Featured Products

Profile Projectors

PJ-H30

Refer to page I-7 for details.

Microscopes

MF

Refer to page I-18 for details.

Microscopes

MF-UD

Refer to page I-21 for details.

INDEX

Mitutoyo

Profile Projectors

PH-3515F
SERIES 172 — Profile Projector

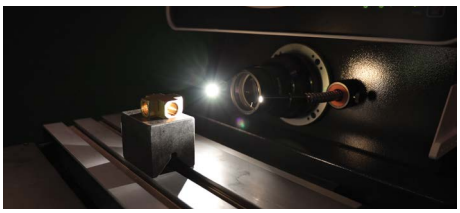
- Benchtop model uses a horizontal optical system.
- Suitable for thread pitch measurements—blurred or distorted images will not be produced when workpiece is angled.
- Erect image on the day-bright screen.
- Standard twin fiber-optic illumination.
- 14" (353mm) diameter protractor screen with cross-hairs and staggered lines for easy alignment.
- Digital angle measurement to 1' or 0.01°.
- Heavy-duty workpiece table incorporates linear scales for fast, accurate measurement.
- Built-in linear scales for use with optional display counters.

PH-3515F

2D Coordinate Interfacing RETROFITS

Model No.	Description
64PKA-M2-P	M2 Non-edge Detection Unit with ASUS Touchscreen PC
64PKA-M2-PE	M2 with Edge Detection Unit & ASUS Touchscreen PC
264-161-13A	QM-DATA200 Arm Type (PJ-Plus)

Built-in Surface Illumination



Includes Built-in Twin Fiber Optics to assist with measuring surface features/defects.

Flexible housing allows the lighting condition to be easily manipulated for a user dealing with a lighting situation.

PH-3515 offers a variety of illumination options from crisp couture illumination users have come to expect, as well as coaxial and surfaces illumination.

- Inspect edges with ease
- Amplify surface features
- Examine small changes in typography (markings, scratching, dents)

KA Counter (174-183A)
(Refer to page H-8 for more details.)
64AAB149: Counter stand

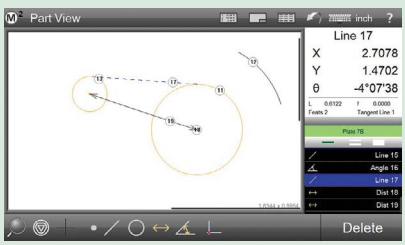
Accessories for Common Industry Applications

Durable working stage with built-in T slots allows for fixtures to be seamlessly mounted to a stage. Mitutoyo offers a variety of fixturing options on the PH-3515F which were made to accommodate common industry applications

- In the picture to the left is the Mitutoyo Tipped Saw Support Stand (172-001) used for streamlined inspection of each tooth grind, ensuring its consistency and accuracy across teeth on a saw blade

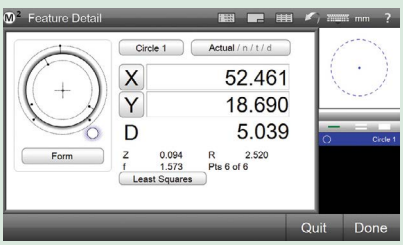
172-001

172-002



M2 Graphics-based "Part View"constructions

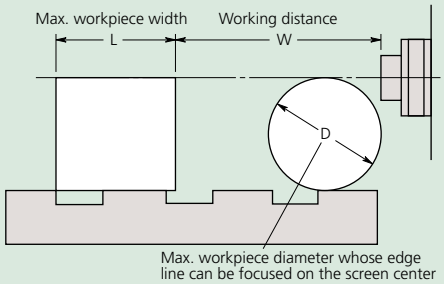
Generate popular construction types, like distances and tangent lines, from within the graphical part view.



M2 Geometric tolerance view

Measure features, set nominals, apply tolerances and view deviation results with only a few quick clicks.

Projection Capacity



PH-3515F Unit: mm

	Magnification			
	10X (standard)	20X	50X	100X
View field	35.3	17.65	7.06	3.5
L	235	235	80	109
W	93 (41)	40	14.6	9.5
D	152.4	116	30.4	19

( ): When using surface illumination

Optional Accessories

172-482: 10X projection lens set (standard accessory)
172-483: 10X projection lens
172-484: 20X projection lens set
172-485: 20X projection lens
172-486: 50X projection lens set
172-487: 50X projection lens
172-166: 100X projection lens set
64PMI308: Machine stand
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″)
172-286: Green filter
512305: Halogen bulb (24V, 150W) (standard accessory)
172-425: Twin surface illumination

Fixture and Stage Accessories*

172-600: Center support
172-601: Center support riser
172-602: Rotary vise (Max. workpiece dia.: 2.3″ / 60mm)
172-603: V-block with clamp (Max. workpiece dia.: 2″ / 50mm)
172-132: Vertical holder
172-001: Tipped-saw support stand
172-002: Cutter support stand
* See page I-13 for details

Find a Distributor

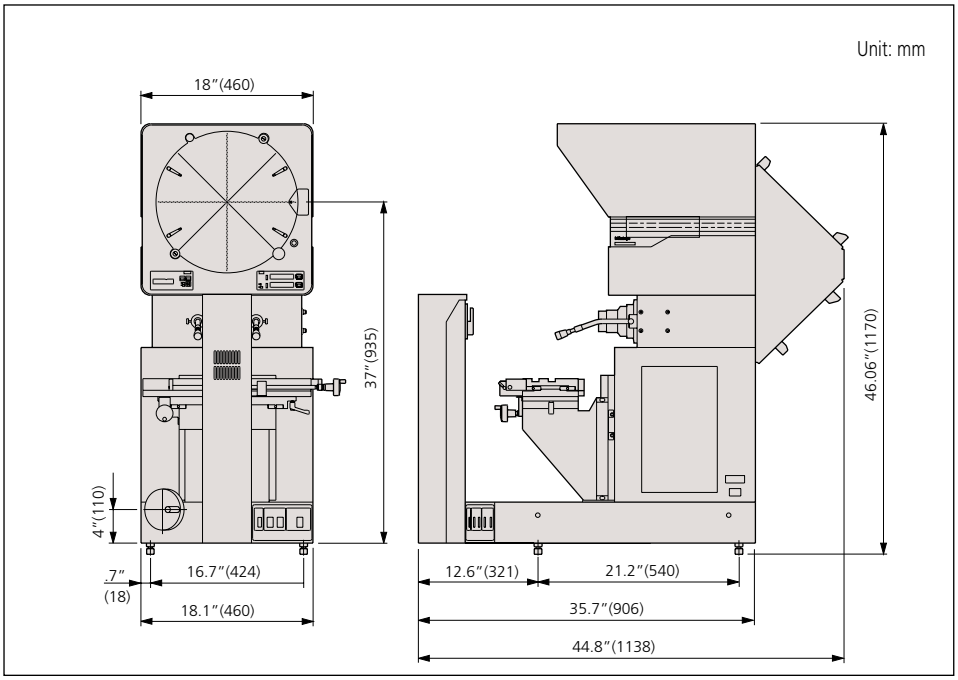
SPECIFICATIONS

Model No.		PH-3515F
Order No.		**172-868-11A***
Projected image		Erect image
Protractor screen	Effective diameter	14″ / 353mm
	Screen material	Fine ground glass
	Reference line	Cross hair line
	Screen rotation	±360°, fine feed and clamp
	Angle display (LED)	Resolution: 1′ or 0.01° (switchable), Range: ±370°, Functions: ABSOLUTE/incremental mode switching, Zero set
Projection lens		Standard accessory: 10X (172-184), Optional accessories: 5X, 20X, 50X, 100X
Magnification accuracy	Contour illumination	±0.1% or less
	Surface illumination	±0.15% or less
Contour illumination	Light source	Halogen bulb (24V 150W)
	Optical system	Telecentric system
	Functions	2-step brightness switch, Heat-absorbing filter, Cooling fan
XY Stage Surface illumination (Optional accessories)	Light source	Halogen bulb (24V 150W)
	Functions	Adjustable condenser lens. Heat-absorbing filter, Cooling fan
	Table travel (X-axis)	10″ / 254mm
	Table size (X, Z)	17.7″x5.7″ / 450x146mm
	Vertical travel (Y-axis)	6″ / 152mm
	Resolution	0.001mm/.00005″*
	Measuring Unit	Built-in Llnear scale
	Max. workpiece width	See (L) in chart to left
	Max. workpiece load	100lbs / 45kg
Power supply		120V AC, 50/60Hz
Mass		333lbs / 150kg
Standard accessories		10X projection lens set, work stage, power cord, halogen bulb, tube fuse, grounding wire, allen wrench

* Counter not included

DIMENSIONS

Unit: mm



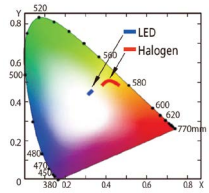
Profile Projectors

PJ-PLUS
SERIES 302 — Premium Benchtop Series

- Excellent durability and energy-saving performance thanks to the adoption of an "LED illumination source" and "fan-less cooling system".
- The measuring projector that "can be operated intuitively" even by inexperienced people and also has excellent durability and energy-saving performance thanks to the adoption of fan-less cooling system.
- Provides stable dimension and angle measurements in harsher environments, such as manufacturing and processing lines, than can be handled by conventional models.

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 more efficient inspection and measurement.

High visibility digital display

In addition to zero-setting and direction change, the data output of each counter value adopts the highly versatile RS-232C.
Resolution: 0.001 mm or 0.0001 in / 0.001 mm.

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 Circular Illuminator for PJ-PLUS (Optional)

LED illumination light can emphasize the contrast of projected workpiece images, stereoscopic and sharp observation. Projected image can be observed at high color reproducibility; Low power consumption: 17.4W; and long operating life: 30,000 hours.

SPECIFICATIONS

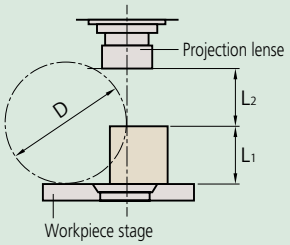
Model No.	172-502A*
Compatible model	PJ-PLUS (Projection lens 10X and 20X
Illumination source	White LED
Power consumption	12 V / 17.4 W
LED life (reference)	30,000 H

* This optional accessory requires (**12AAX044**) and is compatibale with the PJ-PLUS 20x Objective

Example of attaching the LED circular illuminator on PJ-PLUS

PJ-Plus Objectives

Model No.	Description
172-296	Projection lens set, 10X magnification
172-297	Projection lens set, 20X magnification
172-298	Projection lens, 50X magnification
172-299	Projection lens, 100X magnification



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

		Contour Illumination				Surface Illumination			
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	5
PJ-P1010A	L_1	91							
	D	182	87	27	10	182	61	27	10
PJ-P2010A	L_1	90.5							
	D	181	87	27	10	181	61	27	10

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)

Green Filter

(Improved contrast - less seceptible to ambient light)

172-160-3

2D Coordinate Interfacing RETROFITS

Model No.	Description
64PKA-M2-P	M2 Non-Edge Detection Unit with ASUS Touchscreen PC
64PKA-M2-PE	M2 with Edge Detection Unit & ASUS Touchscreen PC
264-161-13A-PJP	QM-DATA200 Arm Type (PJ-Plus)
264-161-13A-PJP-OPT	QM-DATA200 Arm Type & Optoeye Edge Detection (PJ-Plus)

Optional Accessories

172-116: Inspection tool, Standard scale 50 mm/0,1 mm
172-118: Inspection tool, Reading scale 200 mm/0,5 mm
172-119: Inspection tool, Reading scale 8"/0.02"
172-161: Inspection tool, Reading Scale 300 mm/0,5 mm
172-162 : Inspection tool, Reading Scale 12"/0.02"
172-160-3: Green Filter, Colour filter
172-604: Swivel center support, Fixture/clamping material
172-229: Lens accessory, Oblique reflecting mirror for 10X lens
172-230: Lens accessory, Oblique reflecting mirror for 20X lens
172-378: V-BLOCK, with clamp
176-107: Fixture/clamping material, Holder with clamp
172-604: Fixture/clamping material, Swivel center support
12AAE671: Attachment, OPTOEYE-200 Attachment A, 250-350 mm
332-161: Sensor, Optoeye-200 edge detection sensor
176-106: Rotary table
172-196: Rotary table, 100 mm for TM-1005B
172-198: Rotary table, 100 mm with fine feed knob for TM-1005B
172-502: LED Circular Illuminator (PJ-PLUS), for 10x and 20x + adapter 12AAX044
12AAX044: Damping Ring A (for PJ 20X), to connect LED illumination 172-502 to 20x lens

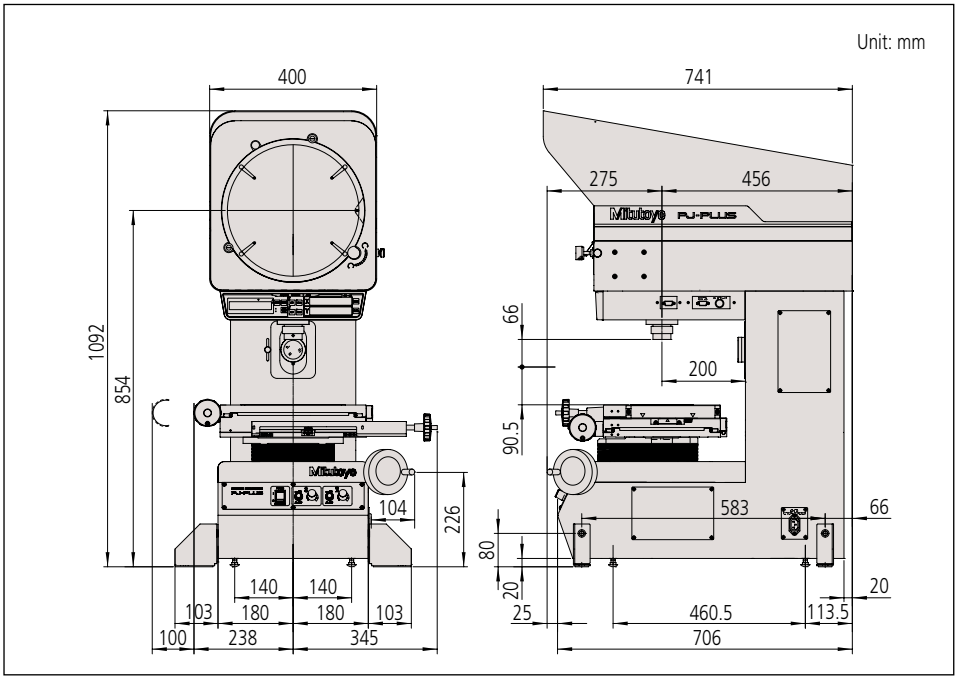
"Got Questions?

SPECIFICATIONS

Model No.		PJ-P101A	PJ-P2010A
Order No.		**302-801-10A**	**302-802-10A**
Unit system for Main Unit		mm/in	
Projected image		Inverted-reversed	
Protractor screen	Effective diameter	ø315 mm / 12.4 in	
	Screen rotation	±360° (±370° for display)	
	Angle display	Digital Counter (ABS/INC mode switching, Zero Set)	
	Resolution	1' or 0.01'	
	Cross-hairs	90° (solid lines)	
Projection lens		Standard accessory: 10X, Optional accessories: 20X, 50X, 100X	
	Magnification	10 x 8 20x (Equipped with external half-mirror for coaxial surface illumination)	
	Lens Mounts	Bayonet Mount	
Magnification accuracy	Contour illumination	±0.1%	
	Surface illumination	±0.15%	
Contour illumination	Light source	White LED light source	
	Optical system	Telecentric system	
	Functions	Variable brightness adjustment	
Surface illumination (Optional accessories)	Light source	White LED light source	
	Optical system	Adjustable condenser lens (ensuring even lighting across entire FOV at specific magnification)	
Counter unit	Angle	Built-in Digital counter, range ±370°, resolution: 1' or 0.01' (switchable), zero set, ABS/INC switchable	
	XY Axis Resolution	.001mm/.0001"	
	Functions	Zero set (with buzzer function), Unit switching, Direction switching OPTOEYE input, External load signal input, RS-232C output	
	Edge Detection	OPTOEYE Retrofit Available (**264-161-13A-PJP-OPT**)	
	Measuring Unit	Digital Linear Scale	
	Measuring Range	100 x 100 mm / 4x4 in	200 x 100 mm / 8 x 4 in
System	Table Size	250 x 250 mm / 9.8 x 9.8 in	350 x 280 mm / 14 x 11 in
	Effective Table Area	142 x 142 mm / 5.6 x 5.6 in	250 x 150 mm / 9.8 x 5.6 in
	Max Workpiece Height	91 mm / 3.58 in	90.5 mm / 3.56 in
	Max Workload	10 kg / 22 lbs	8 kg / 17 lbs

DIMENSIONS

Unit: mm

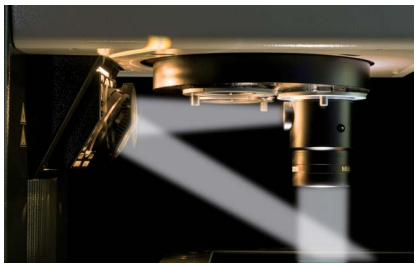


Profile Projectors

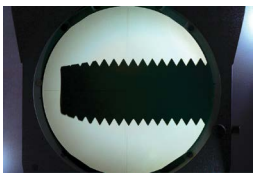
PJ-H30
SERIES 303 — High-Accuracy Profile Projectors

By separating axial motion and stabilizing the XY measuring table 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. The power focusing (PJ-H30D type) provides higher performance.

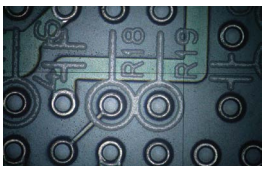
- Newly designed optical system with high NA lenses provides drastically brighter and clearer screen images during surface illumination.
- The three-lens mounting turret includes a 10X lens as standard. Four types of projection lenses (5X, 20X, 50X, 100X) are available.



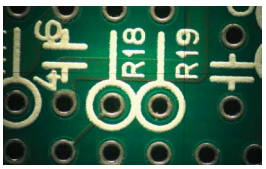
Switchable surface illumination: vertical or oblique



Contour illumination (Standard)



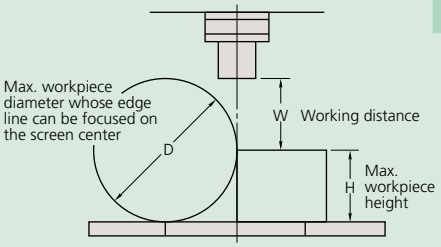
1. Vertical transmitted light illumination



2. Oblique illumination
High color reproducibility

PJ-H30A3017B
XY stage travel range: 12x7″ / 300x170mm

Projection Capacity



Unit: mm

Model No.	View Field (mm)	L_1 (mm)	L_2 (mm)	D (mm)
5X Lens **172-271**	61.2	105	66	148
10X Lens **172-472**	30.6	105	70.5	197
10X Lens with C-mount **172-500**	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

All models equipped with Lens Turret

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

Quick-release mechanism

A quick-release handle inside the X/Y handle allows you to switch stage feed between extremely coarse and fine traverse movement.

10x C-Mount Camera Objective

Model No.	**172-500**
Camera Projected Image	Inverted
Camera Magnification	0.71X
Compatible Sensor Size	Four Thirds 4/3 type
Camera Mount	C Mount
Mountable Mass	0.9 kg or less

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

2D Coordinate Interfacing RETROFITS

Model No.	Description
264-161-13A-PJH	QM-DATA200 Arm Type (PJ-H30
264-161-13A-PJH-OPT	QM-DATA200 Arm Type & Optoeye Edge Detection (PJ-H30)

Optional Accessories

172-271: 5X projection lens
172-472: 10X projection lens (standard accessory)
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")
12AAG981: Green filter
172-370: Machine stand
512305: Halogen bulb (24V, 150W) (standard accessory)

Fixture and Stage Accessories

172-198: Rotary table (Effective diameter: 4" / 100mm)
176-305: Rotary table (Effective diameter: 7.2" / 183mm)
176-306: Rotary table (Effective diameter: 9.4" / 240mm)
172-604: Swivel center support (Max. workpiece dia.: 3.1" / 80mm)
176-107: Holder with clamp
172-378: V-block with clamp (Max. workpiece dia.: 1" / 25mm)
176-317: Fixture mount adapter C
176-304: Fixture mount adapter A

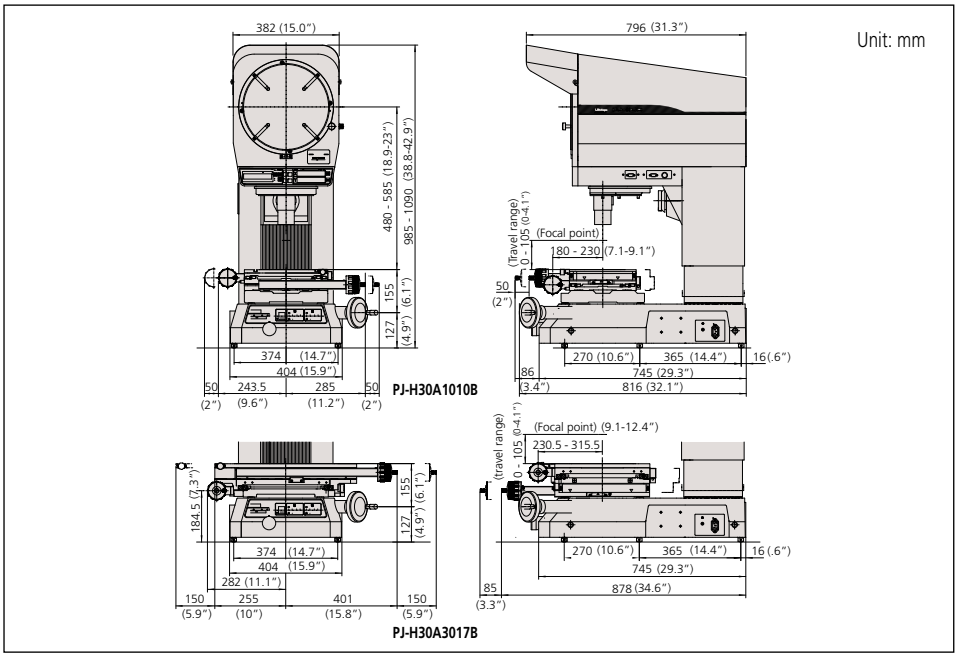
Availability	Models	
	PJ-H30A1010B	**PJ-H30A2017B**
	PJ-H30D1010B	**PJ-H30D2017B**
	PJ-H30A2010B	**PJ-H30A3017B**
	PJ-H30D2010B	**PJ-H30D3017B**
172-198	✔**	✔****
176-305	✔**	
176-306		✔****
176-107 *	✔**	✔****
172-378 *	✔**	✔****
172-604	✔***	✔***

* Able to attach to a Rotary table 172-198 or 176-305 (172-197 can only attach to 176-305).
** Fixture mount adapter C (176-317) is required.
*** Rotary table (172-198) is required.
**** Fixture mount adapter A (176-304) is required.

					
Manual Focus type	Model No.	**PJ-H30A1010B**	**PJ-H30A2010B**	**PJ-H30A2017B**	**PJ-H30A3017B**
	Order No.	**303-716-13A**	**303-717-13A**	**303-718-13A**	**303-719-13A**
Projected Image		Erect image			
Protractor screen	Effective diameter	12" / 306mm			
	Screen material	Fine ground glass			
	Reference line	Cross hair line			
	Screen rotation	±360°, fine feed and clamp			
	Angle display (LED)	Resolution: 1° or 0.01° (switchable), Range: ±370°, Functions: ABSOLUTE/incremental mode switching, Zero set			
Projection lens		Standard accessory: 10x (172-472), Optional accessories: 2X, 5X, 20X, 50X, 100X			
Lens mount		3-lenses mounting turret			
Magnification accuracy	Contour illumination	±0.1% or less			
	Surface illumination	±0.15% or less			
Contour illumination	Light source	Halogen bulb (24V 150W)			
	Optical system	Zoom telecentric system			
	Functions	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			
	XY Range	4 x 4" 100 x 100mm	8 x 4" 200 x 100mm	8 x 6.7" 200 x 170mm	12 x 6.7" 300 x 170mm
	Resolution	.0001" / 0.001mm			
	Measuring unit	Built-in Linear scale			
	Table size	11.8 x 9.4" 300 x 240mm	13.8 x 11" 350 x 280mm	16.1 x 13.5" 410 x 342mm	20 x 13.5" 510 x 342mm
	Effective table area	7.1 x 5.9" 180 x 150mm	9.8 x 5.9" 250 x 150mm	10.6 x 9.4" 270 x 240mm	14.6 x 9.4" 370 x 240mm
	Max. workpiece ht.	4.1" / 105mm			
	Max. workpiece load	22lbs / 10kg	22lbs / 10kg	44 lbs / 20kg	44 lbs / 20kg
Power supply		120V AC, 50/60Hz			
Mass		391lbs / 176kg	396lbs / 178kg	556lbs / 205kg	471lbs / 212kg
Standard accessories		10X projection lens set, masking shield, power cord, halogen bulb, tube fuse, grounding wire, allen wrench, vinyl cover			

DIMENSIONS

Unit: mm



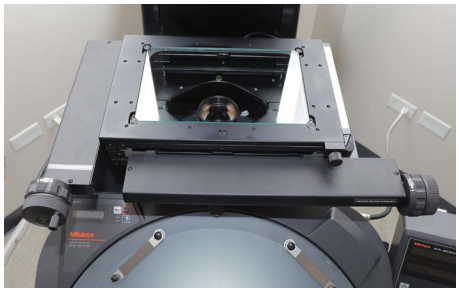
Profile Projectors

PV-5110
SERIES 304 — Profile Projectors

- Large 500mm screen
- Floor model uses a downward illumination system.
- Digital readout protractor screen (including zero-setting, ABS/INC coordinate switching functions) for easy and error-free angle measurement.
- Angled screen allows projected images to be easily traced or compared with a template.
- The oblique surface illumination system provides clear and bright images allowing easy inspection of non-reflective workpieces such as plastic parts or printed materials.

Upward Vertical Projector

The PV-5110 one of the only Upward Vertical Profile Projectors on the market. With its finely tuned optic to view through the bottom of the stage glass, this system is ideal for measuring parts which need to be supported such as rubbers or films. With only the illumination unit mounted overhead, this leaves operators with ample room to position their workpiece.

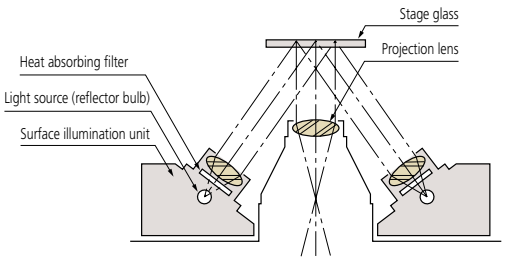


Surface Illumination Units (172-424)

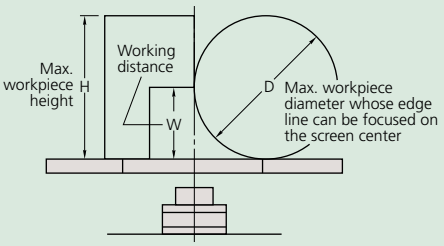
PV-5110

Built-In Oblique Surface Illumination

In addition to traditional couture illumination, this system also offers built-in oblique surface illumination as a standard. Two illumination units (172-424) are placed to the side of the objective which provides bright, even lighting across the surface of the workpiece and stage. It is important to note that the objectives of this system have been finely tuned to measure surface features through the stage glass.



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

Talk to Sales

2D Coordinate Interfacing RETROFITS

Model No.	Description
264-161-13A	QM-DATA200 Arm Type (PJ-H30)
264-161-13A-PV-OPT	QM-DATA200 Arm Type & Optoeye Edge Detection (PV-5110)

KA Counter (174-183A)
(Refer to page H-7 for more details.)

Optional Accessories

172-401: 5X projection lens set
172-406: 5X projection lens
172-402: 10X projection lens set (standard accessory)
172-409: 10X projection lens
172-403: 20X projection lens set
172-411: 20X projection lens
172-404: 50X projection lens set
172-413: 50X projection lens
172-405: 100X projection lens set
172-415: 100X projection lens
172-424: Surface illumination unit (standard accessory)
172-116: Standard scale (50mm)
172-117: Standard scale (2")
172-118: Standard scale (200mm)
172-119: Standard scale (8")
172-161: Reading scale (300mm)
172-329: Reading scale (600mm)
172-162: Reading scale (12")
172-160-2: Green filter (standard accessory)
172-319: Canopy
512305: Halogen bulb (24V, 150W) (standard accessory)

Fixture and Stage Accessories

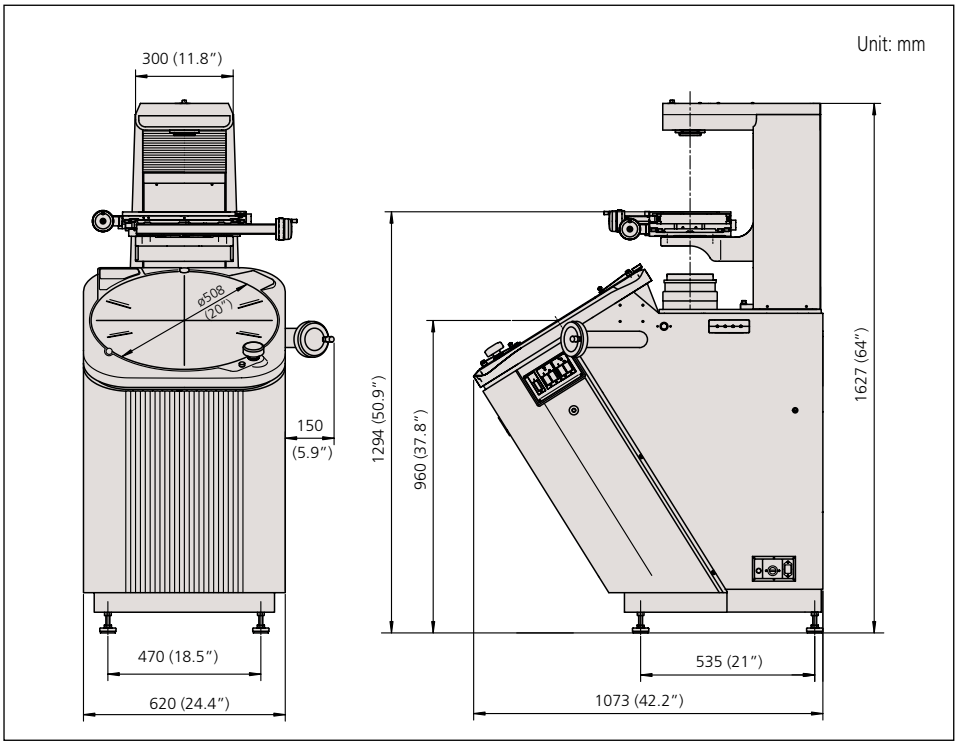
172-196: Rotary table*
(Effective diameter: 4" / 100mm)
172-198: Rotary table with fine feed wheel*
(Effective diameter: 4" / 100mm)
172-604: Swivel center support*
(Max. workpiece dia.: 3.1" / 80mm)
176-107: Holder with clamp*
172-378: V-block with clamp*
(Max. workpiece dia.: 1" / 25mm)
*Stage adapter C (**176-317**) is required.

SPECIFICATIONS

Model No.		PV-5110
Order No.		**304-919-11A***
Projected image		Invert image
Protractor screen	Effective diameter	20" / 508mm
	Screen material	Fine ground glass
	Reference line	Cross hair line
	Screen rotation	±360°, fine feed and clamp
	Angle display (LED)	Resolution: 1' or 0.01°(switchable), Range: ±370°, Functions: ABSOLUTE/incremental mode switching, Zero set
Projection lens		Standard accessory: 10x(172-472), Optional accessories: 5X, 20X, 50X, 100X
Magnification accuracy	Contour illumination	±0.1% or less
	Surface illumination	±0.15% or less
Contour illumination	Light source	Halogen bulb (24V 150W)
	Optical system	Telecentric system
	Functions	2-step 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), 2-step brightness switch, Heat-absorbing filter, Cooling fan
	XY Range	8 x 4" / 200 x 100mm
	Resolution	.0001" / 0.001mm*
	Measuring unit	Built-in Linear scale
	Table size	15 x 9.8" / 380 x 250mm
	Effective table area	10.5 x 6.7" / 266 x 170mm
	Max. workpiece height	See (H) on page I-9
	Max. workpiece load	17.6lbs / 8kg
Power supply		120V AC, 50/60Hz
Mass		467lbs / 210kg
Standard accessories		200x100mm (8" x 4") stage, 10X projection lens set, Surface illumination unit. Counter stand for KA counter, power cord, halogen bulb, fuse, grounding wire, allen wrench

* Counter not included

DIMENSIONS



Accessories for Profile Projectors

SERIES 172 — Profile Projector

Standard Scales

172-116

• Used for checking magnification accuracy.

SPECIFICATIONS

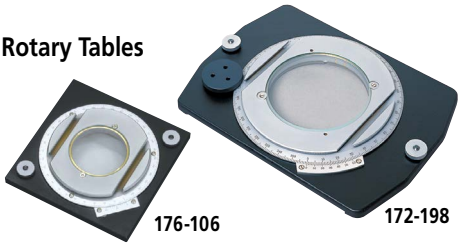
Inch

Graduation	Range	Order No.	Accuracy (20°C)*
0.1"	2"	**172-117**	.00013"

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

Rotary Tables



176-106

172-198

SPECIFICATIONS

Order No.	176-106	172-198
Effective glass dia.	66mm	100mm
Angle reading	6′	2′ (w/ fine adjustment)
Mass	1.7kg	2.5kg

Note: Holder with clamp (**176-107**) can be mounted.

Swivel Center Supports

172-604

SPECIFICATIONS

Order No.	172-604
Max. workpiece dia.	80mm (65mm)*
Max. workpiece length	140mm
Swivel range	±10°
Mass	2.5kg

*When swiveled 10°

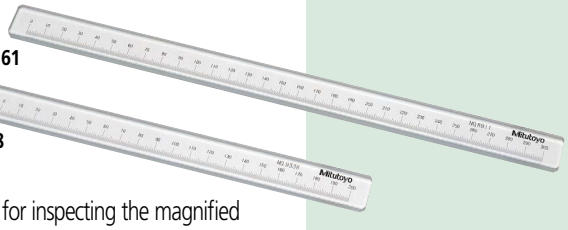
172-603

V-Block with Clamp

SPECIFICATIONS

Order No.	172-603
Max. workpiece dia.	50mm
Width of block	60mm
Mass	1.24kg

Reading Scales



172-161

172-118

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

SPECIFICATIONS

Inch

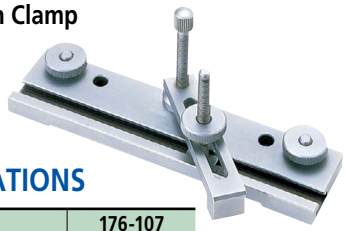
Graduation	Range	Order No.	Accuracy (20°C)*
0.01"	8"	**172-119**	.00071"
0.02"	12"	**172-162**	.00077"

Metric

Graduation	Range	Order No.	Accuracy (20°C)*
0.5mm	200mm	**172-118**	18µm (15+15L/1000)µm
0.5mm	300mm	**172-161**	19.5µm (15+15L/1000)µm
0.5mm	600mm	**172-329**	24µm (15+15L/1000)µm

Holder with Clamp

176-107



SPECIFICATIONS

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

Center Support

172-600

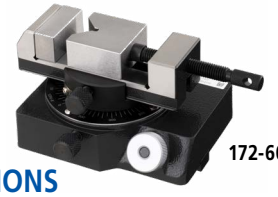
172-601

SPECIFICATIONS

Order No.	172-600
Max. workpiece height	120mm (240mm)*
Mass	3.3kg

*When using a center support riser (**172-601**)

Rotary Vise



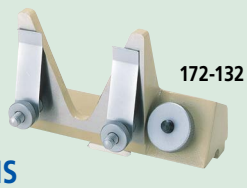
172-602

SPECIFICATIONS

Order No.	172-602
Max. workpiece height	60mm
Width of jaw	40mm
Angle reading	5°
Mass	2.5kg

Need Repair?

Vertical Holder



172-132

SPECIFICATIONS

Order No.	172-132
Mass	1.3kg

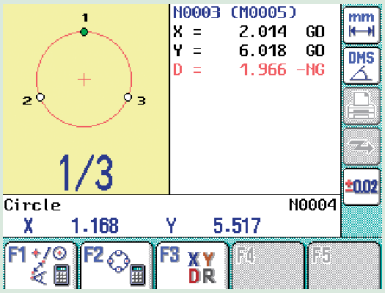
QM-Data Interface Unit

for Profile Projectors

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.

2-D Data Processing Unit QM-Data200

Operation screen (Counter)



OPTOEYE 200 (Automatic Edge Detection)

PJ-H30 with OPTOEYE 200

OPTOEYE 200 and detector mounting plate A

	332-161
Model No.	OPT-200
Illumination	Contour/ surface*1
Detecting directivity	Non-directional
Minimum detectable circle	ø2 mm
Minimum detectable line width	1 mm
Maximum response speed	4.5 mm/s (10 X lens)
Illumination range (Bright)	30 to 2000l
Bright-Dark field difference	20 lX or higher
Repeatability (contour illumination)	σ=1 μm*2

*1, *2 Mitutoyo's test conditions.

Basic Element Measurement

A 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.

B Line
Angle and perpendicularity with the X-axis. (multi-point processing for a maximum of 100 points)

C Circle
Center coordinates, diameter, roundness (multi-point processing for a maximum of 100 points)

D Point-point distance
Distance, coordinates difference, radial difference

F 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)

G Rectangular Hole
Center coordinates, length, width

H Slotted Hole
Center coordinates, length, width, radius of slotted hole

I Intersection Point & Intersecting Angle
Intersection coordinates, intersecting angle, supplementary angle

Pattern Measurement

K Pitch
Point-point distance, difference between coordinates, angle, cumulative distance, cumulative angle

L Linear-point Distance
Perpendicular (shortest) distance

M Line-circle distance
Center-center distance, longest distance, shortest distance

N Circle-circle distance
Center-center distance, longest distance, shortest distance, difference between coordinates, radial difference

SPECIFICATIONS

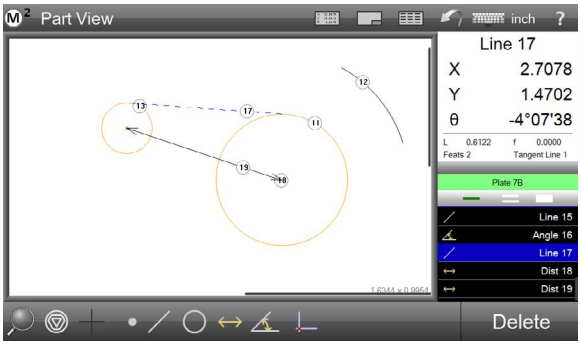
Model No.	QM-Data200	
Order No.	Stand-mount type	Arm-mount type
	264-160-13A	264-161-13A
Display languages (selectable)	Japanese/English/German/French/Italian/Spanish/Portuguese/Czech/ Chinese(simplified/ traditional)/Korean/Turkish/Swedish/Polish/Dutch/Hungarian	
Measured value unit	Length: mm Angle: 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 260x242x310 mm (including the stand)	Approximately 318x153x275 mm (when the arm is in the horizontal posture)
Surface illumination	Halogen bulb (24V 150W)	
Mass	Approximately 2.9 kg	Approximately 2.8 kg
Applicable models	PJ-PLUS Series PJ-H30 Series PV-5110 PH-3515F	PJ-PLUS Series PJ-H30 Series PV-5110*1 PH-3515F*1
Optional accessories	AC adapter, power cable, Easy operation guide	

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

M2 User Interface

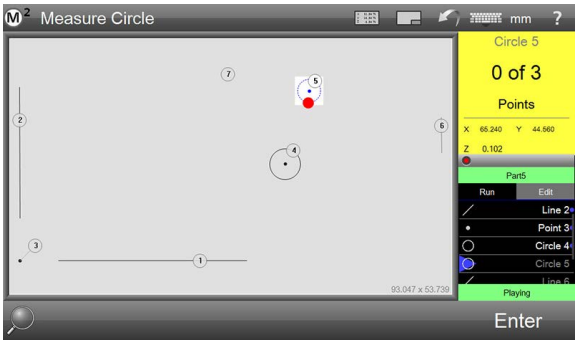
For PH-3515F & PJ-Plus Systems

2-D Coordinate Measurement M2 Hardware & Software Add-on



Graphics-based "Part View"constructions

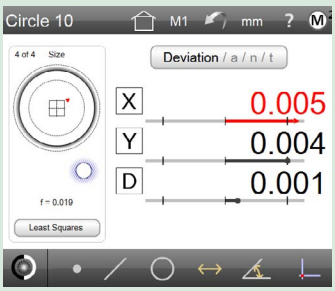
Generate popular construction types, like distances and tangent lines, from within the graphical part view.



Intuitive "Part Playback" / Programmability

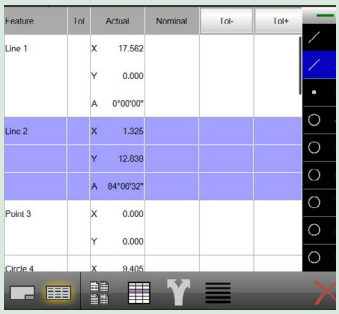
Save your most common part files to be used in playback mode where M2 software will guide you through your predefined procedures to accurately and efficiently inspect your parts.

PH-3515F w/ M2 Software & All-in-One Touchscreen PC **172-868-11A-M2**



Geometric tolerancing

Measure features, set nominals, apply tolerances and view deviation results with only a few quick clicks.



Reports

Flexibility for report contents and formatting allows for full customization of the data format, header information, and header and footer graphics.

Machine & M2 Retrofit Kits Packages

PH-3515F	
172-868-11A-M2	PH-3515F Profile Projector with M2 Hardware/Software and All-in-One Touchscreen Tablet
172-868-11A-M2-EDGE	PH-3515F Profile Projector with M2 Hardware/Software and Touchscreen PC - Automatic EDGE Detection (included)

PJ-PLUS	
302-801-10A-M2	PJ-PLUS 4X4 STAGE - with M2 Hardware/Software and All-in-One Touchscreen Tablet
302-801-10A-M2-EDGE	PJ-PLUS 4X4 STAGE - with M2 Hardware/Software and Touchscreen PC - Automatic EDGE Detection (included)
302-802-10A-M2	PJ-PLUS 8X4 STAGE - with M2 Hardware/Software and All-in-One Touchscreen Tablet
302-802-10A-M2-EDGE	PJ-PLUS 8X4 STAGE - with M2 Hardware/Software and Touchscreen PC - Automatic EDGE Detection (included)

Retrofits

Retrofit Kits	
64PKA-M2-P	RETROFIT KIT - WITH M2 Hardware/ Software and All-in-One Touchscreen Tablet
64PKA-M2-PE	RETROFIT KIT - M2 Hardware/Software and Touchscreen PC - Automatic EDGE Detection (included)

Where to Buy

Kitted Machine & Interface Packages

All-In-One Packages were created for the convenience of our valued customers. These packages help expedite the ordering process as well as ensure all necessary accessories for each of our modular interfacing options.

Model	Interface/DRO	XY Range	Standard Objective	**Package Order No.**	Package Description
PH-3515F	KA Counter	254x152mm	10x	**172-868-11A-KA**	PH-3515F Profile Projector - KA Counter & Tray (Included)
	QM-Data 200	254x152mm	10x	**172-868-11A-QM**	PH-3515F Profile Projector - QM-DATA-200 Arm Type (Included)
	QM-Data 200 & OPTOEYE	254x152mm	10x	**172-868-11A-QM-OPT**	PH-3515F Profile Projector - QM-DATA-200 Arm Type & OPTOEYE (Included)
	M2	254x152mm	10x	**172-868-11A-M2**	PH-3515F Profile Projector - M2 Add-on & Touchscreen PC (Included)
	M2 & AUTO EDGE	254x152mm	10x	**172-868-11A-M2-EDGE**	PH-3515F Profile Projector - M2 Add-on, Touchscreen PC & Automatic EDGE Detection (Included)

Model	Interface/DRO	XY Range	Standard Objective	**Package Order No.**	Package Description
PJ-PLUS	M2	100x100mm	10x	**302-801-10A-M2**	PJ-P1010A Profile Projector - M2 Add-on & Touchscreen PC (Included)
	M2 & AUTO EDGE	100x100mm	10x	**302-801-10A-M2-EDGE**	PJ-P1010A Profile Projector - M2 Add-on, Touchscreen PC & Automatic EDGE Detection (Included)
	M2	200x100mm	10x	**302-802-10A-M2**	PJ-P2010A Profile Projector - M2 Add-on & Touchscreen PC (Included)
	M2 & AUTO EDGE	200x100mm	10x	**302-802-10A-M2-EDGE**	PJ-P2010A Profile Projector - M2 Add-on, Touchscreen PC & Automatic EDGE Detection (Included)

Model	Interface/DRO	XY Range	Standard Objective	**Package Order No.**	Package Description
PV-5110	KA Counter	200x100mm	10x	**304-919-11A-KA**	PV-5110 Profile Projector - KA Counter & Tray (Included)
	QM-Data 200	200x100mm	10x	**304-919-11A-QM**	PV-5110 Profile Projector - QM-DATA-200 Arm Type (Included)
	QM-Data 200 & OPTOEYE	200x100mm	10x	**304-919-11A-QM-OPT**	PV-5110 Profile Projector - QM-DATA-200 Arm Type & OPTOEYE (Included)

QM Data Retrofit Packages

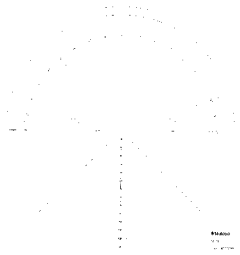
Model	Package Type	**Package Order No.**	Package Description
PH-3515F & PV-5110	KA Counter	**264-161-13A**	QM-DATA200 Arm Type
PJ-H30 Series	QM-DATA 200 Retrofit	**264-161-13A-PJH**	QM-DATA200 Arm Type (PJ-H30)
	QM-DATA 200 & OPTOEYE Retrofit	**264-161-13A-PJH-OPT**	QM-DATA200 Arm Type & OPTOEYE (PJ-H30)
PJ-PLUS Series	QM-DATA 200 Retrofit	**264-161-13A-PJP**	QM-DATA200 Arm Type (PJ-PLUS)
	QM-DATA 200 & OPTOEYE Retrofit	**264-161-13A-PJP-OPT**	QM-DATA200 Arm Type & OPTOEYE (PJ-PLUS)

*Retrofits do not include main unit please reference page 16 for main unit model numbers.

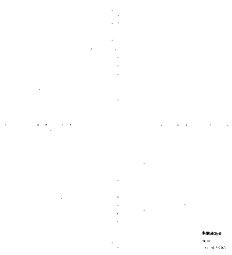
Overlay Chart Set

- 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.

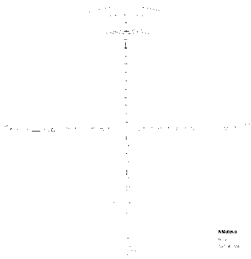
Overlay chart set (12 sheets)
Order No.: 12AAM027



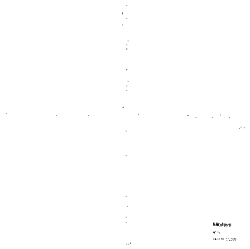
12AAM587
Protractor (1°-grad. radial index) and radius (1mm-radius increment concentric semicircles)



12AAM588
Radius (0.1cm-reading scales and 5mm-radius increment concentric circles)

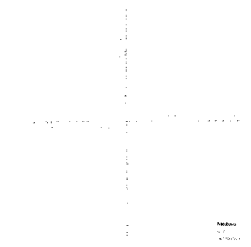


12AAM589
Radius (1X, 10X, 20X, 50X)

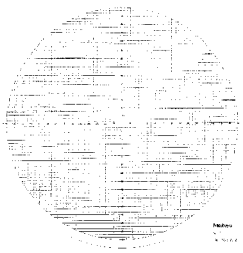


12AAM590
1mm-reading scales (20X, 50X)

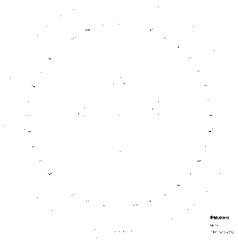
12AAM591
10x10mm sections



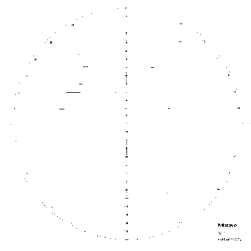
12AAM592
0.5mm-reading scales



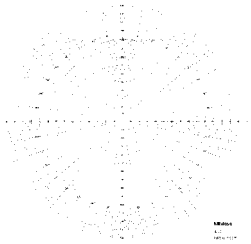
12AAM593
1x1mm sections



12AAM594
Protractor (1°-grad. diametral index)



12AAM595
1mm-reading vertical scale



12AAM596
Protractor (1°-grad. diametral index) and radius (1mm-radius increment concentric circles)

12AAM597
Metric, Unified, and Whitworth screw threads (20X)

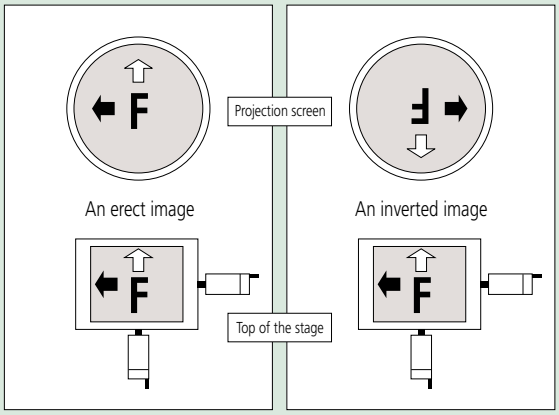
12AAM598
Metric screw thread (100X) and 20° and 14.5° gear teeth (20X)

Get a Quote

Quick Guide to Precision Measuring Instruments

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).



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.)

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

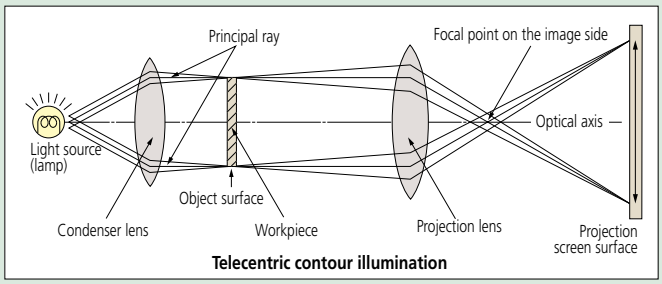
ΔM(%): Magnification accuracy expressed as a percentage of the nominal lens magnification
L : Length of the projected image of the reference object measured on the screen
ℓ : Length of the reference object
M : Magnification of the projection lens

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

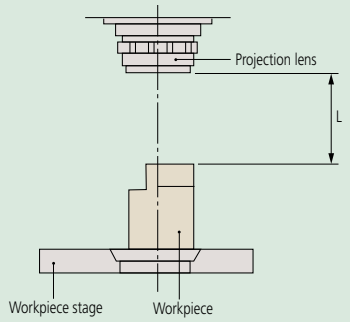
An optical system based on the principle that the primary ray is aligned parallel to the optical axis by placing a lens stop on the focal point on the image side. Its functional feature is that the image will not vary in size even though the image blurs as the object is shifted along the optical axis.
For measuring projectors and measuring microscopes, an identical effect is obtained by placing a lamp filament at the focal point of a condenser lens instead of a lens stop so that the object is illuminated with parallel beams. (See the figure below.)



Telecentric contour illumination

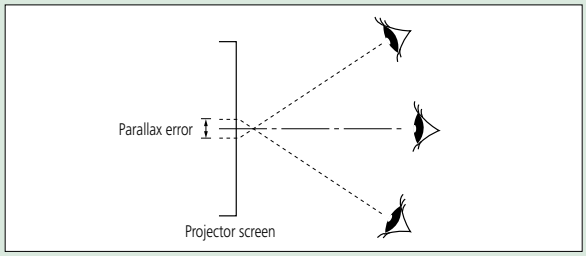
Working distance

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



Parallax error

This is the displacement of an object against a fixed background caused by a change in the observer's position and a finite separation of the object and background planes.



Field of view diameter

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

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

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

Mitutoyo

Microscopes

TM-505B/1005B
SERIES 176 — Toolmakers' Microscopes

The Mitutoyo TM Series is a toolmakers' microscope well suited for measuring dimensions and angles of machined metals. It also can be used to check the shape of screws and gears by attaching an optional reticle. The compact body makes it ideal for use on shop floors with limited space.

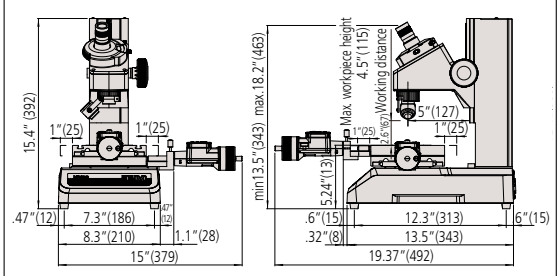
- Angle measurement is performed easily by turning the angle scale disc to align the cross-hair reticle with the workpiece image.
- Illumination intensity can be adjusted.
- Included standard accessories create an overall magnification of 30X. Magnifications can be changed from 20 - 200X by using optional objectives and/or eyepieces.

SPECIFICATIONS

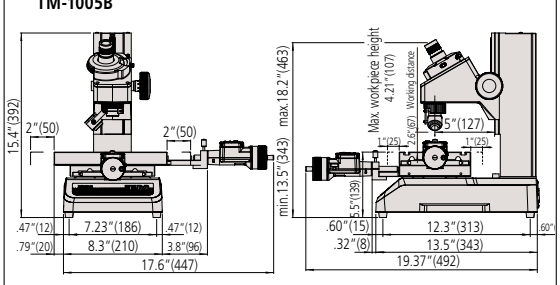
Model No.		TM-505B	TM-A505B	TM-1005B	TM-A1005B
Order No.		**176-818-11A**	**176-820-11A**	**176-819-11A**	**176-821-11A**
Objective lens		Standard accessory: 2X, Options: 5X, 10X			
Microscope head	Maximum height of workpiece	4.53" / 115mm		4.21" / 107mm	
Illumination unit	Transmitted illumination	Stepless brightness adjustment, White LED light source, With green filter			
	Surface illumination	Oblique single-source type, Stepless brightness adjustment, White LED light source			
Cross-travel stage	Measuring range	2" x 2" / 50×50mm		4" x 2" / 100×50mm (An optional 2"/50mm gage block is required to cover full range. A CERA block is recommended.)	
	Table size	6" x 6" / 152×152mm		9.44" x 6" / 240×152mm	
	Usable area of the stage glass	3.8" x 3.8" / 96×96mm		6" x 3.8" / 154×96mm	
Linear measurement method		Micrometer heads optional	Micrometer heads included **(164-164)**	Micrometer heads optional	Micrometer heads included **(164-164)**
Resolution		N/A	.00005"/1µm	N/A	.00005"/1µm
Micrometer head travel range		N/A	2"/50mm	N/A	2"/50mm

DIMENSIONS

TM-505B Unit: Inch(mm)



TM-1005B



Technical Data

Optical tube	• Monocular with 30° depression angle • 90° broken cross-hair reticle (176-126) • Erect image • Diopter adjustable
Eyepiece protractor	• Graduation: 1° • Protractor range: 360° • Minimum reading by vernier: 6'
Eyepiece (176-116)	• Magnification: 15X • Field number: 13
Objective (176-138)	• Magnification: 2X • Working distance: 2.638" (67mm) • Numerical aperture: 0.07
Total magnification	• 30X
Transmitted illumination	• 3W LED • GIF (green) filter • Stepless intensity adjustment
Reflected illumination	• 3W LED • Stepless intensity adjustment • Adjustable position
Power supply	120 V AC, 50/60Hz
Power consumption	4.2W
Mass	TM-505B: Approx. 30.8 lbs. (14kg) TM-1005B: Approx. 33 lbs. (15kg)

Optional Accessories

176-115: 10X eyepiece (field number: 13mm)
176-116: 15X projection lens set (standard accessory)
176-117: 20X eyepiece (field number: 10mm)
176-138: Objective, 2X (W.D. 67mm, N.A. 0.07) (standard accessory)
176-139: Objective, 5X (W.D.: 33mm, N.A.: 0.10)
176-137: Objective, 10X (W.D.: 14mm, N.A.: 0.14)
164-164: Digimatic micrometer head (range: 2"/50mm, reading: .00005"/0.001mm)
152-390: Micrometer head for X-axis (range: 25mm, reading: 0.005mm)
152-389: Micrometer head for Y-axis (range: 25mm, reading: 0.005mm)
611201-531: Rectangular gage block (1")
611202-531: Rectangular gage block (2")
176-204: Dial indicator attachment for Z-axis measurement
959149: SPC cable (2m) for Digimatic micrometer head

Fixture and Stage Accessories

176-106: Rotary table for TM-505B (effective dia.: 66mm)
172-196: Rotary table for TM-1005B (effective dia.: 100mm)
172-604: Swivel center support for TM-1005B (max. workpiece dia.: 3.1" / 80mm)
172-378: V-block with clamp (max. workpiece dia.: 1" / 25mm)
176-107: Holder with clamp

Illumination Units

64AAB214: LED variable ring light
176-208A: LED circular illumination

Reticles

176-126: Broken cross-hair (90°) (standard accessory)
176-111: Concentric circles (up to ø4mm, 0.05mm increment)
176-135: Concentric circle (up to ø.2", .01" increment)
176-114: 60° angle

Protractor eyepiece

LED ring light 64AAB214

Part Number	Description	Sensor Size
64PMI247	MOTICAM S1, 1.2 MEGAPIXEL, 1280x960, USB	1/3"
64PMI249	MOTICAM S3, 3 MEGAPIXEL, 2048 X 1536 PIXELS, USB	1/2.8"
64PMI248	MOTICAM S6, 6 MP, 3072x2048 PIXELS, USB	1/1.8"
64PMI309	MOTICAM BMH4000X, 8 MP HDMI/USB	1/2.8"
64PMI310	MOTICAM BMH4000X, 8 MEGAPIXEL, HDMI / USB, LCD SCREEN	
63AAA060	0.37x C Mount Adapter (TM - Camera Adapter)*1	

*1 Required Item if utilizing C-Mount Camera

Technical Data

Optical tube	• Monocular or Binocular **(Must Choose)** • 25° depression angle • 90° broken cross-hair reticle (12AAG836) • Erect image • TV Mount 50/50
Observation image	• Erect Image
Observation type	• Bright Field
Eyepiece lens	• 10x (Included w/Tube) • 15x (Optional) • 20x (Optional)
Objective	• Magnification: 3X (Included) • W.D.: 3.03" (77mm); N.A.: .09 • Optional: 1x, 5x, 10x, 20x, 50x, 100x
Light source	• Halogen or LED **(Must Choose)** • Adjustable aperture diaphragms • Light intensity infinitely adjustable
Transmitted illumination	• Telecentric illumination
Reflected illumination	• Koehler illumination
Display Unit	
Number of axis	• 2 axes (MF-A Type) or 3 axes (MF-B Type)
Resolution	• 0.0001" / 0.00005" / 0.00001" (0.001 mm / 0.0005 mm / 0.0001 mm)
Functions	•Data output, Axis linear compensation, Metric or English Units, and more
Stage	• Precision travel (2.2+0.02L)µm accuracy • High-accuracy linear glass scales • Quick-release floating mode • Zero-set button
Power consumption	45W LED, 160W Halogen, 120V AC, 50/60 Hz
Mass	• 1010D - 148 lbs. / 67 kg • 2010D - 157 lbs. / 71 kg • 2017D - 326 lbs. / 148 kg • 3017D - 344 lbs./ 156 kg • 4020D - 357 lbs. / 162 kg

LED and Halogen Light Options for Transmitted and Reflected Illumination

(Common to MF D and MF-U D)

LED illumination

Halogen illumination

Available Optical Tubes

(Common to MF D and MF-U D)

Monocular Tube - **176-392**

Binocular Tube - **176-394**

MF
SERIES 176 — Measuring Microscopes

The MF measuring microscopes can be combined with a Mitutoyo vision unit to boost its performance and data management on a PC, further improving measuring efficiency and productivity.

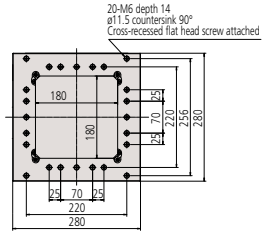
- Observation with a crisp and high-resolution erect image and a wide field of view
- Measuring accuracy that is highest in its class (and conforms to JIS B 7153)
- ML series, high-NA objectives are specially designed for the MF series (long working distance type)
- Illumination unit (reflected/transmitted) selectable from a high-intensity LED or halogen bulb (selection required)
- Variable aperture diaphragm (reflected/transmitted) allows observation measurement while suppressing light diffraction
- Variety of standardized stages in sizes up to 400×200mm
- Quick-release mechanism useful for moving the stage quickly when measuring workpieces that are large in size or quantity
- Coarse/fine feed handles equipped as standard on both sides allow precise focus and observation measurement regardless of handedness
- High-magnification eyepiece observation up to 2000X
- Standard measuring microscope has a wide variety of optional accessories including a vision unit and various digital CCD cameras

MF-B2017D
XY stage travel range: 8 x 6.6" / 200 x 170mm
(with optional binocular tube)

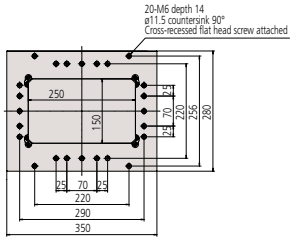
Using optional slide-type nosepiece with 2-lens mount (factory set option)

Selection of XY stage by travel range

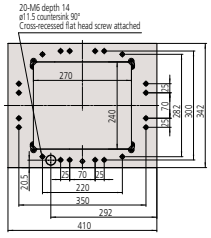
1010D: 4 x 4" / 100 x 100mm



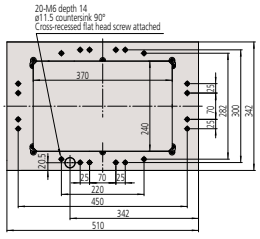
2010D: 8 x 4" / 200 x 100mm



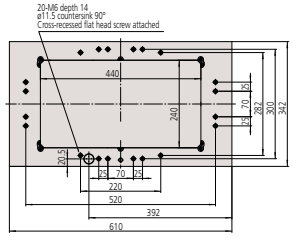
2017D: 8 x 6.7" / 200 x 170mm



3017D: 12 x 6.6" / 300 x 170mm



4020D: 16 x 8" / 400 x 200mm



Microscopes

MF
SERIES 176 — Measuring Microscopes
SPECIFICATIONS

Model No. (XY stage size)		1010D	2010D	2017D	3017D	4020D
Order No.	MF-A	**176-961-13**	**176-962-13**	**176-963-13**	**176-864-10**	**176-965-13**
	MF-B	**176-966-13**	**176-967-13**	**176-968-13**	**176-969-13**	**176-970-13**
XY stage travel range		4 x 4" 100 x 100mm	8 x 4" 200 x 100mm	8 x 7" 200 x 170mm	12 x 7" 300 x 170mm	16 x 8" 400 x 200mm
Z-axis travel range		6" / 150mm		8.7" / 220mm		
Focusing method		Manual focusing (Coarse focusing: 30mm/rev., Fine focusing: 0.2mm/rev.)				
Measurement method		Linear encoder (2-axis model: X / Y-axis, 3-axis model: X / Y / Z-axis)				
Resolution (switchable)		.0001" / .00005" / .00001" (0.001mm / 0.0005mm / 0.0001mm)				
Measuring accuracy (at 20˚C)		XY-axis: (2.2+0.02L) µm, L = Measuring length (mm) when not loaded, JIS B 7153				
Indication accuracy (at 20˚C)		Z-axis: (5+0.04L) µm, L = Measuring length (mm), (MF-B type)				
Floating function		X and Y axes with Quick-release mechanism				
XY stage top size		11 x 11" 280 x 280mm	14 x 11" 350 x 280mm	16.1 x 13.4" 410 x 342mm	20.07 x 13.4" 510 x 342mm	24" x 13.4" 610 x 342mm
Effective glass size		7 x 7" 180 x 180mm	10 x 6" 250 x 150mm	10.6 x 9.4" 270 x 240mm	14.5 x 9.4" 370 x 240mm	17.3 x 9.4" 440 x 240mm
Swivel function		—		±5˚ (left)		±3˚ (left)
Max. stage loading		22lbs / 10kg		44lbs / 20kg		33lbs / 15kg
Max. workpiece height		6" / 150mm		8.7" / 220mm		

MF Selection of Machine Type (must select)

↓	1010	2010	2017	3017	4020	Counter	Motorized stage	Optics
A	**176-961-13**	**176-962-13**	**176-963-13**	**176-864-10**	**176-965-13**	X,Y	Manual	BF
B	**176-966-13**	**176-967-13**	**176-968-13**	**176-969-13**	**176-870-13**	X,Y,Z	Manual	BF
J	-	-	**176-891-13**	**176-892-13**	**176-893-13**	X,Y,Z	Z only	BF

Example: MF-A1010D results in part number 176-861-10

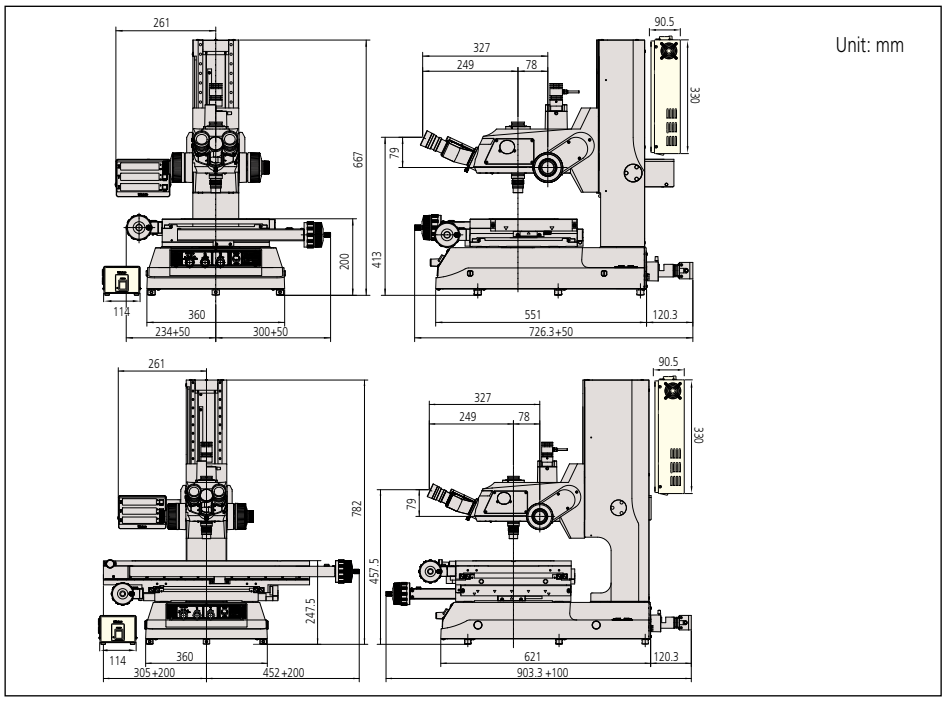
Illumination Unit (must select)

Applicable Illumination Unit	LED	Halogen
Order No.	176-449A	176-451A

Eye Tube Selection (must select)

Monocular with 10X eyepiece	176-392
Binocular with 10X eyepiece	176-394

DIMENSIONS



Optional Accessories

176-392: Monocular tube with 10X eyepiece
176-394: Binocular tube with 10X eyepiece set
378-866: 10X eyepiece set (view field dia.: 24mm)
378-858: 20X eyepiece set (view field dia.: 12mm)
375-043: Protractor eyepiece (10X)
176-313-11: Digital protractor eyepiece (10X)
375-036-2: 1X objective (W.D.: 61mm, N.A.: 0.03)
375-037-1: 3X objective (W.D.: 77mm, N.A.: 0.09) (std. accessory)
375-034-1: 5X objective (W.D.: 61mm, N.A.: 0.13)
375-039: 10X objective (W.D.: 51mm, N.A.: 0.21)
375-051: 20X objective (W.D.: 20mm, N.A.: 0.42)
375-052: 50X objective (W.D.: 13mm, N.A.: 0.55)
375-053: 100X objective (W.D.: 6mm, N.A.: 0.7)
12AAA645: GIF filter (transmitted / surface) (std. accessory)
12AAA646: LB80 color filter (transmitted / surface)
375-054: 0.5X camera adapter (with C-mount adapter)
970441: C-mount adapter
513667: Halogen bulb (12V, 50W)
12BAB345: Halogen bulb (long life type, 12V, 50W)
176-308: Vibration damping stand
176-309: Mounting stand
375-056: Stage micrometer
12AAA846: Foot switch

Illumination Units

176-367-2A: LED ring illuminator
176-387A: Twin fiber-optics illuminator

Fixture and Stage Accessories

176-107: Holder with clamp
172-378: V-block with clamp (max. workpiece dia.: 1" / 25mm)
172-604: Swivel center support[1] (max. workpiece dia.: 3.1" / 80mm)
176-305: Rotary stage with fine feed knob for 1010D/2010D models
176-306: Rotary stage with fine feed knob for 2017D/3017D/4020D models

[1] Fixture mount adapter (**176-310**) is required for 2010D models.
Fixture mount adapter (**176-304**) is required for 2017D/3017D/4020D models.

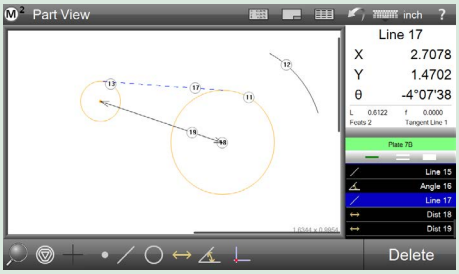
QM-Data200
2-D data processing unit
264-160-13: Stand-Mount Type
12AAA807: Connecting cable set

Focus pilot FP-05
Focus assisting system

Vision Unit
PC-based vision measuring system
359-763

MF Motorized
SERIES 176 — Motorized Type Measuring Microscopes

- Motorized model of the MF Series. The Z-axis is motorized, and the stage can be operated using a remote box.
- Using the optional vision unit enables the image AF function.
- Illumination unit (reflected/transmitted) can be selected from a high-intensity LED or halogen bulb (selection required).
- Variable aperture diaphragm (reflected/transmitted) allows observation measurement while suppressing light diffraction.
- A wide variety of optional accessories are offered.
- ML series, high-NA objectives that are specially designed for the MF series (long-working distance type).
- High-magnification observation up to 2000X.



M2 Software & Hardware
2D Coordinate Measurment Interface
64PKA-M2-MF - MF/MFU M2 Retrofit Kit

MF-J2017D
* The binocular tube, eyepieces, and LED illumination unit are optional accessories.

SPECIFICATIONS

	Model No.	MF-J2017D	MF-J3017D	MF-J4017D
	Order No.	**176-891-13**	**176-892-13**	**176-893-13**
Observation image		BF (Bright field)/Erect image		
Eyepiece	Diopter adjustment	10X (field number: 24), 15X, 20X Note: Monocular unit: a 10X eyepiece (standard accessory), Binocular tube: two 10X eyepieces (standard accessory)		
Objective lens		ML series 3X objective lens (standard accessory), 1X, 5X, 10X, 20X, 50X, 100X		
Illumination unit (One of the two options must be selected.)	LED illumination unit	Transmitted illumination: Telecentric system, Built-in aperture diaphragm, White LED light source, stepless light intensity control, with cooling fan Reflected illumination: Koehler illumination, Variable aperture diaphragm mechanism, White LED light source, stepless light intensity control Control unit: Power ON/OFF switch (main switch), 100 - 240V AC power input connector		
	Halogen illumination unit	Transmitted illumination: Telecentric system, Built-in aperture diaphragm, Halogen bulb (12V, 50W), stepless light intensity control, with cooling fan Reflected illumination: Koehler illumination, Variable aperture diaphragm mechanism, Halogen bulb (12V, 50W), stepless light intensity control, with cooling fan Control unit: Power ON/OFF switch (main switch), 100 - 240V AC power input connector		
Vision AF*1		Available Option		
XY-axis Vision	Measuring range	200×170mm	300×170mm	400×200mm
Z-axis	Measuring range	220mm		
Measuring accuracy*2	(When no load is put on the X- or Y-axis)	(2.2+0.02L) µm L: Measuring length (mm)		
Digital counter	Resolution	1/0.5/0.1µm .0001"/.00005"/.00001" switchable		

*1: Vision Unit **359-763** and an image AF cable **12AAN358** are sold separately.
*2: Measuring method complies with JIS B7153.

Bulb replacement for transmitted/reflected illumination Standard: Halogen bulb (12V, 50W) (**No.513667**)
Bulb life: 1,100 hours

Need Support?

Microscopes

MF-U
SERIES 176 — High-power Multi-function Measuring Microscopes

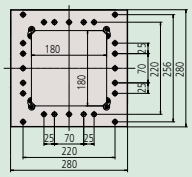
MF-UB3017D
XY stage travel range: 12 x 6.7″ / 300 x 170mm
(with optional turret, objective and fiber illumination)

- Observation with a clear and flareless erect image and a wide field of view
- Measuring accuracy that is highest in its class (and conforms to JIS B 7153)
- Proven high-NA objectives from the FS optical system (long-working distance type)
- Integration of metallurgical and measurement microscope functions provides high-resolution observation and high-accuracy measurement solution
- Illumination unit (reflected/transmitted) selectable from a high-intensity LED or halogen bulb (required)
- Variable aperture diaphragm (reflected/transmitted) allows for contrast adjustment
- Variety of standardized stages in sizes up to 400 × 200 mm
- Quick-release mechanism useful for moving the stage quickly when measuring workpieces that are large in size or quantity
- High-magnification eyepiece observation up to 4000X

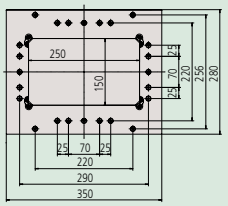
Technical Data

Observation image:	**Erect image**
Optical tube:	Siedentopf type (pupil distance adjustment: 51 - 76mm), 1X tube lens, Binocular tube (depression: 30°), Reticle projection method, with TV mount, Optical path ratio (eyepiece/TV mount: 50/50)
Eyepiece lens:	10X (field No.: 24mm), Optional: 15X, 20X
Turret (optional):	Manual or power
Objective (optional):	M / BD Plan Apo objective from 1X to 200X
Transmitted illumination	
• Light source:	Halogen bulb (12V, 50W) or LED
• Optical system:	Telecentric illumination with adjustable aperture diaphragms
• Functions:	Light intensity adjustable, Non-stepped brightness adjustment
Surface illumination	
• Light source:	Optional halogen illumination unit (fiber-optic cold light illumination) or LED
• Optical system:	Koehler illumination with adjustable aperture diaphragms
• Functions:	Light intensity adjustable, Non-stepped brightness adjustment
Display unit:	
• No. of axis:	2 axes or 3 axes
• Resolution:	.0001″ / .00005″ / .00001″ / 0.001mm / 0.0005mm / 0.0001mm
• Functions:	Zero-setting, Direction switching, Data output (via RS-232C interface)
Power supply:	120V AC, 50/60Hz
Mass:	148lbs/67kg (1010D) / 157lbs/71kg (2010D) / 326lbs/148kg (2017D) / 344lbs/156kg (3017D) / 357lbs/162kg (4020D)

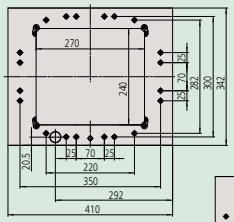
Selection of XY stage by travel range



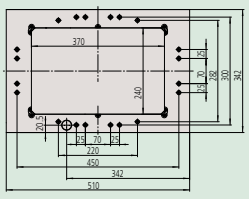
1010D:
4 x 4″ / 100 x 100mm



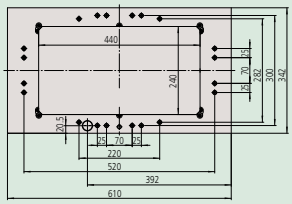
2010D:
8 x 4″ / 200 x 100mm



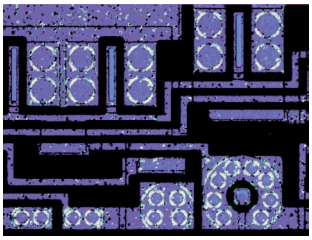
2017D:
8 x 6.7″ / 200 x 170mm



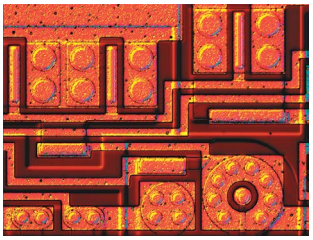
3017D:
12 x 6.6″ / 300 x 170mm



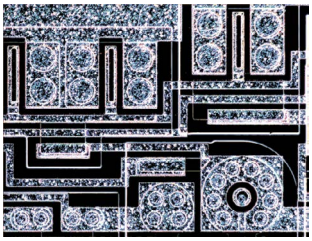
4020D:
16″ x 8″ / 400 x 200mm



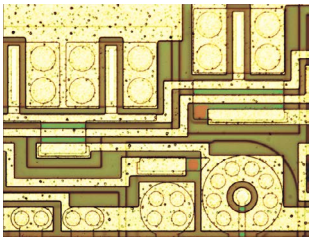
Polarized light observation:
Observing only the filtered light that vibrates in one direction. Used for observing materials with special optical characteristics, such as mineral and liquid crystal.



Differential interference contrast (DIC) observation:
Effective in detecting fine scratches and steps on the surface of metal, liquid crystal, and semiconductors.



Dark field (DF) observation:
Observing only the scattered light by shutting down the direct light to the objectives. The scratches and dust that cannot be viewed in the bright view field can be observed by this method in high-contrast.



Bright field (BF) observation:
Most common method of observation. Observing directly the light reflected from the surface of the workpiece.

Optional Accessories

378-866: 10X eyepiece set (view field dia.: 24mm) (standard accessory)
378-858: 20X eyepiece set (view field dia.: 12mm)

Turret (Nosepiece) **must select**
378-018: Adjustable manual BF turret (4 port)
378-216A: Adjustable power BF turret (5 port)
176-211: Adjustable manual BF/DF turret (4 port)
176-212-11: Adjustable power BF/DF turret (4 port)

Objectives

See page I-28 for objective selection

Manual and Power Turrets

Filters

378-092: Polarization unit
12AAA645: GIF filter (standard accessory)
12AAA646: LB80 color filter (for halogen illuminator, (**176-448A**)

Camera Mounts

375-054: 0.5X camera adapter (with C-mount adapter)
970441: C-mount adapter

Bulbs

513667: Halogen bulb (12V, 50W)
12BAB345: Halogen bulb (long life type, 12V, 50W)
517181: Halogen bulb (12V, 100W)

Illumination Units

176-316A: Halogen illumination unit (12V, 150W)
176-387: Twin fiber-optics illuminator

Fixture and Stage Accessories

176-107: Holder with clamp
172-378: V-block with clamp (max. workpiece dia.: 1" / 25mm)
172-604: Swivel center support* (max. workpiece dia.: 3.1" / 80mm)
176-305: Rotary stage with fine feed knob for 1010D/2010D models
176-306: Rotary stage with fine feed knob for 2017D/3017D/4020D models

*Fixture mount adapter (**176-310**) is required for 2010D models.
Fixture mount adapter (**176-304**) is required for 2017D/3017D/4020D models.

Misc.

176-308: Vibration damping stand
176-309: Mounting stand
375-056: Stage micrometer
937179T: Foot switch

Reticle See page I-21

MF-U
SERIES 176 — High-power Multi-function Measuring Microscopes

SPECIFICATIONS

Model No. (XY stage size)		1010D	2010D	2017D	3017D	4020D
Order No.	MF-UB	**176-976-13**	**176-977-13**	**176-878-10**	**176-879-10**	**176-980-13**
	MF-UD	**176-886-10**	**176-887-10**	**176-888-10**	**176-889-10**	**176-990-13**
XY stage travel range		4 x 4" 100 x 100mm	8 x 4" 200 x 100mm	8 x 6.7" 200 x 170mm	12 x 6.7" 300 x 170mm	16 x 8" 400 x 200mm
Z-axis travel range		6" / 150mm		8.7" / 220mm		
Focusing method		Manual focusing (coarse focusing: 10mm/rev., fine focusing: 0.1mm/rev.)				
Measurement method		Linear encoder (2-axis model: X / Y-axis, 3-axis model: X / Y / Z-axis)				
Resolution (switchable)		.0001" / .00005" / .00001" (0.001mm / 0.0005mm / 0.0001mm)				
Measuring accuracy (at 20˚C)		XY-axis: (2.2+0.02L) µm, L = Measuring length (mm) when not loaded, JIS B 7153				
Indication accuracy (at 20˚C)		Z-axis: (5+0.04L) µm, L = Measuring length (mm)				
Floating function		X and Y axes with Quick-release mechanism				
XY stage top size		11 x 11" 280 x 280mm	14 x 11" 350 x 280mm	16 x 13.6" 410 x 342mm	20 x 13.6" 510 x 342mm	24 x 13.6" 610 x 342mm
Effective glass size		7.1 x 7.1" 180 x 180mm	10 x 6" 250 x 150mm	10.6 x 9.6" 270 x 240mm	14.6 x 9.6" 370 x 240mm	17.3 x 9.6" 440 x 240mm
Swivel function		—		±5˚ (left)		±3˚ (left)
Max. stage loading		22lbs / 10kg		44lbs / 20kg		33lbs / 15kg

Selection of machine type

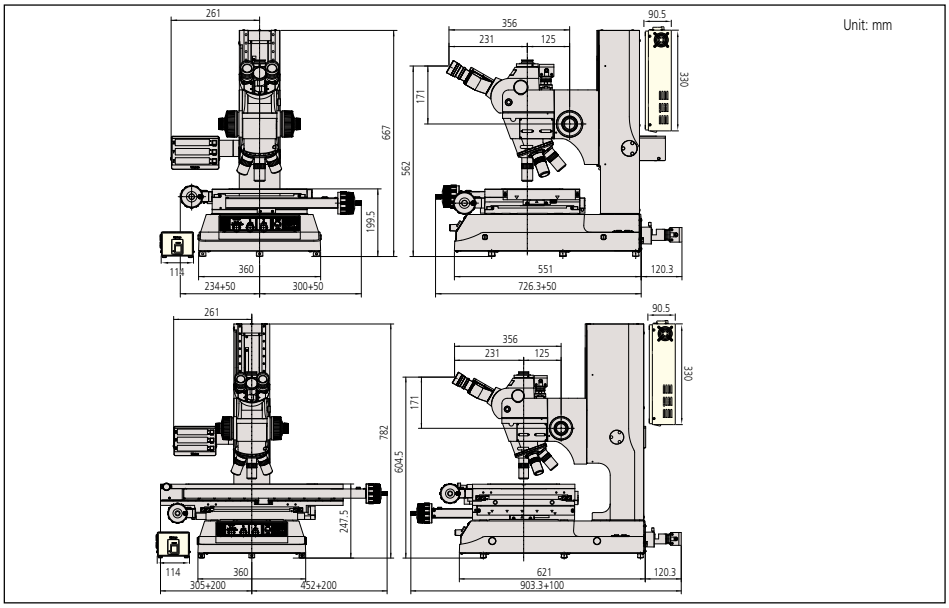
Machine type	MF-UB	MF-UD
Observation type	Bright field (BF)	Bright field / Dark field (BF/DF)
Measurement system	X, Y and Z-axis (3 axes)	X, Y and Z-axis (3 axes)

Illumination Unit (must select LED or Halogen illumination unit)

Applicable Illumination Unit	LED	Halogen
Order No.	**176-446A** (transmitted & reflected)	**176-452A** (transmitted)
		176-316A (reflected)

Note: illumination unit not included. If halogen transmitted illumination is selected, then 176-316A must be chosen.

DIMENSIONS



Microscopes

MF-U Motorized
SERIES 176 — Motorized-type Universal Measuring Microscopes

- Motorized model of the MF-U Series. The Z-axis is motorized and can be operated using a remote box.
- Using the optional vision unit enables the image AF function.
- Illumination unit (reflected/transmitted) can be selected from a high-intensity LED or halogen bulb (required).
- Variable aperture diaphragm (reflected/ transmitted) allows observation measurement while suppressing light diffraction.
- A wide variety of optional accessories are offered.
- Proven high-NA objectives from the FS optical system (long working distance type).
- Integration of metallurgical and measurement microscope functions provide high-resolution observation and a high-accuracy measurement solution.
- High-magnification observation up to 4000X.

MF-UJ2017D
The turret, objectives, and LED illumination unit are sold separately.

MF-U Selection of Machine Type

↓	2017	3017	4020	Counter	Motorized stage	Optics
J	176-894-13	176-895-13	176-896-13	X,Y,Z	Z only	BF
K	176-897-13	176-898-13	176-899-13	X,Y,Z	Z only	BF/DF

SPECIFICATIONS

BF (Bright field)	Model No.	**MF-UJ2017D**	**MF-UJ3017D**	**MF-UJ4020D**
	Order No.	**176-894-13**	**176-895-13**	**176-896-13**
BD (Bright / Dark field)	Model No.	**MF-UK2017D**	**MF-UK3017D**	**MF-UK4020D**
	Order No.	**176-897-13**	**176-898-13**	**176-899-13**
Observation image		BF (Bright field), DF (Dark field) , Polarization, Differential Interference Contrast (DIC) / Erect image		
Eyepiece	Diopter adjustment	10X (standard accessory) (Field number: 24), 15X, 20X		
Objective lens (optional)	BF (Bright field)	M Plan Apo, M Plan Apo HR, M Plan Apo SL, G Plan Apo		
	BD (Bright / Dark field)	BD Plan Apo, D Plan Apo HR, BD plan Apo SL		
Illumination unit (One of the two options must be selected.)	LED illumination unit	Transmitted illumination: Telecentric system, Built-in aperture diaphragm, White LED light source, stepless light intensity control, with cooling fan Reflected illumination: Koehler illumination, Variable aperture diaphragm mechanism, White LED light source, Non-step light intensity control Control unit: Power ON/OFF switch (main switch), 100 - 240V AC power input connector		
	Halogen illumination unit	Transmitted illumination: Telecentric system, Built-in aperture diaphragm, Halogen bulb (12V, 50W), stepless light intensity control, with cooling fan Reflected: BF/BD Kohler illumination with adjustable aperture diaphragm, 12V100W or 12V15W halogen lamp (selectable), external fiber illumination, stepless brightness adjustment Control unit: Power ON/OFF switch (main switch), 100 - 240V AC power input connector		
Vision AF *1		3		
XY-axis	Measuring range	8×6.7" / 200×170mm	12×6.7" / 300×170mm	16×8" / 400×200mm
Z-axis	Measuring range	8.7" / 220mm		
Measuring accuracy	(When no load is put on the X- or Y-axis)	(2.2+0.02L) µm L: Measuring length (mm)		
Digital counter	Resolution	1/0.5/0.1µm .0001"/.00005"/.00001" switchable		

*1: Vision unit and an image AF cable are separately required.
*2: Measuring method complies with JIS B7153.

Bulb replacement for transmitted illumination Standard: Halogen bulb (12V, 50W) (**No.513667**), Bulb life: 1,100 hours
For replacement for reflected illumination (from separate light source) Standard: Halogen bulb (12V, 100W) (**No.517181**),
High-intensity bulb (12V, 100W) (**No.12BAD602**)
*At the time of purchase, a standard bulb and a high-intensity bulb are provided. (Only for the reflected illumination models.)

Need Service?

Accessories for Measuring Microscope

Stage Micrometer

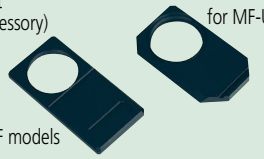
SPECIFICATIONS

Order No.	375-056
Range	1mm
Graduations	0.01mm
Accuracy (at 20˚C)	(1+L)µm, L = Measuring length (mm)
Dimensions (WxD)	3" x 1" / 76 x 26mm
Mass	16g

Optional Reticles

12AAG838 (12AAG878): Cross-hair (7µm width)
12AAG836 (12AAG877)*: Cross-hair (5µm width)
12AAG873 (12AAG876): Cross-hair (3µm width)
12AAG839 (12AAG879): Cross-hair and 45˚ angle
12AAG840 (12AAG880): Broken cross-hair and 60˚ angle
12AAG842: 20mm scale (0.1mm reading)
12AAG843: Concentric circle (ø1.2 - ø18mm)
12AAG844: 10mm scale (0.1mm reading)
12AAG854: Concentric circle (ø.01" - ø.2")
( ): for MF-U models,
* Standard accessory

Reticle mount
(standard accessory)



for MF-U models

for MF models

Cross-hair and 90˚ angle
(standard accessory)

Focus Pilot FP-05

- By installing this system on the camera mount of an MF series measuring microscope and projecting the focusing chart onto the workpiece surface, the focal point can be detected with high accuracy and high repeatability.
- The brightness of the chart can be adjusted.
- A wide view field observation on the monitor is made possible with the use of a CCD camera (C-mount adapter is included.)
- Four types of chart patterns are available.* The pattern should be selected in accordance with the type of workpiece surface texture.

* Factory installed option

Concentric circle

Slit

SPECIFICATIONS

Order No.	375-057-11	375-058-11	375-067-11	375-068-11
Applicable microscopes	MF D models		MF-U D models	
Light source	Green LED	Red LED	Green LED	Red LED
Magnification	0.5X, Accuracy: 0.1%**			
Camera adapter	C-mount (provided)			
Applicable CCD camera	Up to 2/3-inch			
Mass	4lbs / 1.8kg			

**Within 2/3 area from the center of view field

Manual and Power Turrets

SPECIFICATIONS

Order No.	176-211	378-018	176-212-11	378-016A	378-216A
Observation type	BD	BF	BD	BF	BF
No. of objective mounts	4-mount	4-mount	4-mount	4-mount	5-mount
Driving method	Manual		Motor		
Dimensions (W x D x H)	—	—	Turret: 6.5 x 2.6 x 5.4" 164 x 65 x 137		
			Control Box: 4.1 x 3 x 7.6" 108 x 72 x 193		

Accessories for Measuring Microscope

Twin fiber-optics illuminator

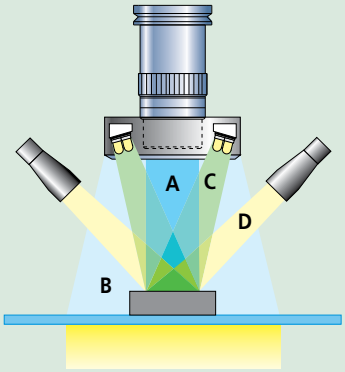
SPECIFICATIONS

Order No.	176-387
Applicable microscopes	MF, MF-U models
Length of fiber cable	28" / 700mm
Light source	Halogen bulb (12V, 100W) (**517181**: halogen bulb)
Dimensions (W x D x H)	Light unit: 9.3 x 3 x 4.7" 235 x 76 x 120mm

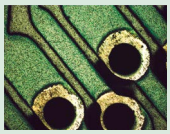
LED Ring Illuminator

SPECIFICATIONS

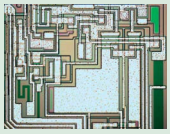
Order No.	176-367-2A
Applicable microscopes	MF models with 1X/3X/5X/10X objective
Light source	White LED
Length of LED cable	59" / 1500mm



A: Vertical surface illumination (Halogen)

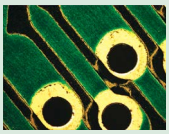

PCB


HDD suspension


IC circuit

B: Ring fiber optics illumination


Flexible PCB


PCB


Electric parts

C: LED ring illumination


HDD suspension


PCB


Black resin molded parts

D: Twin fiber-optics illumination

IC package


Garnet


PCB

Accessories for Measuring Microscope

QM-Data200
SERIES 264 — 2-D Data Processing Unit

Technical Data

Resolution:	0.0001mm
Program functions:	Part program creation, execution, editing
Statisical processing:	Number of data, maximum value, minimum value, mean value, standard deviation, range, histogram
Element memory:	Maximum of 1000 elements
Element recall:	Point, line, circle, distance, ellipse, rectangular hole, slotted hole, intersection and intersecting angle
Element key-in:	Point, line, circle
Display system:	Monographic LCD (320 x 240 dots, with back light)
Measurement result file output:	RS-232C/USB output (CSV format, MUX-10F format)
Display language:	Japanese/English/German/ French/Italian/Spanish/ Portuguese/Swedish/Polish/ Dutch/Hungarian
Data input:	RS-232C/USB, X/Y/Z-axis signal, Footswitch
Data output:	RS-232C/USB
Power supply	120V AC, 50/60Hz
Mass	2.2kg (stand-mount type)
2.1kg (arm-mount type)	

QM-Data200
Order No.: 264-160-13A (stand-mount type)
Order No.: 264-161-13A (arm-mount type)

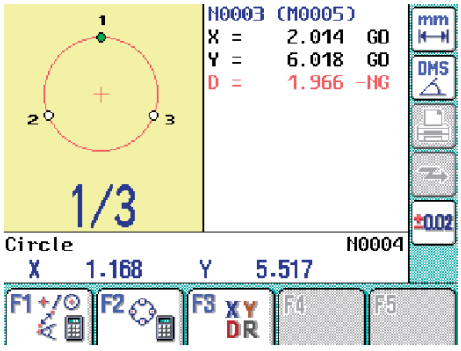
The QM-Data200 is a geometric readout/ analysis unit for optical instruments like profile projectors. This features powerful 2-D coordinate measurement capabilities with unmatched simple key operation. The QM-Data200 improves operator productivity, minimizes errors, and saves measurement time and production cost.

- Various graphic displays on the large colored LCD screen for easy measurement operations.
- One-key operation for combined measurements that are often used (circle-circle distance, etc.)
- The AI measurement function (automatic identification of measuring item) eliminates switching between the measurement command keys.
- Equipped with the measurement procedure teaching function and the measuring position navigation in Repeat mode.
- The user menu function allows users to register measurement commands or part programs to create custom menus.
- Tolerance zone measurement of data processing results and various statistical processing for each item is available.
- Measurement results output to "MS-Excel"in spreadsheet (CSV) format.
- Measurement procedures and results can be saved using a USB Drive.
- Two models available: a stand-alone type with tilt system and a flexible-arm type that can be mounted on a profile projector.

QM-Data 200
Stand-mount type

Intuitive panel design

The QM-Data200 employs Geometry Keys to accelerate the measurement process. The probing routine of standard geometric features and combinations are designed with Geometry Keys on the front panel. Click the key you need and capture features to complete the measurement quickly and accurately. This improves operator productivity, reduces errors, and saves operation time and cost.



Graphic display

Measurement information and data are visualized on the back-lit colored LCD with graphical interfaces. The geometric feature selected is displayed with the probing navigator. The measurements map and blink indication show the probing points and sequences. This improves operation accuracy and reduces errors and time.

Need Integration Help?

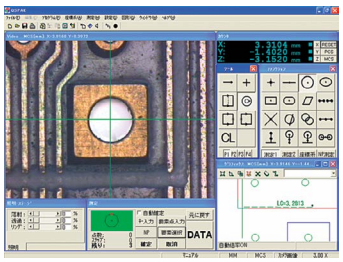
Accessories for Measuring Microscope

Vision Unit

SERIES 359 — Vision System Retrofit for MF and MF-U Microscopes

- The automatic edge-detection tools and various macro icons allow measurement in one easy step.
- The graphics and measurement navigation functions facilitate operation.
- Image data input/storage function.
- Measurement results are output in CVS format. This lets the user generate an inspection table in MS-Excel®.
- Allows the tolerance zone measurement of measurement results and various types of statistical processing for each item.
- Combined use with the focus pilot provides high-accuracy height measurements. (Patent pending)
- A series of measuring operations can be performed using just one screen display.
- The auto-brightness control function reproduces the type and degree of illumination required. (This function is limited to the MF/MF-U series.)

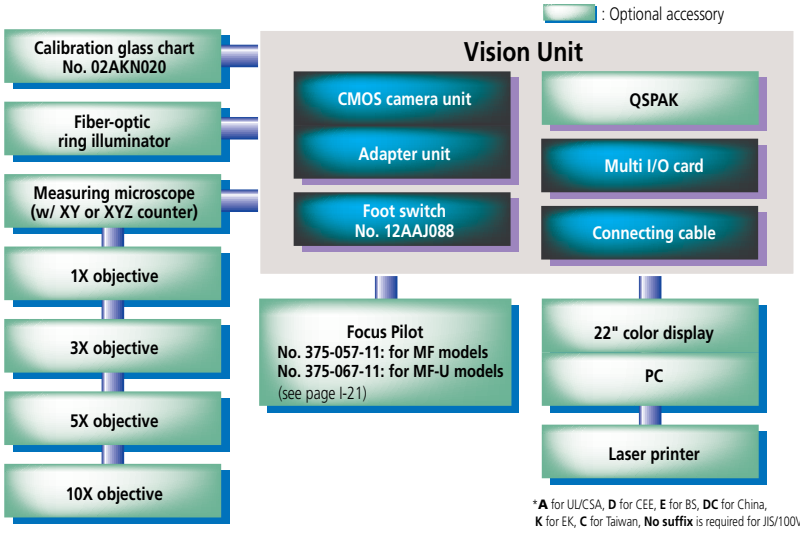
QSPAK Measurement Window



The PC system, QSPAK software and microscope are optional.

Vision Unit
No.: 359-763 (for MF D)

: Optional accessory



*A for UL/CSA, D for CEE, E for BS, DC for China, K for EK, C for Taiwan, No suffix is required for JIS/100V

SPECIFICATIONS

Projected Image	Inverted Image
Onscreen Magnification	19x-1900x (22" Monitor)
Camera Unit	
Image Sensor Size	1/2" Color CMMOS
Image Sensor Resolution	3 MP
Interface	USB 2.0
Dimensions (WxDxH)	2.28 x 2.32 x 3.27" 58 x 59 x 83mm
Adapter Unit	
Measurement Software	QSPak VUE (optional)
Dimensions (DXH)	1.77 x 4.84" / 45 x 123mm
Magnification	0.5x
Optional Accessory:	Foot Switch **(12AAJ088)**

QSPAK, optional software

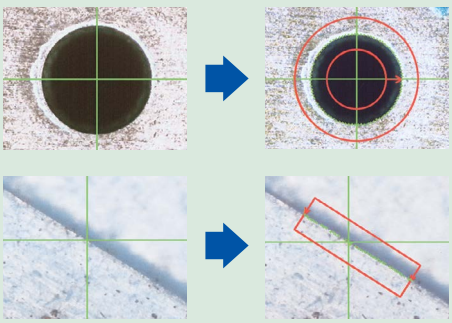
For observation/comparison of form
- Template matching function
- Manual pattern matching function

For simple measurement
- One-click edge detection tool function
- Smart tool function
- User macro function

For repeated measurement/ auto-measurement
- Quick navigation function
- Playback function
- Graphic function
- External data output function
- Statistical calculation function

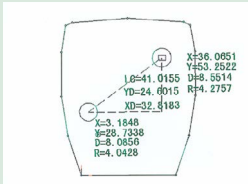
One-click Edge Detection

By clicking the mouse near the edge of a workpiece, QSPAK automatically scans the edge and detects it, showing its coordinates. This function also works with the point tool, box tool, circle tool and auto-focus tool.



Graphic Window

The measurement results and measured elements are plotted in the graphic window in real-time. By using this function, the user can check the current measuring position at a glance. The graphic window can be used for geometrical calculation.



Accessories for Measuring Microscope

FS-70
SERIES 378 — Microscope Unit for Semiconductor Inspection

- The optical system that was developed for the best-selling FS60 models was further enhanced for the FS70 models. It is ideal as a microscope unit of a prober station for semiconductors. (All models CE marked.)
- The FS70L supports three types of YAG laser wavelength ranges (1064nm, 532nm and 355nm), while the FS70L4 supports two types of wavelength ranges (532nm and 266nm), thus expanding a scope of laser applications, allowing laser-cutting of thin films used in semiconductors and liquid crystal substrates. However, Mitutoyo assumes no responsibility for the performance and/or safety of the laser system used with Mitutoyo microscopes. Careful examination is recommended in selecting a laser-emission unit.
- Bright field, differential interference contrast (DIC) and polarized observations are optional with FS70Z and FS70. The FS70L and FS70L4 do not support the DIC method.
- By employing an inward revolver, the long working distance objectives provide excellent operability.
- An ergonomic design with superb operability: the FS70 employs the erect-image optical system (the image in the field of view has the same orientation as the specimen) and enlarged fine focus adjustment wheel with rubber-grip coarse adjustment knob.


FS70Z


FS70L

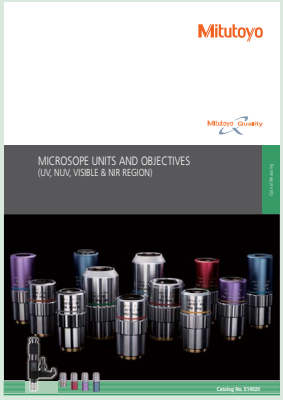

FS70L4

Technical Data

Focus Adjustment Method:	With concentric coarse and fine focusing wheels (right and left)
Range:	50mm travel range 0.1mm/rev. for fine adjustment, 3.8mm/rev. for coarse adjustment
Trinocular tube Image:	Erect image
Pupil distance:	Siedentopf type, adjustment range: 2-3" / 51-76mm
Field number:	24
Tilt angle:	0° - 20° (only -TH, -THS models)
Illumination system:	Reflective illumination for bright field (Koehler illumination, with aperture diaphram)
Light source (optional):	12V100W fiber optics, non-stepped adjustment, light guide length 1.5m, power consumption 150W
Objectives (optional):	M Plan Apo, M Plan Apo SL, G Plan Apo

Optional Accessories

For a complete listing of accessories see Microscope Units and Objectives brochure, E4191-378



Refer to No. (**E14020**) for more details.

Model No. **Order No.**	FS70 **378-184-1**	FS70-TH **378-184-3**	FS70Z **378-185-1**	FS70Z-TH **378-185-3**	FS70L **378-186-1**	FS70L-TH **378-186-3**	FS70L4 **378-187-1**	FS70L4-TH **378-187-3**
Short base model No. **Order No.**	FS70-S **378-184-2**	FS70-THS **378-184-4**	FS70Z-S **378-185-2**	FS70Z-THS **378-185-4**	FS70L-S **378-186-2**	FS70L-THS **378-186-4**	FS70L4-S **378-187-2**	FS70L4-THS **378-187-4**
Focus adjustment	50mm travel range with concentric coarse (3.8mm/rev) and fine (0.1mm/rev) focusing wheels (right / left)							
Image	Erect image							
Pupil distance	Siedentopf type, adjustment range: 2 - 3" / 51 - 76mm							
Field number	24							
Tilt angle	—	0° - 20°	—	0° - 20°	—	0° - 20°	—	0° - 20°
Optical pass ratio	50/50	100/0 or 0/100	50/50	100/0 or 0/100	100/0 or 0/100		100/0 or 0/100	
Protective filter	—		—		Built-in laser beam filter		Built-in laser beam filter	
Tube lens	1X		1X - 2X zoom		1X		1X	
Applicable laser	—		—		1064/532/355nm		532/266nm	
Camera mount	C-mount (using optional adapter B)				Use a laser with TV port.		C-mount receptacle (with green filter switch)	
Illumination system, optional	Reflective illumination for bright field (Koehler illumination, with aperture diaphragm) 12V 100W fiber optics, non-stepped adjustment, light guide length: 1.5m, power consumption 150W							
Objective, optional (for observation)	M Plan Apo, M Plan Apo SL, G Plan Apo							
Objective, optional (for laser-cutting)	—				M/LCD Plan NIR, M/LCD Plan NUV		M Plan UV	
Loading weight*	32lbs/14.5kg	30lbs/13.6kg	31lbs/14.1kg	29lbs/13.2kg	31lbs/14.2kg	30lbs/13.5kg	31lbs/13.9kg	29lbs/13.1kg
Mass (main unit)	13lbs/6.1kg	15.5lbs/7.1kg	14.5lbs/6.6kg	16.5lbs/7.5kg	14lbs/6.4kg	15.5lbs/7.2kg	14.5lbs/6.7kg	16.5lbs/7.5kg

*Loading weight on optical tube excluding weight of objective lenses and eyepieces.

Mitutoyo

Accessories for Measuring Microscope

VMU
SERIES 378 — Unit for Incorporating into Equipment

- Telecentric system equipped with an aperture diaphragm is standard on the epi-illumination optical system.
- Best suited to process images for which uniform illumination is required.
- Design and manufacture are flexible to meet your demands such as double camera mounting or double (low/high) magnification.

VMU-V VMU-H VMU-LB VMU-L4B

- Compact and lightweight microscope designed to be built in for camera observation
- Can be used with YAG (near-infrared, visible, near-ultraviolet, or ultraviolet) lasers.*1
  *1 The performance and safety of laser-equipped system products is not guaranteed.
- For VMU-LB and VMU-L4B, the rigidity and general performance of the microscope main unit have been enhanced compared with previous models.
- Compatible with infrared optical systems*2
  *2 An infrared source and infrared camera are necessary.

SPECIFICATIONS

Model No.		VMU-V	VMU-H	VMU-LB	VMU-L4B
Order No.		**378-505**	**378-506**	**378-513**	**378-514**
Camera mounting direction		Vertical	Horizontal	Vertical (Rotatable)	
Observation		Bright-field/Erect image	Bright-field/Inverted image	Bright-field/Erect image	
Optical tube	TV adapter	Equipped with a C-mount			Equipped with a C-mount (Equipped with a green filter switching mechanism)
	Image forming (tube) lens	Built-in 1X (visible/near-infrared calibration)		Built-in 1X (near-infrared/visible/ near-ultraviolet calibration)	Built-in 1X (ultraviolet/visibility compensation)
	Available for lasers	—		YAG laser source (Fundamental, Second/Third harmonic) mountable	YAG laser source (Second/Third/Fourth harmonic) mountable
Objective (optional)	For observation	M Plan Apo, M Plan Apo HR, M Plan Apo SL, G Plan Apo			
	For laser processing	—		NIR Series NUV Series Note 1: Selected depending on the wavelength of the laser source	NIR Series NUV Series UV Series Note 2: Selected depending on the wavelength of the laser source
Applicable camera (s)		2/3 type or less cameras (C-mount type)			
Optical system epi-illumination		Telecentric system equipped with an aperture diaphragm			
Illuminated lens tube		Bright-field illuminated lens tube			
Illumination unit (optional)		Fiber-optic cable illumination unit (100 W) (**378-700**)			
Main unit mass		650 g	750 g	1270 g	1300 g

Note 3: The **M Plan Apo 1X** objective is used with the polarization unit (**378-710** or **378-715**).

Refer to the **Microscope Units and Objectives Brochure (E14020)** for more details.

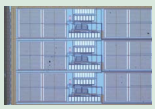
WIDE VMU

WIDE VMU-HR WIDE VMU-BDV WIDE VMU-BDH

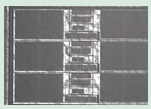
SPECIFICATIONS

		For Bright-field Observation	For Bright/Dark-field Observation	
Model No.		**WIDE VMU-HR**	**WIDE VMU-BDV**	**WIDE VMU-BDH**
Order No.		**378-519**	**378-517**	**378-518**
Camera mounting orientation		Vertical	Vertical	Horizontal
Observation		Bright-field/Erect image	Bright/Dark-field/ Erect image	Bright/Dark-field/ Inverted image
Optical tube	Optical system	Magnification: 1X Visible light - Near-infrared light	Magnification: 1X Visible light	
	Camera Mount	F-Mount, C-Mount (with aligning and parfocal adjustment mechanism)		
	Imaging forming (tube) lens	Built in 1X (visible - NIR)	Built in 1X (visible)	
	Image field	ø30		
	Polarized unit*1	Mountable		
Objective (required option)		M Plan Apo, M Plan Apo HR, M Plan Apo SL, G Plan Apo, NIR Series	BD Plan Apo	
Applicable camera		Diagonal line length: 30 mm or less (equivalent to APS-C format)		
Optical system epi-illumination		Telecentric (Pupil diameter of ø16.8) Note: Coaxial epi-illumination, with aperture diaphragm	Telecentric illumination, Bright/Dark-field illumination optical tube (Dual-port fiber-optic illumination) Bright/Dark-field switching with light source on-off	
Illuminated lens tube		Bright-field illuminated lens tube (rotatable) *3, selectable between LED adapter and fiber adapter (both supplied as standard)	Bright-field illuminated lens tube (rotatable) *3	
Illumination unit (optional)*2		Fiber-optic illumination unit (100 W) (378-700)		
Main unit mass		1400 g	2000 g	2150 g

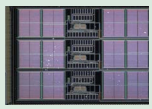
*1 Polarized observation by Bright-field illumination *2 Support for third-party LED illuminators (**WIDE VMU-HR** only)
*3 The fiber (light source) mount orientation can be changed.



Bright-field



Infrared



Dark-field

- Observation over a wide field of view (Image field of ø30 mm)
- Greatly enhanced brightness on the periphery of the field of view (Reduces the dependence on the light distribution characteristics.)
- Compatible with infrared optical systems*
  * An infrared source and infrared camera are necessary. For more details on infrared observation, visit your local Mitutoyo M³ Solution Center or contact your Mitutoyo Sales Representative.
- Small optical observation system
- Compatible with HR series of high resolving power lens (designed with pupil diameter of ø16.8 mm)
- Available for various observation methods (Including bright-field, dark-field for visual or scratch inspection, and polarized observation of objects with polarization characteristics)

Accessories for Measuring Microscope

Varifocal Lens TAGLENS

- Without changing the required magnification, ultra-high speed variable focal length enables obtaining perfectly focused images in real-time with stress-free operation.
- The time required for auto-focusing is drastically reduced, and the optical system focus range is extended without the expense of a mechanical drive.

TAGLENS-T1

Ultra-high speed, varifocal lens.
A dedicated controller and software are equipped as standard.

SPECIFICATIONS

Operating principle	Variable refraction index
Resonance frequency	70 kHz
Effective aperture	ø11 mm*
Transmittance	90% or more (λ400 to 700 nm)*

* The above values are based on optical design theoretically.

Refer to the **Varifocal Lens TAGLENS Brochure (E14025)** for more details.

Video Microscope Unit VMU-T1

Microscope unit for configuring a varifocal optical system by incorporating TAGLENS-T1, the objective and the camera.

SPECIFICATIONS

Compatible TAGLENS	TAGLENS-T1
Imaging lens magnification	1X
Imaging area	ø11 mm
Applicable objective	**M Plan Apo** Series
Options	Manual turret, Power turret, Polarizer, Focusing unit A or B, XY stage, Simplified stand.

M Plan Apo Series

Objective		1X	2X	5X	7.5X	10X	20X	50X
Depth of focus×2 (mm)		0.88	0.18	0.028	0.012	0.007	0.003	0.0018
Total scanning width (mm)		16	4.0	0.64	0.28	0.16	0.04	0.007
Real FOV (mm)	1/2 inch camera	4.8×6.4	2.4×3.2	0.96×1.28	0.64×0.85	0.48×0.64	0.24×0.32	0.096×0.128
	2/3 inch camera	6.6×8.8	3.3×4.4	1.32×1.76	0.88×1.17	0.66×0.88	0.33×0.44	0.132×0.176

Schedule Service

Accessories for Measuring Microscope

Eyepieces
SERIES 378

- The field of view is extra wide.
- Optional reticles are available.

SPECIFICATIONS

Order No. (2pcs. set)	Magnification	Field number	Mass	Individual order No.
378-866	10X	24	85g	**378-856-5**
378-858	20X	12	55g	**378-858-5**

378-866

378-858

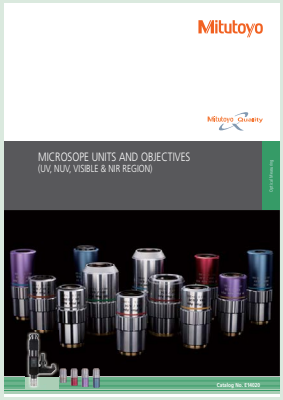
Reticles (optional)

516848: Cross-hair
516576: Broken cross hair (90° and 60°)
516578: Concentric circle (Diametric increment: 1.2mm)
516577: 20mm scale (Minimum reading: 0.1mm) with cross hair
516849: 10mm scale (Minimum reading: 0.1mm)
516850: 5mm scale (Minimum reading: 0.05mm)

Objectives
SERIES 378

The Mitutoyo 378 Series objectives have the world's longest working distance and an infinity correction optical system. These objectives provide flexible observation at high magnifications and independent correction of chromatic aberration.

- The long working distance objectives provide excellent clearance between the lens surface and the workpiece surface in focus, making it possible to observe workpieces which are usually hard to focus because of awkward projections.
- The metallurgical plan apochromatic (M Plan Apo) objective provides a flat, chromatic aberration-free image throughout the field of view, making it suitable for any type of microscope.
- Specially designed objectives also are available with correction for near-infrared radiation, near-ultraviolet radiation, and ultraviolet radiation, or various thicknesses of LCD screen glasses.
- The mounting screw threads of objectives are designed to conform to JIS B-7141-1988.



Refer to **No. (E14020)** for more details.

M Plan Apo and M Plan Apo SL
Objectives for bright field observation

BD Plan Apo and BD Plan Apo SL
Objectives for bright/dark field observation

Find Training

Near-infrared radiation corrected M Plan Apo NIR objectives

Near-ultraviolet radiation corrected M Plan Apo NUV objectives

Ultraviolet radiation corrected M Plan UV objectives

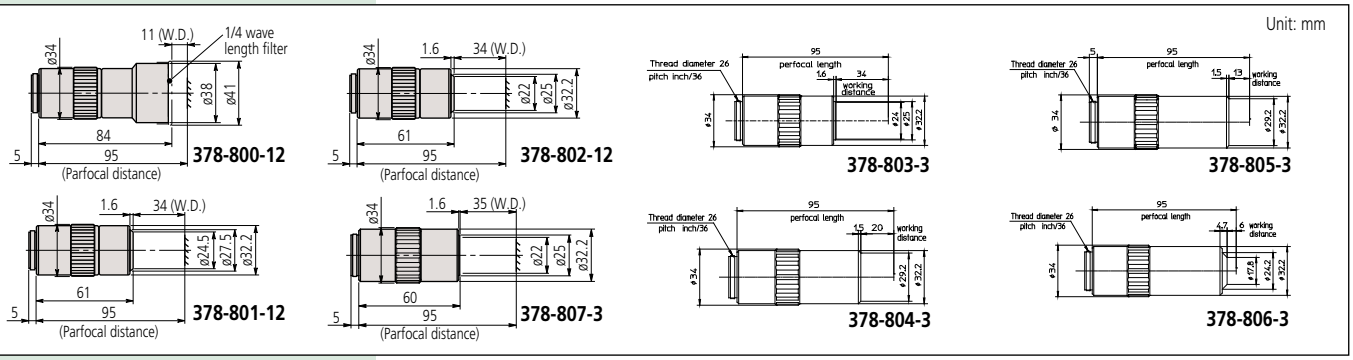
Accessories for Measuring Microscope

M Plan Apo for Bright Field Observation

Order No.	Mag.	N.A.	W.D.	f	R	D.F.	View field 1	View field 2	Mass
378-800-3	1X	0.025	11.0mm	200mm	11.0μm	440μm	ø24mm	4.8x6.4mm	300g
378-801-12	2X	0.055	34.0mm	100mm	5.0μm	91μm	ø12mm	2.4x3.2mm	220g
378-802-12	5X	0.14	34.0mm	40mm	2.0μm	14.0μm	ø4.8mm	0.96x1.28mm	230g
378-807-3	7.5X	0.21	35.0mm	26.67mm	1.3μm	6.2μm	ø3.6mm	0.64x0.85mm	240g
378-803-3	10X	0.28	34.0mm	20mm	1.0μm	3.5μm	ø2.4mm	0.48x0.64mm	240g
378-804-3	20X	0.42	20.0mm	10mm	0.7μm	1.6μm	ø1.2mm	0.24x0.32mm	270g
378-805-3	50X	0.55	13.0mm	4mm	0.5μm	0.9μm	ø0.48mm	0.10x0.13mm	290g
378-806-3	100X	0.70	6.0mm	2mm	0.4μm	0.6μm	ø0.24mm	0.05x0.06mm	320g

DIMENSIONS

Unit: mm



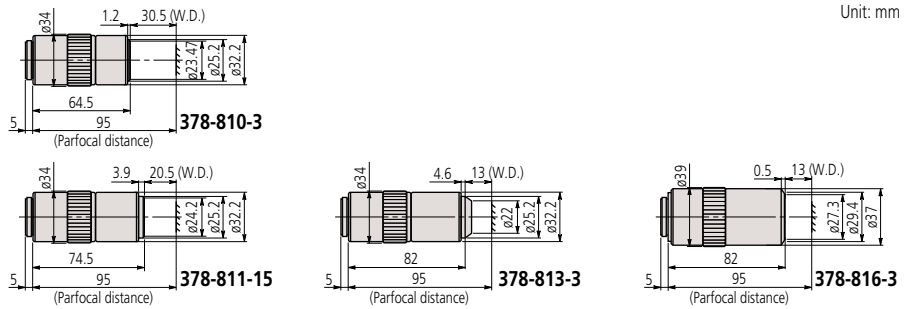
Note:
These objectives offer extra-long working distance.

M Plan Apo SL for Bright Field Observation

Order No.	Mag.	N.A.	W.D.	f	R	D.F.	View field 1	View field 2	Mass
378-810-3	20X	0.28	30.5mm	10mm	1.0μm	3.5μm	ø1.2mm	0.24x0.32mm	240g
378-811-15	50X	0.42	20.5mm	4mm	0.7μm	1.6μm	ø0.48mm	0.10x0.13mm	280g
378-813-3	100X	0.55	13.0mm	2mm	0.5μm	0.9μm	ø0.24mm	0.05x0.06mm	290g
378-816-3	200X	0.62	13.0mm	1mm	0.4μm	0.7μm	ø0.12mm	0.025x0.03mm	490g

DIMENSIONS

Unit: mm



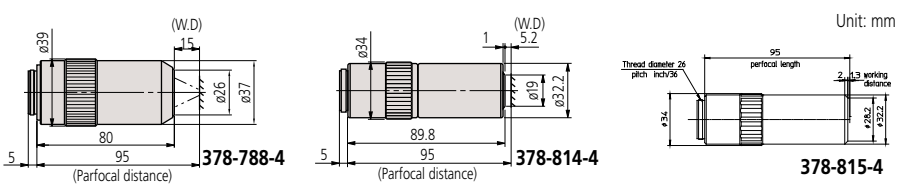
Note:
These objectives offer extra-high resolving power.

M Plan Apo HR for Bright Field Observation

Order No.	Mag.	N.A.	W.D.	f	R	D.F.	View field 1	View field 2	Mass
378-787-16	5X	0.21	27mm	40mm	1.3μm	6.2μm	ø4.8mm	0.96x1.28mm	285g
378-788-15	10X	0.42	15mm	20mm	0.7μm	1.6μm	ø2.4mm	0.48x0.64mm	460g
378-814-4	50X	0.75	5.2mm	4mm	0.4μm	0.49μm	ø0.48mm	0.10x0.13mm	400g
378-815-4	100X	0.90	1.3mm	2mm	0.3μm	0.34μm	ø0.24mm	0.05x0.06mm	410g

DIMENSIONS

Unit: mm



Mag.: Magnification
N.A.: Numerical aperture
W.D.: Working distance
f: Focal distance
R: Resolving power
D.F.: Focal depth
View field 1: Field of view when using ø24mm eyepiece
View field 2: Field of view when using 1/2" CCD camera

Mitutoyo

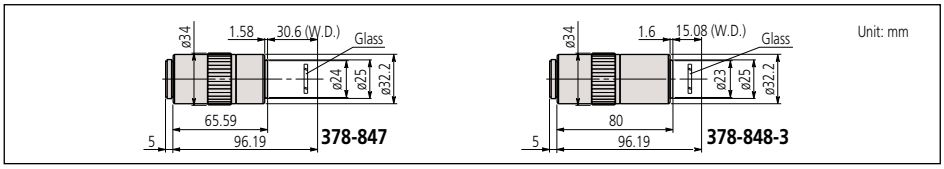
Accessories for Measuring Microscope

Glass Thickness (t = 3.5mm) Corrected G Plan Apo for Bright Field Observation

Order No.	Mag.	N.A.	W.D.	f	R	D.F.	View field 1	View field 2	Mass
378-847	20X	0.28	29.42mm*	10mm	1.0μm	3.5μm	ø1.2mm	0.24x0.32mm	270g
378-848-3	50X	0.50	13.89mm*	4mm	0.6μm	1.1μm	ø0.48mm	0.10x0.13mm	320g

*In air

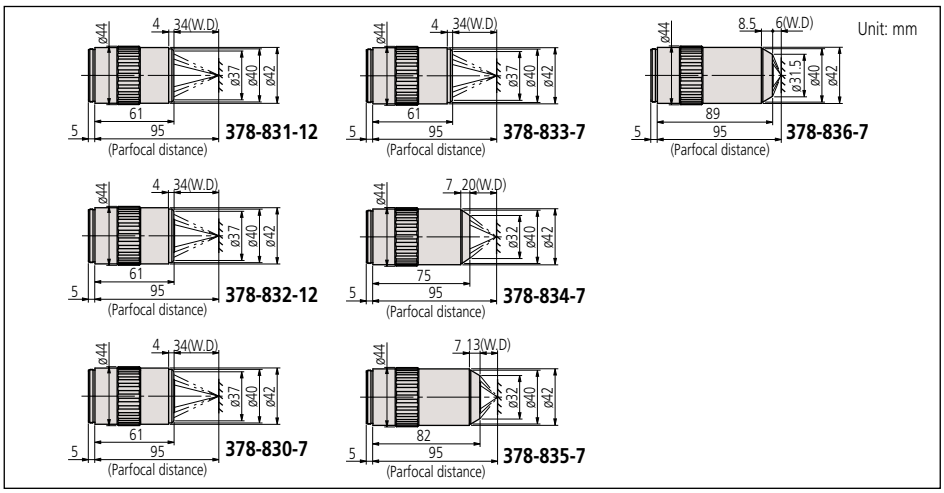
DIMENSIONS



BD Plan Apo for Bright/Dark Field Observation

Order No.	Mag.	N.A.	W.D.	f	R	D.F.	View field 1	View field 2	Mass
378-831-13	2X	0.055	34.0mm	100mm	5.0μm	91μm	ø12mm	2.4x3.2mm	340g
378-831-13	5X	0.14	34.0mm	40mm	2.0μm	14.0μm	ø4.8mm	0.96x1.28mm	350g
378-830-7	7.5X	0.21	34.0mm	26.67mm	1.3μm	6.2μm	ø3.6mm	0.64x0.85mm	350g
378-833-7	10X	0.28	34.0mm	20mm	1.0μm	3.5μm	ø2.4mm	0.48x0.64mm	350g
378-834-7	20X	0.42	20.0mm	10mm	0.7μm	1.6μm	ø1.2mm	0.24x0.32mm	400g
378-835-7	50X	0.55	13.0mm	4mm	0.5μm	0.9μm	ø0.48mm	0.10x0.13mm	440g
378-836-7	100X	0.70	6.0mm	2mm	0.4μm	0.6μm	ø0.24mm	0.05x0.06mm	460g

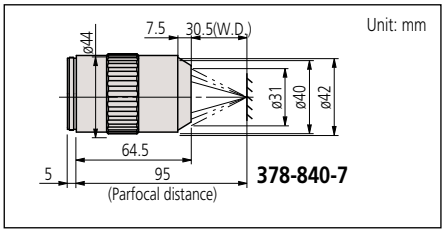
DIMENSIONS



BD Plan Apo SL for Bright/Dark Field Observation

Order No.	Mag.	N.A.	W.D.	f	R	D.F.	View field 1	View field 2	Mass
378-840-7	20X	0.28	30.5mm	10mm	1.0μm	3.5μm	ø1.2mm	0.24x0.32mm	350g

DIMENSIONS



Note:
The G Plan Apo Series are designed for observing a workpiece through BK-7 glass (thickness = 3.5mm).

Find a Distributor

Note:
These objectives offer extra-long working distance.

Mag.: Magnification
N.A.: Numerical aperture
W.D.: Working distance
f: Focal distance
R: Resolving power
D.F.: Focal depth
View field 1: Field of view when using ø24mm eyepiece
View field 2: Field of view when using 1/2" CCD camera

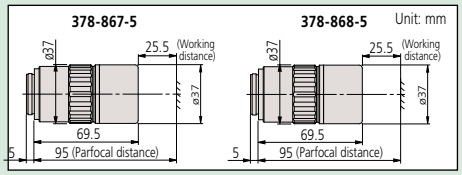
Accessories for Measuring Microscope

M Plan Apo NIR B

Order No.	Mag.	N.A.	W.D. (mm)	f (mm) (λ=550nm)	R (μm) (λ=550nm)	±DOF (μm)	View field 1	View field 2	Mass (g)
378-867-5	20X	0.40	25.5	10	0.7	1.7	1.2	0.24×0.32	350
378-868-5	50X	0.42	25.5	4	0.7	1.6	0.48	0.10×0.13	375

> A high-transmission laser type objective suited to the fundamental and second harmonic of the YAG laser. Corrected over the visible (420nm) to near-infrared (1064nm) spectrum.
> This series of objective has greatly improved in operability thanks to the achievement of an ultra-long working distance of 25.5mm while maintaining the NA of the NIR series 20X/50X.

DIMENSIONS



Note:
These objectives are designed so that a workpiece's image can be focused within the focal depth even when the wavelength is changed anywhere from the visible range (l = 480nm) up to near-infrared range (l = 1800nm). Therefore, the M Plan NIR Series are suitable for laser repair. However, when the wavelength used exceeds 1100nm, the focusing position may slightly deviate from that in the visible range due to changes in glass dispersion and refractive index.

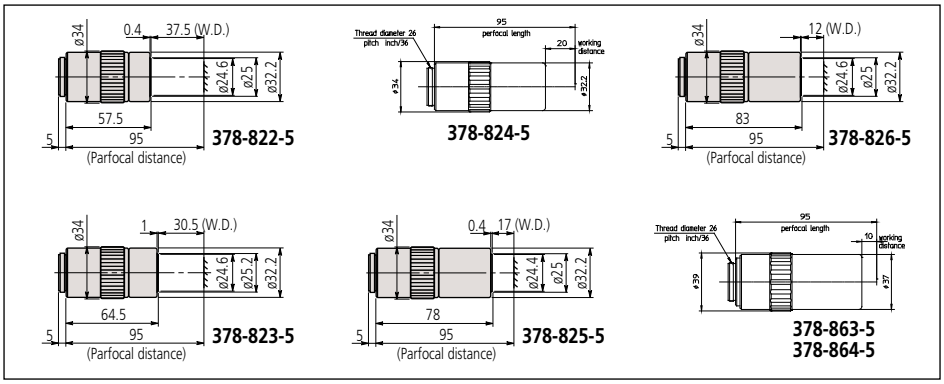
Near-infrared Radiation Corrected M Plan Apo NIR for Bright Field Observation

Order No.	Mag.	N.A.	W.D.	f	R	D.F.	View field 1	View field 2	Mass
378-822-5	5X	0.14	37.5mm	40mm	2.0μm	14.0μm	ø4.8mm	0.96x1.28mm	220g
378-823-15	10X	0.26	30.5mm	20mm	1.1μm	4.1μm	ø2.4mm	0.48x0.64mm	250g
378-824-16	20X	0.40	20.0mm	10mm	0.7μm	1.7μm	ø1.2mm	0.24x0.32mm	300g
378-825-17	50X	0.42	17.0mm	4mm	0.7μm	1.6μm	ø0.48mm	0.10x0.13mm	315g
378-826-15	100X	0.50	12.0mm	2mm	0.6μm	1.1μm	ø0.24mm	0.05x0.06mm	335g
378-863-5*	50X	0.65	10mm	4mm	0.4μm	0.7μm	ø0.48mm	0.10x0.13mm	450g
378-864-15	100X	0.70	10mm	2mm	0.4μm	0.6μm	ø0.24mm	0.05x0.06mm	450g

* High Resolution (HR objectives)

DIMENSIONS

Unit: mm



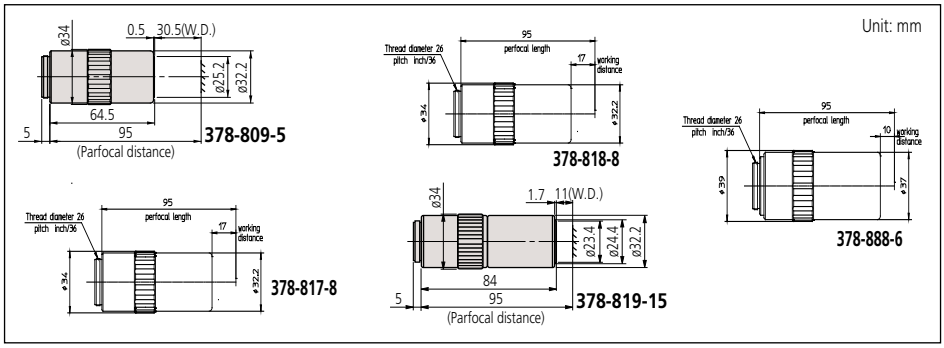
Near-ultraviolet Radiation Corrected M Plan Apo NUV for Bright Field Observation

Order No.	Mag.	N.A.	W.D.	f	R	D.F.	View field 1	View field 2	Mass
378-809-5	10X	0.28	30.5mm	20mm	1μm	3.5μm	ø2.4mm	0.48x0.64mm	255g
378-817-8	20X	0.42	17.0mm	10mm	0.7μm	1.7μm	ø1.2mm	0.24x0.32mm	340g
378-818-8	50X	0.44	15.0mm	4mm	0.7μm	1.6μm	ø0.48mm	0.10x0.13mm	350g
378-819-15	100X	0.50	11.0mm	2mm	0.6μm	1.1μm	ø0.24mm	0.05x0.06mm	380g
378-888-6*	50X	0.65	10.00mm	4mm	0.42μm	0.65μm	ø0.48mm	0.10x0.13mm	500g

*High resolution (HR objective)

DIMENSIONS

Unit: mm



Note:
These objectives are designed so that a workpiece's image can be focused within the focal depth even when the wavelength is changed anywhere from the visible range (l = 620nm) to the near-ultraviolet range (l = 355nm). Therefore The M Plan NUV Series are suitable for laser repair using a high frequency laser beam.

Mag.: Magnification
N.A.: Numerical aperture
W.D.: Working distance
f: Focal distance
R: Resolving power
D.F.: Focal depth
View field 1: Field of view when using ø24mm eyepiece
View field 2: Field of view when using 1/2" CCD camera

Accessories for Measuring Microscope

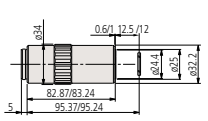
Near-infrared Radiation and LCD Glass Thickness (t = 1.1mm or 0.7mm) Corrected LCD Plan Apo NIR for Bright Field Observation

Order No.	Mag.	N.A.	W.D.	f	R	D.F.	View field 1	View field 2	Mass
378-821-16	20X (t0.7)	0.40	20mm*	10mm	0.7μm	1.7μm	ø1.2mm	0.24x0.32mm	305g
378-827-16	20X (t1.1)	0.40	19.98mm*	10mm	0.7μm	1.7μm	ø1.2mm	0.24x0.32mm	305g
378-828-16	50X (t1.1)	0.42	17.13mm*	3.9mm	0.7μm	1.6μm	ø0.48mm	0.10x0.13mm	320g
378-829-5	50X (t0.7)	0.42	17.26mm*	3.9mm	0.7μm	1.6μm	ø0.48mm	0.10x0.13mm	320g
378-754-15	100X (t0.7)	0.50	12.06mm*	2mm	0.6μm	1.1μm	ø0.24mm	0.05x0.06mm	335g

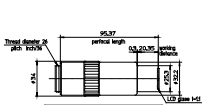
*In air

DIMENSIONS

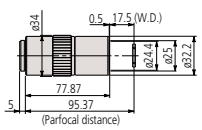
Unit: mm



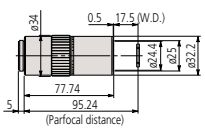
378-754-15



378-827-5



378-828-17



378-829-5

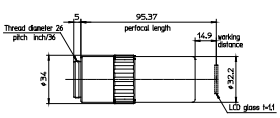
Near-ultraviolet Radiation and LCD Glass Thickness (t = 0.7mm) Corrected LCD Plan Apo NUV for Bright Field Observation

Order No.	Mag.	N.A.	W.D.	f	R	D.F.	View field 1	View field 2	Mass
378-890-8	20X (t0.7)	0.42	16.96mm*	10mm	0.7μm	1.7μm	ø1.2mm	0.24x0.32mm	340g
378-891-6**	50X (t0.7)	0.65	9.76mm*	4mm	0.42μm	0.65μm	ø0.48mm	0.10x0.13mm	500g
378-820-8	50X (t0.7)	0.44	14.76mm*	4mm	0.7μm	1.6μm	ø0.48mm	0.10x0.13mm	310g
378-751-4	100X(t1.1)	0.50	11.03mm	2mm	0.6μm	1.1μm	ø0.24mm	0.05x0.06mm	380g

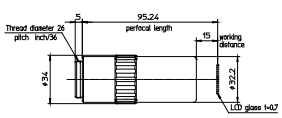
* In air
** High-Resolution (HR Objectives)

DIMENSIONS

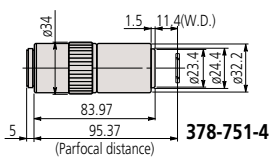
Unit: mm



378-753-5



378-820-8



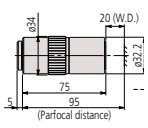
378-751-4

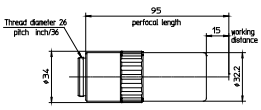
Ultraviolet Radiation Corrected M Plan UV for Bright Field Observation

Order No.	Mag.	N.A.	W.D.	f	R	D.F.	View field 1	View field 2	Mass
378-844-15	10X	0.25	20mm	20mm	1.1μm	4.4μm	ø2.4mm	0.48x0.64mm	310g
378-837-8	20X	0.37	15.0mm	10mm	0.8μm	2.1μm	ø1.2mm	0.24x0.32mm	330g
378-838-8	50X	0.41	12.0mm	4mm	0.7μm	1.7μm	ø0.48mm	0.10x0.13mm	400g
378-839-5	80X	0.55	10.0mm	2.5mm	0.5μm	0.9μm	ø0.3mm	0.06x0.08mm	380g

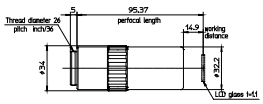
DIMENSIONS

Unit: mm

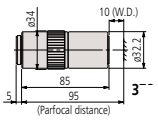




378-837-8



378-838-8



378-839-5

Note:
These near-infrared (l = 1800nm) corrected objectives are designed for observing a workpiece through LCD glass (thickness = 1.1mm (**378-827-5**, **378-828-5, 378-752-5**) or 0.7mm (**378-829-5**, **378-754-5**) and for laser repair.

Note:
These near ultraviolet corrected objectives are designed for observing a workpiece through LCD glass (thickness = 1.1mm (**378-753-6, 378-751-4**) or 0.7mm (**378-820-6**) and for laser repair.

Note:
These ultraviolet corrected objectives are designed so that a workpiece's image can be focused within the focal depth even when the wavelength is changed anywhere from the visible range (l = 550nm) to the ultraviolet range (l = 266nm). Therefore the M Plan UV Series are suitable for laser repair using a high-frequency laser beam.

Mag.: Magnification
N.A.: Numerical aperture
W.D.: Working distance
f: Focal distance
R: Resolving power
D.F.: Focal depth
View field 1: Field of view when using ø24mm eyepiece
View field 2: Field of view when using 1/2" CCD camera

Digital Imaging with Software

Order No.	Description
64PMI247	Moticam S1, 1.2 Megapixel, 1/3" Sensor, USB
64PMI249	Moticam S3, 3 Megapixel, 1/2.8", USB
64PMI248	Moticam S6, 6MP, 1/1.8" Sensor, USB
64PMI309	Moticam 4000x, 8MP, 1/1.8" Sensor, USB/ HDMI Output
64PMI310	Moticam BMH4000X, 1/2.8" Sensor, USB/ HDMI output, built-in 11" screen

64PMI247

64PMI248

64PMI249

64PMI310

Got Questions?

MSM-400
SERIES 377 — Stereo Microscopes

- Continuous 1X - 4X magnification
- Image always in focus throughout zoom range
- Crisp, erect images with high resolution and excellent stereoscopic effect
- Stereo-tube can be rotated a full 360° for viewing at any angle
- Bilateral zoom control knob adds convenience and increases operator efficiency
- Diopter adjustment for both eyepieces
- Binocular tube inclination: 45°
- Focusing range: 1.46" (37mm)
- LED Illumination
- Interpupillary adjustable range: 2.12" - 2.99" (54mm - 76mm)
- The MSM-414L is a traditional binocular stereo microscope for industrial, medical and classroom applications. It is ideal for electrical small part inspection, assembly, and medical/ biological dissection.

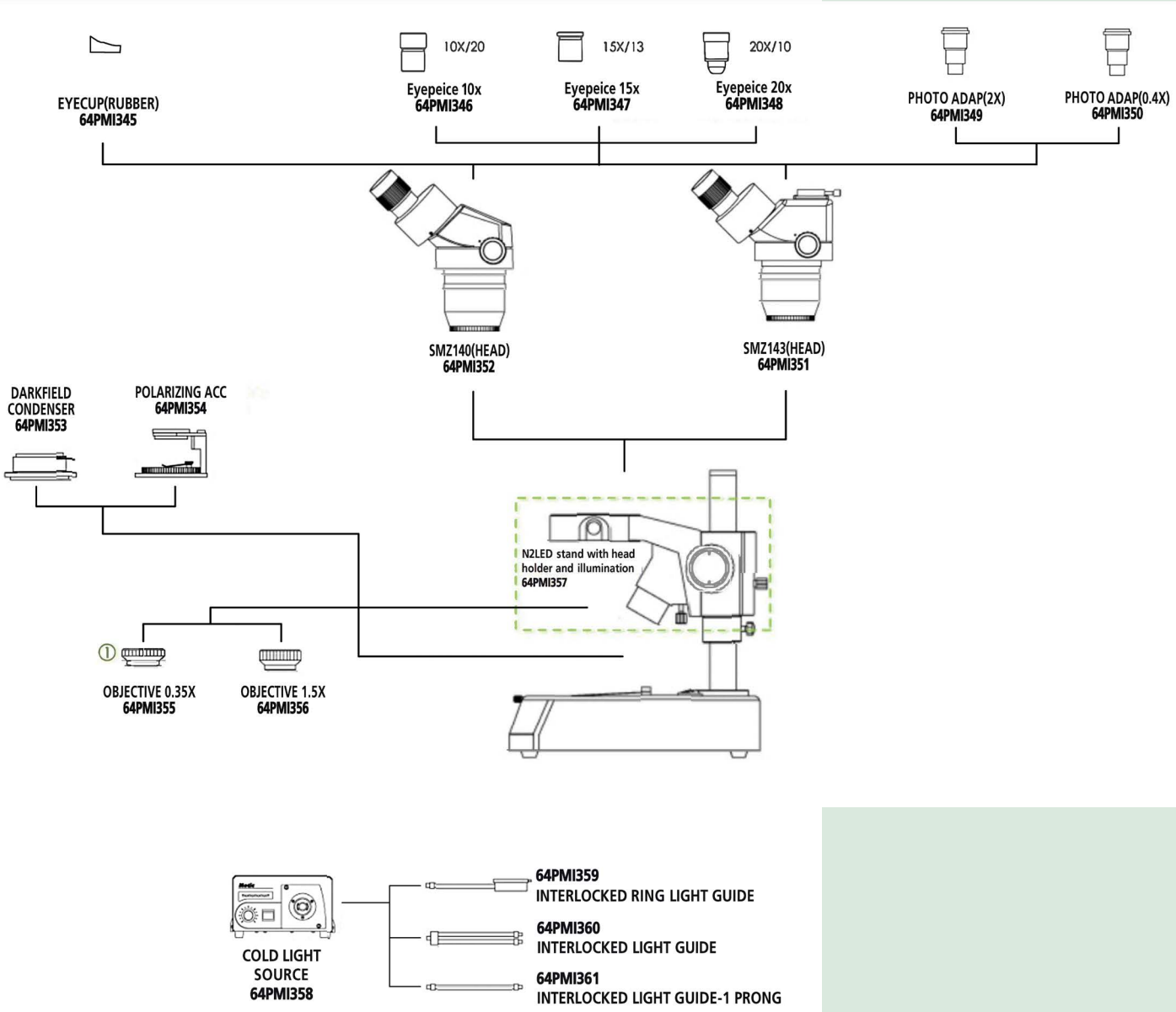
377-993A

SPECIFICATIONS

Model.	MSM-414L	MSM-414TL
Order No.	**377-992A**	**377-993A**
Optical tube	Binocular	Trinocular
Total magnification	10X - 40X	
Eyepiece	10X (377-016)	
Objective	1X - 4X	
Working distance	80mm	
Field of view	20mm - 5mm	
Dimensions	H=13.2"x W=6.7"x D=9.3"	
Mass	13.2 lbs (6kg)	

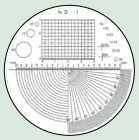
Microscopes

Stereo Microscope — Parts Breakdown

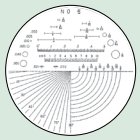


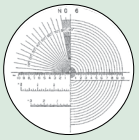
Talk to Sales

Optional Reticles for Pocket Comparators


183-102

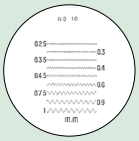

183-104

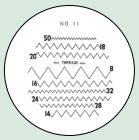

183-106


183-107


183-109

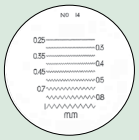

183-110


183-111


183-112


183-113


183-114


183-115

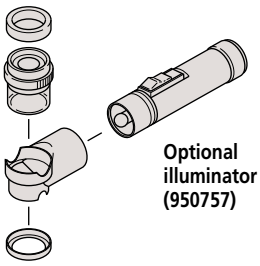
8x Pocket Comparator Sets SERIES 183

- 8x Eyepiece which includes a set of reticles for dimensional, angle and other types of measurements.
- Illuminator (**950757**) is available.


183-101

Pocket Comparator 8X with Reticles Set

Set No.	
183-901	183-101, 183-106
183-902	183-101, 183-102, 183-106, 183-107, 183-112, 183-113, 183-114
183-903	183-101, 183-102, 183-106, 183-107, 183-109, 183-113, 183-115
183-904	183-101, 183-102


Optional illuminator (950757)

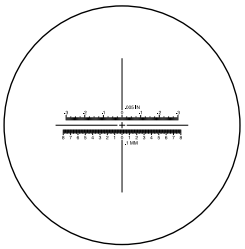
Zoom Loupe SERIES 183

- Allows the user 8X - 16X zoom observation.
- Magnification indicator is provided for 8X, 10X, 12X, 14X and 16X observation.
- Metric and inch scales are provided for measuring.
- Comes with a carrying case.

SPECIFICATIONS

Magnification	Order No.	Remarks
8X - 16X	**183-304**	With reticle (Scale graduation: 0.1mm, .005")

183-304


Reticle provided

Clear Loupe SERIES 183

SPECIFICATIONS

Magnification	Order No.	Remarks
5X	**183-310**	Drawtube removable
15X	**183-312**	Drawtube removable

183-310

183-312

Quick Guide to Precision Measuring Instruments

Microscopes

Numerical Aperture (NA)

The NA figure is important because it indicates the resolving power of an objective lens. The larger the NA value the finer the detail that can be seen. A lens with a larger NA also collects more light and will normally provide a brighter image with a narrower depth of focus than one with a smaller NA value.

$$NA = n \cdot \sin\theta$$

The formula above shows that NA depends on N, the refractive index of the medium that exists between the front of an objective and the specimen (for air, n=1.0), and angle θ, which is the half-angle of the maximum cone of light that can enter the lens.

Resolving Power (R)

The minimum detectable distance between two image points, representing the limit of resolution. Resolving power (R) is determined by numerical aperture (NA) and wavelength (λ) of the illumination.

$$R = \frac{\lambda}{2 \cdot NA} \ (\mu m)$$

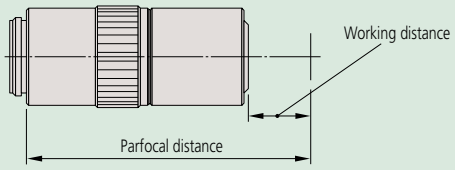
λ = 0.55μm is often used as the reference wavelength

Working Distance (W.D.)

The distance between the front end of a microscope objective and the surface of the workpiece at which the sharpest focusing is obtained.

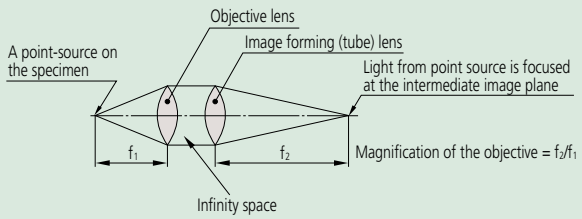
Parfocal Distance

The distance between the mounting position of a microscope objective and the surface of the workpiece at which the sharpest focusing is obtained. Objective lenses mounted together in the same turret should have the same parfocal distance so that when another objective is brought into use the amount of refocusing needed is minimal.



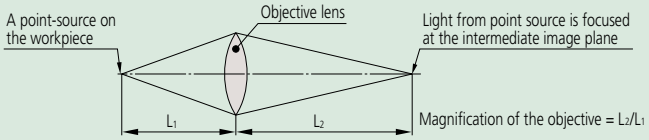
Infinity Optical System

An optical system where the objective forms its image at infinity and a tube lens is placed within the body tube between the objective and the eyepiece to produce the intermediate image. After passing through the objective, the light effectively travels parallel to the optical axis to the tube lens through what is termed the infinity space within which auxiliary components can be placed, such as differential interference contrast (DIC) prisms, polarizers, etc., with minimal effect on focus and aberration corrections.



Finite Optical System

An optical system that uses an objective to form the intermediate image at a finite position. Light from the workpiece passing through the objective is directed toward the intermediate image plane (located at the front focal plane of the eyepiece) and converges in that plane.



Focal Length (f)

unit: mm

The distance from the principal point to the focal point of a lens: if f1 represents the focal length of an objective and f2 represents the focal length of an image forming (tube) lens then magnification is determined by the ratio between the two. (In the case of the infinity-correction optical system.)

$$\text{Objective magnification} = \frac{\text{Focal length of the image-forming (tube) lens}}{\text{Focal length of the objective}}$$

Example: $1X = \frac{200}{200}$ Example: $10X = \frac{200}{20}$

Focal Point

Light rays traveling parallel to the optical axis of a converging lens system and passing through that system will converge (or focus) to a point on the axis known as the rear focal point or image focal point.

Depth of Focus (DOF)

unit: mm

Also known as depth of field, this is the distance (measured in the direction of the optical axis) between the two planes which define the limits of acceptable image sharpness when the microscope is focused on an object. As the numerical aperture (NA) increases, the depth of focus becomes shallower, as shown by the expression below:

$$DOF = \frac{\lambda}{2 \cdot (NA)^2}$$ λ = 0.55μm is often used as the reference wavelength

Example: For an **M Plan Apo 100X** lens (**NA = 0.7**)
The depth of focus of this objective is

$$\frac{0.55\mu m}{2 \times 0.7^2} = 0.6\mu m$$

Bright-field Illumination and Dark-field Illumination

In brightfield illumination a full cone of light is focused by the objective on the specimen surface. This is the normal mode of viewing with an optical microscope. With darkfield illumination, the inner area of the light cone is blocked so that the surface is only illuminated by light from an oblique angle. Darkfield illumination is good for detecting surface scratches and contamination.

Apochromat and Achromat Objectives

An apochromat objective is a lens corrected for chromatic aberration (color blur) in three colors (red, blue, yellow).
An achromat objective is a lens corrected for chromatic aberration in two colors (red, blue).

Magnification

The ratio of the size of a magnified object image created by an optical system to that of the object. Magnification commonly refers to lateral magnification although it can mean lateral, vertical, or angular magnification.

Principal Ray

A ray considered to be emitted from an object point off the optical axis and passing through the center of an aperture diaphragm in a lens system.

Aperture Diaphragm

An adjustable circular aperture which controls the amount of light passing through a lens system. It is also referred to as an aperture stop and its size affects image brightness and depth of focus.

Field Stop

A stop which controls the field of view in an optical instrument.

Telecentric System

An optical system where the light rays are parallel to the optical axis in object and/or image space. This means that magnification is nearly constant over a range of working distances, therefore, almost eliminating perspective error.

Erect Image

An image in which the orientations of left, right, top, bottom and moving directions are the same as those of a workpiece on the workstage.

Field number (FN), real field of view, and monitor display magnification

unit: mm

The observation range of the sample surface is determined by the diameter of the eyepiece's field stop. The value of this diameter in millimeters is called the field number (FN). In contrast, the real field of view is the range on the workpiece surface when actually magnified and observed with the objective lens.
The real field of view can be calculated with the following formula:

(1) The range of the workpiece that can be observed with the microscope (diameter)

$$\text{Real field of view} = \frac{\text{FN of eyepiece}}{\text{Objective lens magnification}}$$

Example: The real field of view of a 1X lens is $24 = \frac{24}{1}$

The real field of view of a 10X lens is $2.4 = \frac{24}{10}$

(2) Monitor observation range

$$\text{Monitor observation range} = \frac{\text{The size of the camera image sensor (diagonal length)}}{\text{Objective lens magnification}}$$

• Size of image sensor

Format	Diagonal length	Length	Height
1/3″	6.0	4.8	3.6
1/2″	8.0	6.4	4.8
2/3″	11.0	8.8	6.6

(3) Monitor display magnification

$$\text{Monitor display magnification} = \text{Objective lens magnification} \times \frac{\text{Display diagonal length on the monitor}}{\text{Diagonal length of camera image sensor}}$$

Mitutoyo