| | | XY range | 100 x 100 mm / 4" x 4" | 200 x 100 mm / 8" x 4" | 200 x 170mm / 8" x 6.7" |
| Protractor screen | Model | PJ-H30A1010B | PJ-H30A2010B | PJ-H30A2017B | PJ-H30A3017B |
| | Order No. | 303-712-1A* | 303-713-1A* | 303-714-1A* | 303-715-1A* |
| Protractor screen/ OPTOEYE built-in/ motor-driven focusing | Model | PJ-H30D1010B | PJ-H30D2010 | PJ-H30D2017B | PJ-H30D3017B |
| | Order No. | 303-732-1A* | 303-733-1A* | 303-734-1A* | 303-735-1A* |
| Measuring unit | High-accuracy digital scale | | | | |
| Quick-release mechanism | X and Y axes standard | | | | |
| Top surface size | 300 x 240 mm / 12" x 9.4" | 350 x 280 mm / 13.8" x 11" | 410 x 342 mm / 16" x 13.4" | 510 x 342 mm / 20" x 13.4" | |
| Effective size of stage glass | 180 x 150 mm / 7.1" x 6" | 250 x 150 mm / 9.8" x 6" | 270 x 240 mm / 10.6" x 9.4" | 370 x 240 mm / 14.6" x 9.4" | |
| Stage glass thickness | 6 mm / .24" | 6 mm / .24" | 8 mm / .31" | 8 mm / .31" | |
| Stage glass | 380412 | 382762 | 12BAD363 | 12BAD330 | |
| Swivel adjustment range | ±3° (right) | | | ±5° (left) | |
| Maximum loading | 10 kg / 22 lbs | | | 20 kg / 44 lbs | |
| Measuring accuracy | (3+0.02L) μm L: Measured length (mm) Note: The measurement method conforms to JIS B 7184 . | | | | |

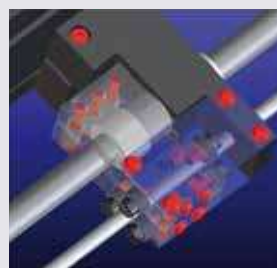
* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, -1D for CEE, -1 DC for CCC, -1E for BS, -1K for KC, C and No suffix are required for PSE.

Stage

Quick-release mechanism allows rapid traverse

| | |
|-------------------------------|---|
| PV-5110 |  |
| XY range | 200 x 100 mm / 8" x 4" (164 x 68mm / 6.5" x 2.7") ^{*1} |
| PV-5110 main unit Order No. | 304-919A ^{*2} |
| Measuring unit | Digital scale |
| Quick-release mechanism | X and Y axes |
| Top surface size | 380 x 250 mm / 15" x 9.8" |
| Effective size of stage glass | 266 x 170 mm / 10.5" x 6.7" |
| Stage glass thickness | 6 mm / .24" |
| Stage glass | 382762 |
| Swivel adjustment range | ±3° |
| Maximum loading | 5 kg / 11 lbs |

*1 () The range where no shading is observed using a 5X projection lens.
 *2 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, -1D for CEE, -1 DC for CCC, -1E for BS, -1K for KC, C and No suffix are required for PSE.



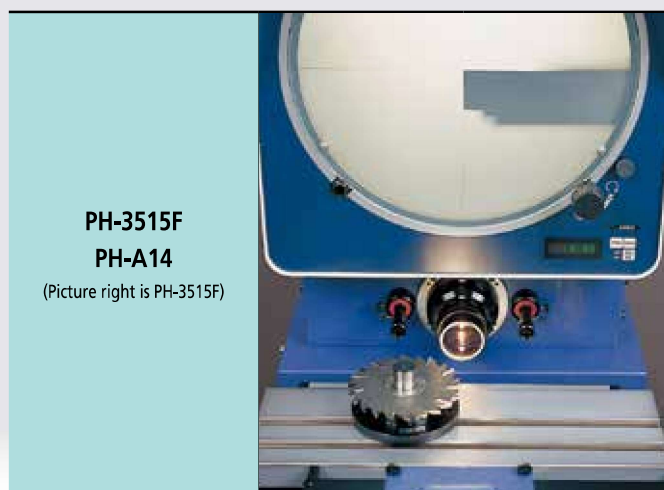
Twist roller system



Quick-release handle

A quick-release mechanism inside the X/Y handle allows you to switch stage feed between extremely coarse and fine traverse movement. Since the stage is completely free floating, it is very convenient when the distance to the next measuring position is large or when you need to return to the reference position swiftly. Since this mechanism has adopted the twist roller system, there is almost no shock in switching, and the feed is smooth.

Note: Except for PJ-PLUS Series and PH Series.



PH-3515F
PH-A14

(Picture right is PH-3515F)

| Model No. | PH-3515F | PH-A14 |
|---|-----------------------------|---------------------------|
| XY range | 254 x 152 mm / 10" x 6" | 200 x 100 mm / 8" x 4" |
| PH-3515F main unit Order No. | 172-868A ^{*1} | 172-810-10A ^{*2} |
| Measuring unit | Digital scale | |
| Quick-release mechanism | Only X-axis | |
| Top surface size | 450 x 146 mm / 17.7" x 5.7" | 407 x 152.4 mm / 16" x 6" |
| Dovetail groove | Two (Pitch = 43 mm) | |
| Minimum swivel angle reading | 30' | — |
| Maximum measuring diameter (horizontally fixed) ^{*3} | 340mm / 13.4" | 300 mm / 11.8" |
| Swivel adjustment range | ±10° | — |
| Maximum loading | 45 kg / 100 lbs | |

Photo: Cutter (Outside diameter of 175 mm max.) is mounted on the tipped-saw support fixture (172-001).

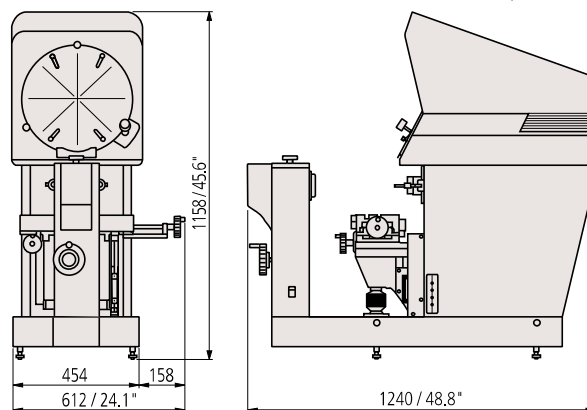
*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.

*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 When using the projection lens 10X (Standard accessory).

Dimensions of PH-A14

(Unit: mm/inch)











Accessories (Optional)

■ 2-D Data Processing Unit QM-Data200











The QM-Data200 is a geometric readout/analysis unit for optical instruments such as profile projectors. This unit features powerful 2-D coordinate measurement capabilities with easy-to-use key operation. Measurement results can be visualized on the LCD display and printed out if required.

Basic element measurement

| | | | |
|---|---|---|---|
|  Point Coordinates (Multi-point processing for a maximum of 100 points) Note: In multi-point processing, the mean value is used as the measured value. |  Line Angle and perpendicularity with the X axis. (Multi-point processing for a maximum of 100 points) |  Circle Center coordinates, diameter, roundness (Multi-point processing for a maximum of 100 points) |  Point-point distance Distance, Coordinates difference, radial difference |
|  Ellipse Center coordinates, major-axis diameter, minor-axis diameter, angle with the X axis, departure from the X axis (Multi-point processing for a maximum of 100 points) |  Rectangular hole Center coordinates, length, width |  Slotted hole Center coordinates, length, width, radius of slotted hole |  Intersection point and intersecting angle Intersection coordinates, intersecting angle, supplementary angle |

Pattern measurement

| | | | |
|--|---|--|---|
|  Pitch Point-point distance, difference between coordinates, angle, cumulative distance, cumulative angle |  Line-point distance Perpendicular (shortest) distance |  Line-circle distance Center-center distance, longest distance, shortest distance |  Circle-circle distance Center-center distance, longest distance, shortest distance, difference between coordinates, radial difference |
|  Line-circle intersection Coordinates of intersection |  Intersection of circles Coordinates of intersection |  Midpoint between points Coordinates of midpoint |  Midpoint between line and point Coordinates of midpoint |

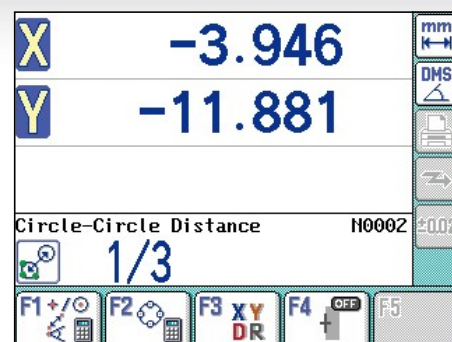
■ Specifications

| Code | QM-Data200 | |
|-----------------------------------|--|---|
| | Stand-mount type | Arm-mount type |
| Order No. | 264-155A*1 | 264-156A*1 |
| Display languages (selectable) | Japanese/English/German/French/Italian/Spanish/Portuguese/Czech/Chinese/Korean/Turkish/Swedish/Polish/Dutch/Hungarian | |
| Measured value unit | Length: mm Angle: degree/degree minute second (selectable) | |
| Resolution | 0.1 μm | |
| Program functions | Part program creation, execution, editing | |
| Statistical processing | Number of data, maximum value, minimum value, mean value, standard deviation, range, histogram, statistics on a measuring function basis (by command) | |
| Display system | COLOR TFT LCD (with LED backlight) | |
| Edge Sensor Position Compensation | Supported (Projector) | |
| Input/Output | XYZ : Maximum of three Linear Scales RS-232C 1 : For connecting to external PC RS-232C 2 : For connecting to counter of measuring instrument OPTOEYE : For inputting edge signal from OPTOEYE (OPTOEYE 200) FS : For connecting to optional foot switch PRINTER : For connecting to optional printer USB-MEMORY : For connecting to USB memory | |
| Measurement result file output | RS-232C output (CSV format, MUX-10 format) | |
| Power | 100 to 240 V AC | |
| Maximum power consumption | 17 W (does not include optional accessories) | |
| External dimensions (WxDxH) | Approximately 260 x 242 x 310 mm / 10.2" x 9.5" x 12.2" (including the stand) | Approximately 318 x 153 x 275 mm / 12.5" x 6.0" x 10.8" (when the arm is in the horizontal posture) |
| Mass | Approximately 2.9 kg / 6.4 lbs | Approximately 2.8 kg / 6.2 lbs |
| Applicable models | PJ-PLUS Series PJ-H30 Series PV-5110 PH-3515F PH-A14 | PJ-PLUS Series PJ-H30 Series PV-5110*2 PH-3515F*2 PH-A14*2 |
| Standard accessories | AC adapter, power cable, Easy operation guide | |

■ Operation screen (Counter)



Measurement result



Magnified counter screen

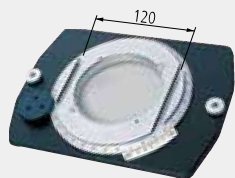
*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, 00 for CCC (power cord for CCC and User's Manual set of Simplified Chinese are provided for separately), E for BS, K for KC, C and No suffix are required for PSE.

*2 The arm-mount type cannot be used concurrently with a counter stand.
Note: For details, refer to the QM-Data200 and Vision Unit brochure.

Accessory

Rotary tables

Used for rotating the workpiece on the stage without needing to handle it.



172-198



176-305



176-306

| Order No. | 172-198 | 176-305 | 176-306 |
|-----------------------------|--|--|--|
| Product Name | Rotary table with fine feed wheel | Rotary table with fine feed wheel A | Rotary table with fine feed wheel B |
| Rotary stage size | 146 mm / 5.7" | 240 mm / 9.4" | 270 mm / 10.6" |
| Fine adjustment | ✓ | ✓ | ✓ |
| Effective glass diameter | 96 mm / 3.8" | 182 mm / 7.2" | 238 mm / 9.4" |
| Minimum angle reading | 2° | — | — |
| External dimensions (WxDxH) | 240 x 172 x 19.7 mm / 9.4" x 6.8" x .78" | 280 x 280 x 23.7 mm / 11" x 11" x .93" | 342 x 342 x 23.2 mm / 13.4" x 13.4" x .91" |
| Mass | 2.4 kg / 5.3 lbs | 5.5kg / 12.1lbs | 6.5kg / 14.3kg |
| Applicable models | PJ-PLUS Series | ✓ ^{*1} | — |
| | PJ-H30 Series | ✓ ^{*1} | ✓ |
| | PV-5110 | ✓ ^{*2} | — |

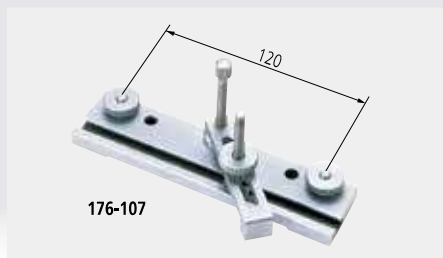
*1 Since the rotary stage section is small, if it is used for a large stage, some restrictions may be imposed on the measuring range.

*2 When using a 50X or a 100X projection lens, you need to remove the stage glass in order to prevent a collision between the stage glass for X/Y stage and the projection lens.

*3 It is possible to set for only the 2010 size.

Holder with clamp

Used for clamping down a thin workpiece, such as a board or a pressed product.



176-107

| Order No. | 176-107 |
|-----------------------------|--|
| Applicable models | PJ-PLUS Series PJ-H30 Series PV-5110 |
| Maximum width to be clamped | 0 to 35mm / 1.4" |
| Mass | 0.4 kg / .88 lbs |

V-block with clamp

Used for clamping a cylinder.



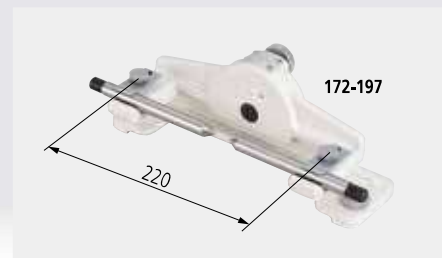
172-234

172-378

| Order No. | 172-234 | 172-378 |
|--|-----------------------------|--|
| Applicable models | PH-3515F / PH-A14 | PJ-PLUS Series PJ-H30 Series PV-5110 |
| Maximum workpiece diameter to be clamped | 50 mm / 2" | 25 mm / 1" |
| Central height from a mounting surface | 38 to 48 mm / 1.5" to 1.89" | 38 to 48 mm / 1.5" to 1.89" |
| Mass | 1.24 kg / 2.7" | 0.8 kg / 1.8 lbs |

Swivel center support

Used for holding a center-drilled workpiece. Since an inclination of ±10 degrees can be set, it is suitable for helping measure the depth and flank angle of threads.



172-197

| Order No. | 172-197 |
|---------------------------------------|--|
| Applicable models | PJ-PLUS Series PJ-H30 Series PV-5110 |
| Maximum workpiece size to be clamped* | 80 mm / 3.1" (65 x 140mm / 2.6" x 5.5") |
| Inclination | ±10° |
| Mass | 2.5 kg / 5.5 lbs |

* The maximum measurable dimension varies according to the projection magnification. Dimension in parentheses is that for an inclination of 10°.

Adapter

This enables a workpiece clamping option, such as the holder with clamp or the swivel center support, to be attached to the X/Y stage of the projector.

| Order No. | 176-304 | 176-310 | 176-317 |
|-----------------------------|-------------------------------------|-----------------------------------|--------------------------------------|
| Product Name | Stage adapter | Stage adapter (B) | Stage adapter (C) |
| External dimensions (WxDxH) | 50 x 340 x 15 mm / 2" x 13.4" x .6" | 50 x 280 x 15 mm / 2" x 11" x .6" | 73 x 278 x 17 mm / 2.9" x 11" x .67" |
| Mass | 1.5 kg / 3.3 lbs | 1.2 kg / 2.64 lbs | 1.8 kg x 3.96 lbs |
| Applicable models | PJ-PLUS | ✓ | — |
| | PJ-H30 | ✓ | — |
| | PV-5110 | — | ✓ |

Accessories (Optional)

Rotary vise

Used for clamping a workpiece. It rotates the horizontal plane.



172-144

| Order No. | 172-144 |
|---|--------------------|
| Applicable models | PH-3515F PH-A14 |
| Rotation range | 360° |
| Size between mounting surface and top surface | 76 mm / 3" |
| Minimum angle reading | 5° |
| Mass | 2.8 kg / 6.2 lbs |

Center supports

Used for holding a center-drilled workpiece.



172-142

| Order No. | 172-142 |
|--|-------------------------------------|
| Applicable models | PH-3515F PH-A14 |
| Maximum workpiece diameter to be clamped | 120 mm / 4.7" / (240 mm / 9.4")* |
| Mass | 3.3 kg / 7.3 lbs |

* When center support risers (172-143) are used.

Center support risers

These are used to raise the center supports to a more convenient working height, or to enable a larger diameter workpiece to be inspected.



172-143

| Order No. | 172-143 |
|-------------------|--------------------|
| Applicable models | PH-3515F PH-A14 |
| Height | 60 mm / 2.4" |
| Mass | 2.2 kg / 4.8 lbs |

Vertical holder

Used for holding small thin parts.



172-132

| Order No. | 172-132 |
|-------------------|--------------------|
| Applicable models | PH-3515F PH-A14 |
| Glass size | — |
| Mass | 1.3 kg / 2.9 lbs |

Standard scale

Glass scale used for checking magnification accuracy

172-116



| Order No. | 172-116 | 172-330 | 172-117 |
|------------------|--|---------|--|
| Range | 50 mm | 80 mm | 2 in |
| Graduation | 0.1 mm | | 0.01 in |
| Accuracy (20 °C) | (3+5L/1000) μm L=Measured length (mm) | | (120+5L)×10 ⁻⁶ in L=Measured length (in) |

Working standard scale (Made to order)

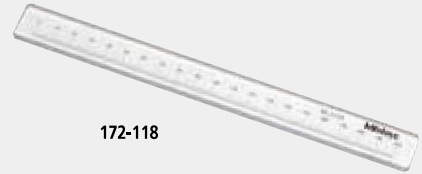
- Although the reference scale is used for checking the indication accuracy of the X/Y table, it also substitutes for a standard scale or a reading scale. A substitute for the standard scale is HL1, and that for the reading scale is HL2.
- Refer to page 15 for details of 14005 brochure.



Reading scale

Glass scale specially designed for inspecting the magnified image of a standard scale on the projection screen

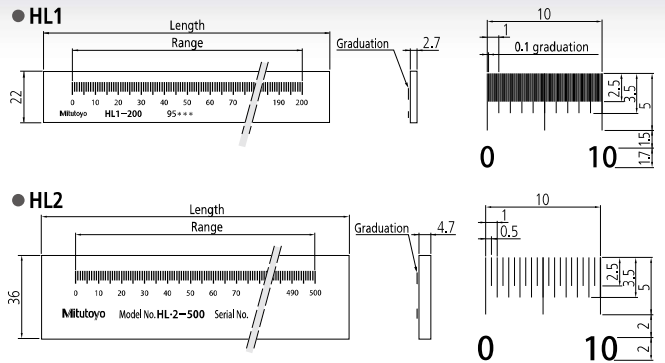
172-118



| Order No. | 172-118 | 172-161 | 172-329 | 172-119 | 172-162 |
|------------------|--|---------|---------|---|---------|
| Range | 200 mm | 300 mm | 600 mm | 8 in | 12 in |
| Graduation | 0.5 mm | | | 0.02 in | |
| Accuracy (20 °C) | (15+15L/1000) μm L=Measured length (mm) | | | (600+15L)×10 ⁻⁶ in L=Measured length (in) | |

Dimensions

Unit: mm



| Order No. | 182-511-30* | 182-512-30* | 182-522-30* | 182-523-30* | 182-525-30* |
|--------------------------------|------------------------------------|-------------|-------------|-------------|-------------|
| Code | HL1-50 | HL1-100 | HL2-200 | HL2-300 | HL2-500 |
| Range (mm) | 50 | 100 | 200 | 300 | 500 |
| Length (mm) | 75 | 125 | 230 | 330 | 530 |
| Graduation line thickness (μm) | 20 | | | | |
| Material | Soda-lime glass | | | | |
| Accuracy (20 °C) (μm) | 1.5+2L/1000 L=Measured length (mm) | | | | |

* If the specified code No. ends with "-30," we will attach a calibration certificate.
Note: The unit of the working standard scales is mm only.

Accessory

Green filter

These filters are for adjusting image contrast, and are inserted in the transmitted illumination section during use.



| Order No. | 172-160-3 | 12AAG981 | 172-160-2 | 172-286 |
|------------------------------|-------------------------|-----------------------------|-------------------------|---------------------------|
| Applicable models | PJ-PLUS | PJ-H30 | PV-5110 | PH-3515F PH-A14 |
| External dimensions (WxD) mm | 50 x 110 (2" x 4.3") | 195 x 260 (7.7" x 10.2") | 50 x 167 (2" x 6.6") | 58 x 120 (2.3" x 4.7") |
| Mass | 0.3 kg / .66lbs | 0.44 kg / .97 lbs | 0.3 kg / .66lbs | |

OPTOEYE 200 (Projected image position detecting device)



- An edge detecting device for improving the measuring efficiency and reliability of a profile projector by removing the need to position the cross hairs on an edge manually. This has the effect of eliminating the operator variability factor from data entry and shortening the measurement time.
- The detector uses an optical fiber that can be easily fixed on the screen with chart clips.
- The device is provided with an error detection function that works if the screen light intensity changes.
- This device can be retrofitted onto the QM-Data200 and does not need an AC adapter since power is supplied from the QM-Data200 through the connecting cable.
- When using the Optoeye system, there are two ways to connect: connection to the projector main unit via an RS-232C cable, or direct connection of the projector main unit's X- and Y-axis linear scales to QM-Data200.
- This system can be used in combination with the QM-Data200 but is only available for the PJ-H30A. (PJ-H30D does not need this system because it has a built-in Optoeye sensor.)

| Order No. | 332-151 |
|--------------------------------------|-------------------------------|
| Model | OPT-200 |
| Illumination | Contour/surface ^{*1} |
| Detecting directivity | Non-directional |
| Minimum detectable circle | ø2 mm |
| Minimum detectable line width | 1 mm |
| Maximum response speed | 1000 mm/s |
| Illumination range (Bright) | 30 to 1500 ℓX |
| Bright-Dark field difference | 20 ℓX or higher |
| Repeatability (contour illumination) | $\sigma = 1 \mu\text{m}^2$ |

*1, *2 Mitutoyo's test conditions.

| Configuration of standard accessories | |
|--|--|
| Electronic unit | |
| Detector: Optical fiber: 1950 mm | |
| Connecting cable: For connecting electrical component main unit and QM-Data200 | |
| Fixture for QM-Data200 (12BAG139): For fixing the electrical component main unit to QM-Data200 | |

Note: Detector mounting plate is an optional accessory.

Built-in OPTOEYE (only PJ-H30D)



| | |
|---------|--|
| PJ-H30D | Detecting sensor: Built into center of screen, non-directional illumination ^{*3} , Minimum detectable circle: ø2 mm (projected image size), Minimum line width: 1mm (projected image size), Repeatability: $\sigma = 1 \mu\text{m}^4$ |
|---------|--|

*3 This may be undetectable depending on the illumination conditions.

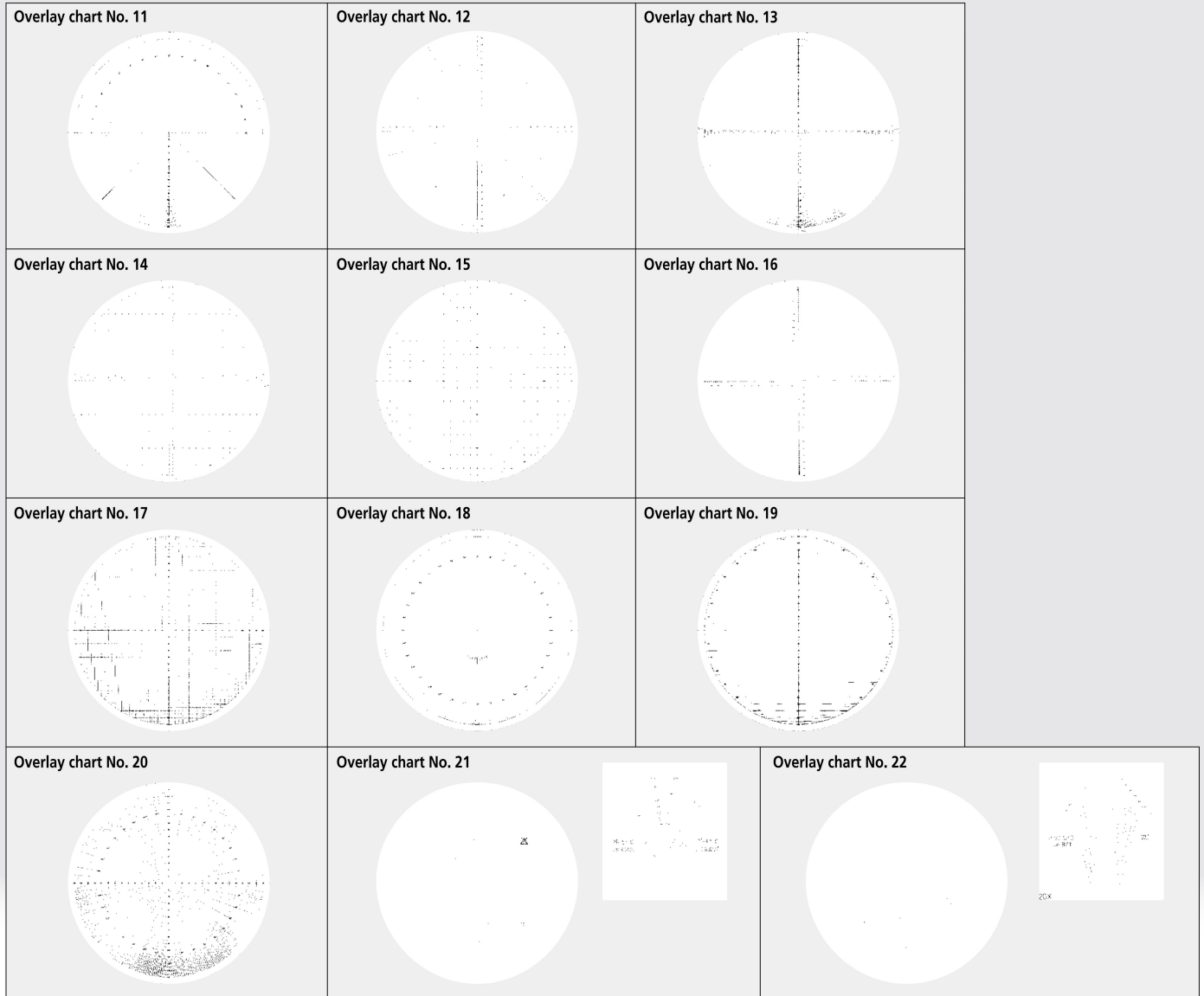
*4 Mitutoyo test conditions.

Accessories (Optional)

Accessory

■ Overlay charts

To quickly check an image projected on the screen, an appropriate chart is used. 13 types of overlay charts are available according to the application.



| Product name | Order No. | Specification |
|--------------------------|-----------|--|
| Overlay charts Set of 12 | 12AAM027 | Set of 12 charts (Overlay charts No.11 – No.22) |
| Overlay chart No.11 | 12AAM587 | Upper side: radial lines (at intervals of 1°) Lower side: concentric circles (at intervals of 1 mm in radius) |
| Overlay chart No.12 | 12AAM588 | Concentric circles (at intervals of 5 mm in radius) with cross hairs (1 mm graduation) |
| Overlay chart No.13 | 12AAM589 | Concentric circles (at intervals of 1 mm in radius) with cross hairs |
| Overlay chart No.14 | 12AAM590 | Horizontal: Parallel lines at intervals of 50 mm (50-times enlargement of 1 mm) Vertical: Parallel lines at intervals of 20 mm (20-times enlargement of 1 mm) |
| Overlay chart No.15 | 12AAM591 | 10 mm-interval grids |
| Overlay chart No.16 | 12AAM592 | Cross hairs (0.5 mm graduation) |

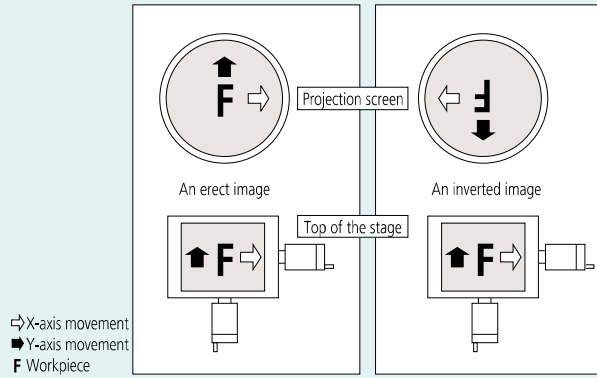
| Product name | Order No. | Specification |
|---------------------------------------|-----------|---|
| Overlay chart No.17 | 12AAM593 | 1 mm-interval grids |
| Overlay chart No.18 | 12AAM594 | 1°-interval radial lines |
| Overlay chart No.19 | 12AAM595 | Horizontal: 1 mm-interval parallel lines |
| Overlay chart No.20 | 12AAM596 | Concentric circles (at intervals of 1 mm in radius) and radial lines (at intervals of 1°) |
| Overlay chart No.21 | 12AAM597 | Metric screw for 20X lens: P = 0.2 to 2 mm Unified screw: 28 to 12 threads/in Whitworth screw: 20 to 10 threads/in |
| Overlay chart No.22 | 12AAM598 | Metric screw for 100X lens: P = 0.08 to 0.25 mm Involute tooth profile for 20X lens (reference rack tooth profile) 20°m: 0.2 to 1 14.5°m: 0.2 to 1 |
| Overlay chart (Staggered cross-hairs) | 12AAM599 | Solid lines + Staggered cross-hairs |

Quick guide to Profile Projectors

Basic knowledge

■ 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).



■ 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. (Note that magnification accuracy is not the same as measuring accuracy.)

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

$\Delta M (\%)$: 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
 I : Length of the reference object
 M : Magnification of the projection lens

Nominal magnification: Magnification displayed on the projection lens.

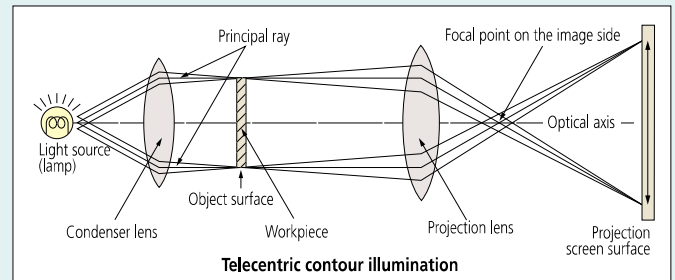
■ Type of Illumination

- 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-reflecting mirror or a projection lens with a built-in half-reflecting 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 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

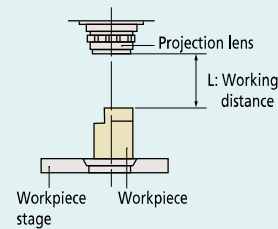
This is an optical system where the principal ray is aligned parallel to the optical axis by placing a lens stop on the focal point on the image side. Its functional feature is that the image will not vary in size though the image blurs as the object is shifted along the optical axis.

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 the object is illuminated with parallel beams. (See the figure below.)



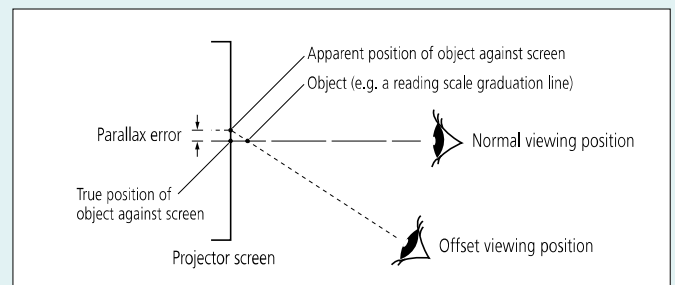
■ Working distance

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 means an error resulting from variations in the line of sight when reading a scale.



■ 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 $\phi 500\text{mm} / 19.6''$:
 Field of view diameter is given by $\frac{500\text{mm} / 19.6''}{5} = 100\text{mm}$

The $\phi 100\text{mm}$ range is projected over the entire projection screen.



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