

### Illumination Units Page 449



### Magnifiers Page 450



### Measuring Microscopes Page 452



### Microscope Units Page 479



### Eyepieces and Objective Lenses Page 482



### Measuring Projectors Page 489



#### Consumable spares

No.	Description
011315	Lamp 10,8V, 30W, GX5,3 for 011079-1

## Cold-light Illuminator

### Cold-light Illuminator and Conductors



011079-1  
(Swan neck light  
conductor 011080-1 is optional)



011080-1

#### Cold-Light Illuminator

No.	Input	Output	Light brightness control	Filter insertion	Dimensions [mm]	Mass [kg]
011079-1	50VA	35W	Stepless	Lateral	168 x 120 x 268	1,3

#### Swan neck light Conductor

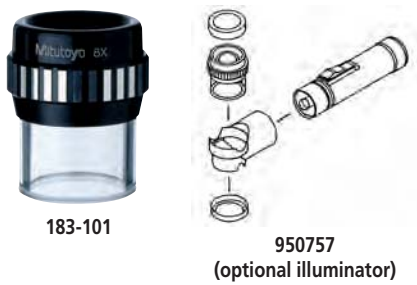
No.	Arm diameter [mm]	Arm length [mm]
011080-1	4	550

# Precision Magnifier

## Series 183

This magnifier is ideal for a variety of measuring tasks.  
With the Precision Magnifier you can:

- Easily perform measurements including length, diameter, line thickness and thread pitch.
- Replace the reticles quickly.



### Pocket Comparators

No.	Dimensions [mm]	Magnification	Field of View [mm]	Mass [g]
183-101	Ø 37 x 48	8X	24,5	40
183-131	Ø 37 x 45	10X	24,5	42

### Pocket Comparators Set delivered in a case (including magnifier and reticles)

No.	Set compilation
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

### Reticles for Pocket Comparators

No.	Description
183-102	Diameter 0,1; 0,2; 0,3; 0,4; 0,5; 0,6; 0,7; 1,5; 3 mm Grid 0,3" x 0,4" (Pitch 0,025") Radius 0 – 10 mm (Pitch 0,5 mm) Angle 0 – 90° (Pitch 1°) Scale 0 – 10 mm (Pitch 0,1 mm)
183-103	Angle, radius, length, diameter
183-104	Thickness 0,02 – 0,16 mm (Pitch 0,01 mm)
183-105	Angle 0 – 90° (Reading 0–10° = 1°; 10–90° = 5°) Radius 0 – 10 mm (Reading 0,5 mm) Diameter 0,1–1 mm (Reading 0,1 mm) Scale 0 – 10 mm (Reading 0,1 mm) Grid 5 x 10 mm (Pitch 1 mm)
183-107	Angle 0 – 90° (Reading 0–80° = 5°; 80–90° = 1°) Radius 0 – 10 mm (Reading 0–1 mm = 0,1 mm; 1–10 mm = 0,5 mm) Scale 0 – 38"
183-108	Grid 10 x 10 mm (Pitch 0,5 mm) Diameter 0,1; 0,2; 0,3; 0,4; 0,5; 0,6; 0,7; 0,8; 0,9; 1; 1,5; 2; 2,5 mm
183-109	Scale 0 – 20 mm (Reading 0,1 mm)
183-110	Angle 0 – 180° (Reading 1°) Radius 0 – 10 mm (Reading 0,5 mm)
183-111	Thread pitches 0,25; 0,3; 0,35; 0,4; 0,45; 0,6; 0,75; 0,9; 10 mm
183-113	Angle 0 – 90° (Reading 1°) Radius 0 – 0,5" (Reading 0 – 0,5" = 0,005") Scale 0 – 10 mm (Reading 0,1 mm)
183-115	ISO-Thread pitches 0,25; 0,3; 0,35; 0,4; 0,45; 0,5; 0,7; 0,8; 1 mm

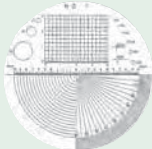


### Specifications

Measuring plate diameter	30 mm
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### Optional accessories

No.	Description
950757	Magnifier holder with illumination (without battery)
353489	Battery LR14



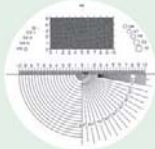
183-102



183-103



183-104



183-105



183-107



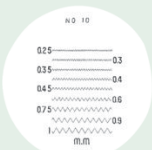
183-108



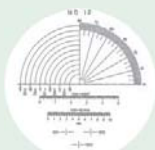
183-109



183-110



183-111



183-113



183-115

# Pocket Magnifiers

## Series 183 - Slim model

These slim model pocket magnifiers are designed to give you maximum stability, secure holding and easy handling.



183-201

No.	Dimensions [mm]	Magnification	Field of View [mm]	Mass [g]
183-201	ø14,5 x 125	25X	3,4	17

## Series 183 - Freestanding model



183-202



183-203

No.	Dimensions [mm]	Magnification	Field of View [mm]	Mass [g]
183-202	ø31,5 x 115	25X	3,3	90
183-203	ø31,5 x 100	50X	1,6	82

## Series 183

- Clear Loupe Magnifiers.
- Transparent draw tube enables clear imaging of the workpiece.



183-301



183-302



183-303



183-304



Reticle  
(provided with 183-304)

No.	Dimensions [mm]	Magnification	Field of View [mm]	Mass [g]
183-301	ø32 x 43	7X	25	17
183-302	ø32 x 40	10X	24	18
183-303	ø32 x 30	15X	10	23
183-304	ø45 x 70	8 - 16X zoom	10-20	149

# Measuring Microscope TM Generation B Series

## Series 176

With this Toolmaker's Microscope you can measure dimensions and angles on small workpieces thanks to the optional analogue or digital micrometer heads and the built-in circular scale.

Further benefits of the TM Generation B include:

- Toolmakers microscopes well-suited for measuring dimensions and angles of features on small workpieces with the XY stage and rotating eyepiece scale.
- Compact design with recessed grips for better portability. The slim design makes this microscope ideal for use in areas with limited space.
- Powerful adjustable LED light sources for contour and surface illumination provide optimum lighting conditions for workpiece inspection.
- The TM Generation B is available with work stages of 50 x 50 mm or 100 x 50 mm.



TM-505B fitted with optional digimatic micrometer heads



Rotating eyepiece with angle reading

Specifications	
Observation image	Erect
Angle reading	Range : 360° Minimum reading : 6' (by vernier)
Objective lens	2X <b>(176-138)</b> Working distance: 67 mm Optional: 5X, 10X
Eyepiece	15X <b>(176-116)</b> , View field ø13 mm Optional : 10X, 20X
Total magnification	30X
Transmitted illumination	Light source : White LED with green filter Functions: Light intensity adjustable
Surface illumination	Light source : White LED Functions: Light intensity adjustable
Power supply	100/240V AC, 50/60Hz
Mass	TM-505B: 14 [kg] TM-1005B: 15 [kg]

Standard accessories	
No.	Description
176-116	Eyepiece 15X (field of view ø13 mm)
176-138	Objective lens 2X
176-126	Eyepiece reticle cross hairs



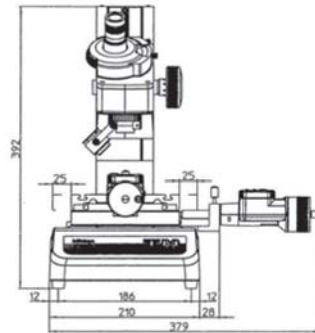
Optional LED Ring Light

# Measuring Microscope TM Generation B Series

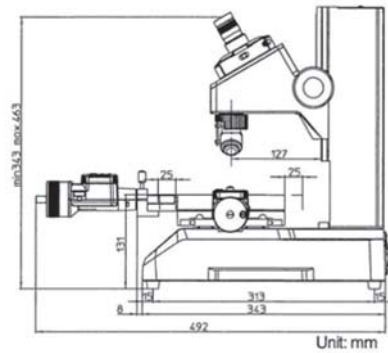
## Series 176

### Dimensions

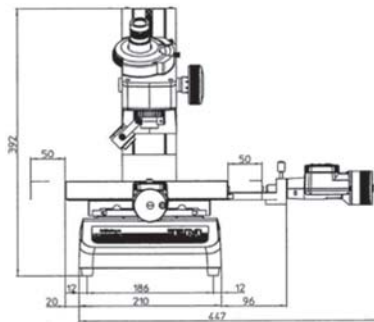
Model	TM-505B	TM-1005B
No.	176-818D	176-819D
XY stage travel range mm	50 x 50	100 x 50
XY stage table top size	152 x 152 mm	240 x 152 mm
Effective area of table	96 x 96 mm	154 x 96 mm
Max. workpiece height mm	115	107



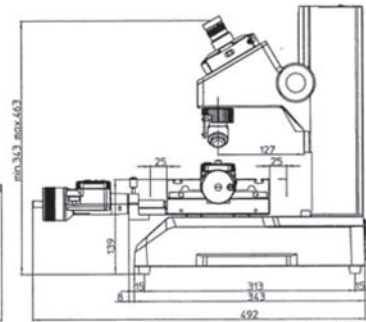
TM-505B



Unit: mm



TM-1005B



Unit: mm

# Accessories for Measuring Microscope TM Generation B

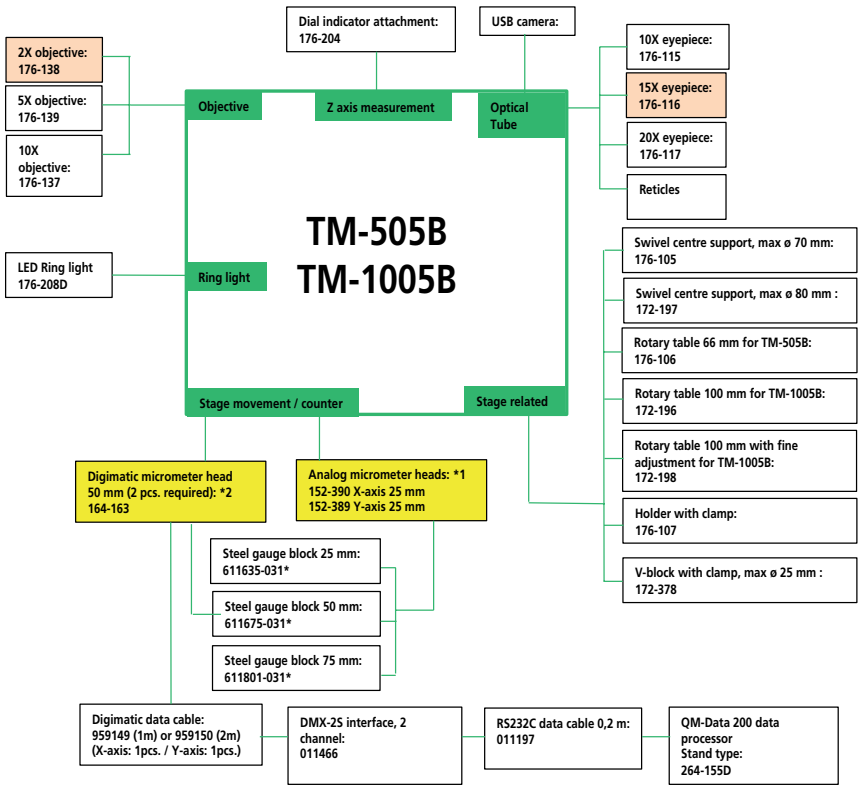
## Series 176

### Accessories

#### Objective Lenses and Eyepieces

No.	Objective lens	Eyepiece 10X (176-115)	Eyepiece 15X (176-116)	Eyepiece 20X (176-117)
176-137	10X	100X (1,3 mm)	150X (1,3 mm)	200X (1 mm)
176-138	2X <sup>(1)</sup>	20X (6,5 mm)	30X (6,5 mm)	40X (5 mm)
176-139	5X	50X (2,6 mm)	75X (2,6 mm)	100X (2 mm)

<sup>(1)</sup> Standard accessory  
The number in brackets is the diameter of the field of view



Standard accessory

Necessary option  
either chose \*1 or \*2

\* Necessary gauge blocks for extending stage travel range:

Stage travel range	TM with analog micrometer heads 0-25 mm	TM with digimatic micrometer heads 0-50 mm
Range 25-50 mm	X-axis:611635-031 Y-axis:611635-031	
Range 25-75 mm	X-axis:611675-031	
Range 25-100 mm	X-axis:611801-031	
Range 50-100 mm		X-axis:611675-031

#### Optional accessories

No.	Description
176-115	Eyepiece 10X (field of view ø13 mm)
176-117	Eyepiece 20X (field of view ø10 mm)
176-139	Objective lens 5X (W.D : 33 mm, N.A. : 0.10)
176-137	Objective lens 10X (W.D : 14 mm, N.A. : 0.14)
152-390	Micrometer head for X-axis 25 mm
152-389	Micrometer head for Y-axis 25 mm
176-204	Dial indicator attachment for Z-axis measurement
176-106	Rotary table 66 mm
176-105	Swivel centre support
172-197	Swivel centre support
172-378	V-block with clamp (Max. workpiece ø25 mm)
176-107	Holder with clamp
990561	Workpiece clip (2 pcs./set)
176-208D	LED Ring light
164-163	Digital micrometer head 50 mm
959149	Digimatic cable with data switch (1 m)
959150	Digimatic cable with data switch (2 m)
06ADV380C	USB Input tool Direct cable with data switch (2 m)
02AZD790C	U-WAVE Data Cable with data switch
12AAE044	Ring illumination adapter for TM
611635-031	Steel Individual Metric Gauge Block 25 mm Grade 1
611675-031	Steel Individual Metric Gauge Block 50 mm Grade 1
172-196	Rotary table 100 mm
172-198	Rotary table 100 mm with fine adjustment

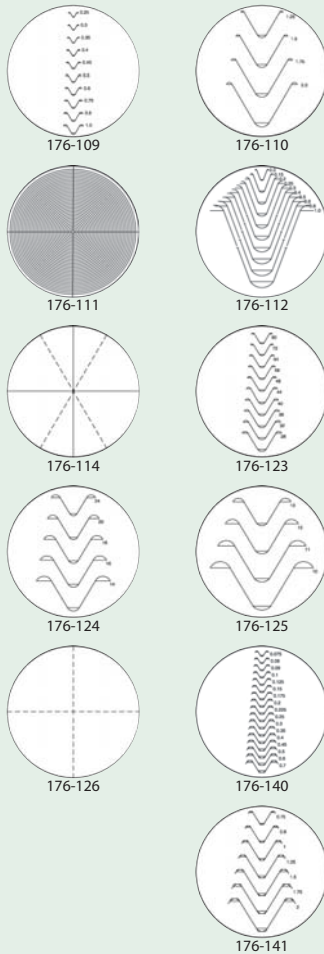
176-106 : for stage 50 x 50 mm  
172-196 and 172-198 : for stage 100 x 50 mm

# Accessories for Measuring Microscope TM Generation B

## Series 176

### Reticles

No.	Remarks
176-109	Metric screw threads (pitch = 0,25 - 1 mm)
176-110	Metric screw threads (pitch = 1,25 - 2 mm)
176-111	Concentric circle (up to ø 4 mm, 0,05 mm increment)
176-112	20° involute gear teeth (normal rack type)
176-114	60° angle
176-123	Unified screw threads (80 - 28TPI)
176-124	Unified screw threads (24 - 14TPI)
176-125	Unified screw threads (13 - 10TPI)
176-126	Cross-hair (standard accessory)
176-140	ISO metric screw threads (0,075 - 0,7 mm)
176-141	ISO metric screw threads (0,75 - 2 mm)





# Measuring Microscope MF Generation D Series

## Series 176

### MF Generation D Series: Manual models

This versatile measuring microscope, whether you use it to boost the performance with Mitutoyo's vision unit, for data management on a PC or other applications, offers you further improved measuring efficiency.

The MF offers you the following benefits:

- Measuring accuracy that is one of the highest in its class.
- Proven high-NA objectives from the ML optical series (long working distance type).
- Integration of metallurgical and measurement microscope functions enabling you to make high-resolution observations and high-accuracy measurements.
- Illumination unit (reflected/transmitted) gives you the option of a high-intensity LED or halogen bulb.
- The variable aperture diaphragm (reflected/ transmitted) allows observation measurement while suppressing light diffraction.
- Variety of standardized stages in sizes up to 400 × 200 mm.
- Quick-release mechanism enabling you to move the stage quickly when measuring large or numerous workpieces.
- High-magnification eyepiece observation up to 2000X.
- A good choice of optional accessories, including a Vision Unit, various digital CCD cameras or data management on a PC, promises a wide field of application and excellent measuring efficiency.



MF-B2017D



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



1010D  
100x100 mm



2010D  
200x100 mm



3017D  
300x170 mm



4020D  
400x200 mm

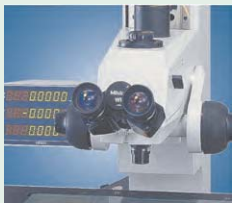
Specifications	
Observation image	Erect image
Optical tube	Monocular or binocular tube (depression: 25"), Reticle projection method, with TV mount, Optical path ratio (eyepiece/TV mount: 50/50)
Eyepiece	10X, 15X, 20X
Objective lens	Standard: 3X Optional: 1X, 5X, 10X, 20X, 50X, 100X
Transmitted illumination	Optical system: Telecentric illumination with adjustable aperture diaphragm Functions: Light intensity adjustable, non-stepped brightness adjustment
Surface illumination	Optical system: Koehler illumination with adjustable aperture diaphragm Functions: Light intensity adjustable, non-stepped brightness adjustment
Display unit	No. of axes: 2 (MF-A type) or 3 (MF-B type) Resolution: 0,001 mm/0,0005 mm/0,0001 mm Functions: Zero-setting, Direction switching, Data output (USB and RS-232C interface)
Indication accuracy (at 20°C)	XY-axis: (2,2+0,02L) μm Z-axis: (5+0,04L) μm L: Measuring length (mm) when not loaded, JIS B 7153
Floating function	X and Y axes with Quick-release mechanism
Power supply	100/110/120/220/240 VAC, 50/60Hz



Reticle mounts (standard accessories)



176-392  
Optional monocular



176-393  
Optional binocular



Refer to the MF / MF-U microscopes brochure

# Measuring Microscope MF Generation D Series

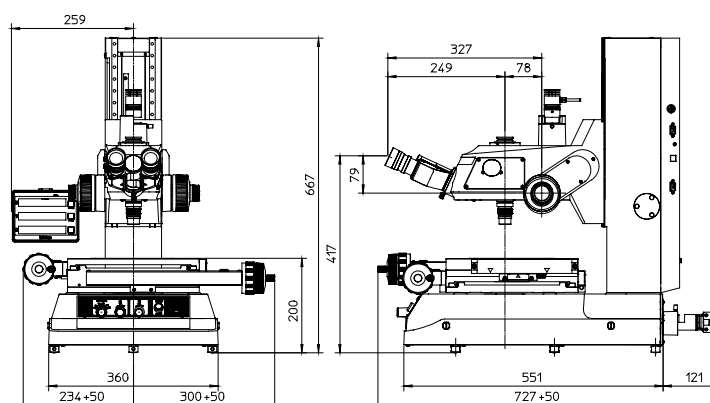
## Series 176

### Specifications/Dimensions

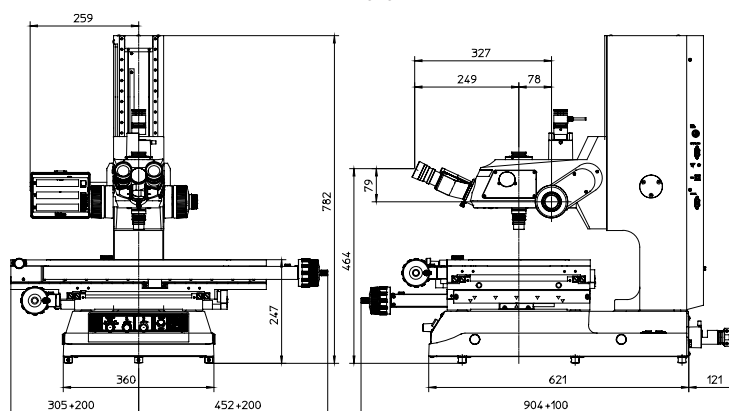
Model	1010D	2010D	2017D	3017D	4020D
No.	176-861-10 176-866-10	176-862-10 176-867-10	176-863-10 176-868-10	176-864-10 176-869-10	176-865-10 176-870-10
Swivelling function (left)	-	-	-	-	-
MF-A (2 axis) No.	176-861-10	176-862-10	176-863-10	176-864-10	176-865-10
MF-B (3 axis) No.	176-866-10	176-867-10	176-868-10	176-869-10	176-870-10
XY stage travel range mm	100 x 100	200 x 100	200 x 170	300 x 170	400 x 200
Z-axis travel range mm	150	150	220	220	220
XY stage top size mm	280 x 280	350 x 280	410 x 342	510 x 342	610 x 342
Effective glass size mm	180 x 180	250 x 150	270 x 240	370 x 240	440 x 240
Swivelling function	-	-	±5° (left)	±5° (left)	±3° (left)
Max. stage loading kg	10	10	20	20	15
Max. workpiece height mm	150	150	220	220	220
Mass kg	65,5	69,5	130	138	144

### Optional accessories

No.	Description
12AAA165	Lens cleaning set
375-054	0.5X camera adapter (with C-mount adapter)
12BAB345	Halogen bulb (24V/50W)
176-308	Vibration damping stand
375-056	Stage micrometer
12AAA846	Foot switch
264-155D	QM-Data 200 Stand type
<b>Eyepieces</b>	
176-392	Monocular tube with 10X eyepiece
176-393	Binocular tube with 10X eyepiece set
375-043	Protractor eyepiece (10X)
176-313D	Digital protractor eyepiece (10X)
378-856-5	10X eyepiece set (ø24 mm)
378-857-5	15X eyepiece set (ø16 mm)
378-858-5	20X eyepiece set (ø12 mm)
<b>Filters</b>	
12AAA643	ND2 colour filter
12AAA644	ND8 colour filter
12AAA645	GIF filter (transmitted / surface)
12AAA646	LB80 colour filter (transmitted / surface)
<b>Mounts</b>	
970441	C-mount adapter
176-370-1	Slide type nosepiece (2-mount / parfocal) factory-fit option
176-370-2	Slide type nosepiece (2-mount / mag. adjusted) factory-fit option
<b>Objective Lenses</b>	
375-036-2	1X lens (WD : 61 mm, NA : 0.03)
375-037-1	3X lens (WD : 77 mm, NA : 0.09)
375-034-1	5X lens (WD : 61 mm, NA : 0.13)
375-039	10X lens (WD : 51 mm, NA : 0.21)
375-051	20X lens (WD : 20 mm, NA : 0.42)
375-052	50X lens (WD : 13 mm, NA : 0.55)
375-053	100X lens (WD : 6 mm, NA : 0.7)



1010D



4020D



Focus pilot FP-05  
Focus assisting system



QM-Data 200



Vision Unit  
PC-based vision measuring system

# Measuring Microscope MF Generation D Series

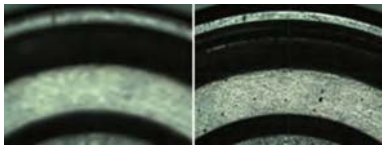
## Series 176

### MF Generation D Series: Models with motorized Z-axis movement

The MF Generation D version with a motorized Z-axis. This feature renders fast and accurate Auto Focus possible when used in combination with the optional Vision Unit. The MF with motorized Z-axis is available in 3 stage sizes and incorporates all the functionality of the standard MF Generation D series.

The MF Generation D with motorized Z-axis offers the following benefits:

- Auto Focus function when using the optional Vision Unit.
- A measuring accuracy that is one of the highest in its class.
- Proven high-NA objectives (long working distance type).
- Integration of metallurgical and measurement microscope functions enabling you to make high-resolution observations and high-accuracy measurements.
- Illumination unit (reflected/transmitted) offers the option of a high-intensity LED or halogen bulb.
- The variable aperture diaphragm (reflected/ transmitted) allows observation measurement while suppressing light diffraction.
- Variety of 3 standardized stages in sizes up to 400 × 200 mm.
- Quick-release mechanism enabling you to move the stage quickly when measuring large or numerous workpieces.
- High-magnification eyepiece observation up to 2000X.
- A large lineup of optional accessories, including a Vision Unit, various digital CCD cameras and data management for a PC, grants a wide field of applications and excellent measuring efficiency.



Screen image before and after Auto Focus\*  
\* When using optional Vision Unit



MF-J2017D

Specifications	
Observation image	Erect image
Optical tube	Monocular or binocular tube (depression: 25°), Reticle projection method, with TV mount, Optical path ratio (eyepiece/TV mount: 50/50)
Eyepiece	10X, 15X, 20X
Objective lens	Standard: 3X Optional: 1X, 5X, 10X, 20X, 50X, 100X
Transmitted illumination	Optical system: Telecentric illumination with adjustable aperture diaphragm Functions: Light intensity adjustable, non-stepped brightness adjustment
Surface illumination	Optical system: Koehler illumination with adjustable aperture diaphragm Functions: Light intensity adjustable, non-stepped brightness adjustment
Display unit	No. of axes: 3 Resolution: 0,001 mm/0,0005 mm/0,0001 mm Functions: Zero-setting, Direction switching, Data output (USB and RS-232C interface)
Indication accuracy (at 20°C)	XY-axis: (2,2+0,02L) μm Z-axis: (5+0,04L) μm L: Measuring length (mm) when not loaded, JIS B 7153
Floating function	X and Y axes with Quick-release mechanism
Power supply	100/110/120/220/240 VAC, 50/60Hz
Remote Box	- Speed adjustment - Coarse/Fine Speed switching - Jog shuttle - Emergency stop switch - AF button - Counter reset button - Data output button - Power switch - Limit setting (Z-axis) Remote Box



Refer to the MF / MF-U microscopes brochure

# Measuring Microscope MF Generation D Series

## Series 176

### Specifications/Dimensions

#### MF Generation D: Models with motorized Z-axis movement

Model No.	MF-J2017D	MF-J3017D	MF-J4020D
XY stage travel range mm	200 x 170	300 x 170	400 x 200
Z-axis travel range mm	220	220	220
XY stage top size mm	410 x 342	510 x 342	610 x 342
Effective glass size mm	270 x 240	370 x 240	440 x 240
Swivelling function	±5° (left)	±5° (left)	±3° (left)
Max. stage loading kg	20	20	15



Focus pilot FP-05  
Focus assisting system



QM-Data 200



Vision Unit  
PC-based vision measuring system

### Optional accessories

No.	Description
12AAA165	Lens cleaning set
375-054	0.5X camera adapter (with C-mount adapter)
12BAB345	Halogen bulb (24V/50W)
176-308	Vibration damping stand
375-056	Stage micrometer
12AAA846	Foot switch
264-155D	QM-Data 200 Stand type
<b>Eyepieces</b>	
176-392	Monocular tube with 10X eyepiece
176-393	Binocular tube with 10X eyepiece set
375-043	Protractor eyepiece (10X)
176-313D	Digital protractor eyepiece (10X)
378-856-5	10X eyepiece set (ø24 mm)
378-857-5	15X eyepiece set (ø16 mm)
378-858-5	20X eyepiece set (ø12 mm)
<b>Filters</b>	
12AAA643	ND2 colour filter
12AAA644	ND8 colour filter
12AAA645	GIF filter (transmitted / surface)
12AAA646	LB80 colour filter (transmitted / surface)
<b>Mounts</b>	
970441	C-mount adapter
176-370-1	Slide type nosepiece (2-mount / parfocal) factory-fit option
176-370-2	Slide type nosepiece (2-mount / mag. adjusted) factory-fit option
<b>Objective Lenses</b>	
375-036-2	1X lens (WD : 61 mm, NA : 0.03)
375-037-1	3X lens (WD : 77 mm, NA : 0.09)
375-034-1	5X lens (WD : 61 mm, NA : 0.13)
375-039	10X lens (WD : 51 mm, NA : 0.21)
375-051	20X lens (WD : 20 mm, NA : 0.42)
375-052	50X lens (WD : 13 mm, NA : 0.55)
375-053	100X lens (WD : 6 mm, NA : 0.7)

# Measuring Microscope MF Generation D Series

## Series 176

### MF Generation D Series: Motor driven models

All the functionality of the manual MF Generation D Series enhanced with motor driven axis in X, Y and Z offers the best you can expect of a measuring microscope when efficiency and operability is concerned.

The MF-D Series offers you the following benefits:

- Motor driven axis enabling you to move the stage quickly and without fatigue, ideal for measuring large or numerous workpieces.
- ML series, high NA objective lenses with long working distance.
- Focussing made easy when using the optional Vision Unit.
- Measuring accuracy that is one of the highest in its class.
- Illumination unit (reflected/transmitted) gives you the option of a high-intensity LED or halogen bulb.
- The variable aperture diaphragm (reflected/ transmitted) allows observation measurement while suppressing light diffraction.
- Variety of standardized stages in sizes up to 400 × 200 mm.
- High-magnification eyepiece observation up to 2000X.
- A good choice of optional accessories, including a Vision Unit, digital CCD cameras or data management on a PC, promises a wide field of application and excellent measuring efficiency.



MF-UJ 2017D

### MF Generation D: Motor driven models

Model	MF-G2017D	MF-G3017D	MF-G4020D
No.	176-781D	176-782D	176-783D
XY stage travel range mm	200 x 170	300 x 170	400 x 200
Effective glass size mm	270 x 240	370 x 240	440 x 240
Swiveling function (left)	± 5°	± 5°	± 3°
Z-axis travel range mm	220	220	220
XY stage top size mm	410 x 342	510 x 342	610 x 342
Max. stage loading kg	20	20	15

Specifications	
Resolution (switchable)	0,0001mm/0,0005mm/0,001mm
Observation image	Erect image
Optical tube	Monocular or binocular tube (depression: 25"), Reticle projection method, with TV mount, Optical path ratio (eyepiece/TV mount: 50/50)
Eyepiece	10X, 15X, 20X
Transmitted illumination	Optical system: Telecentric illumination with adjustable aperture diaphragm Functions: Light intensity adjustable, non-stepped brightness adjustment
Surface illumination	Optical system: Koehler illumination with adjustable aperture diaphragm



176-392  
Optional monocular



176-393  
Optional binocular



Refer to the MF/MF-U microscopes brochure



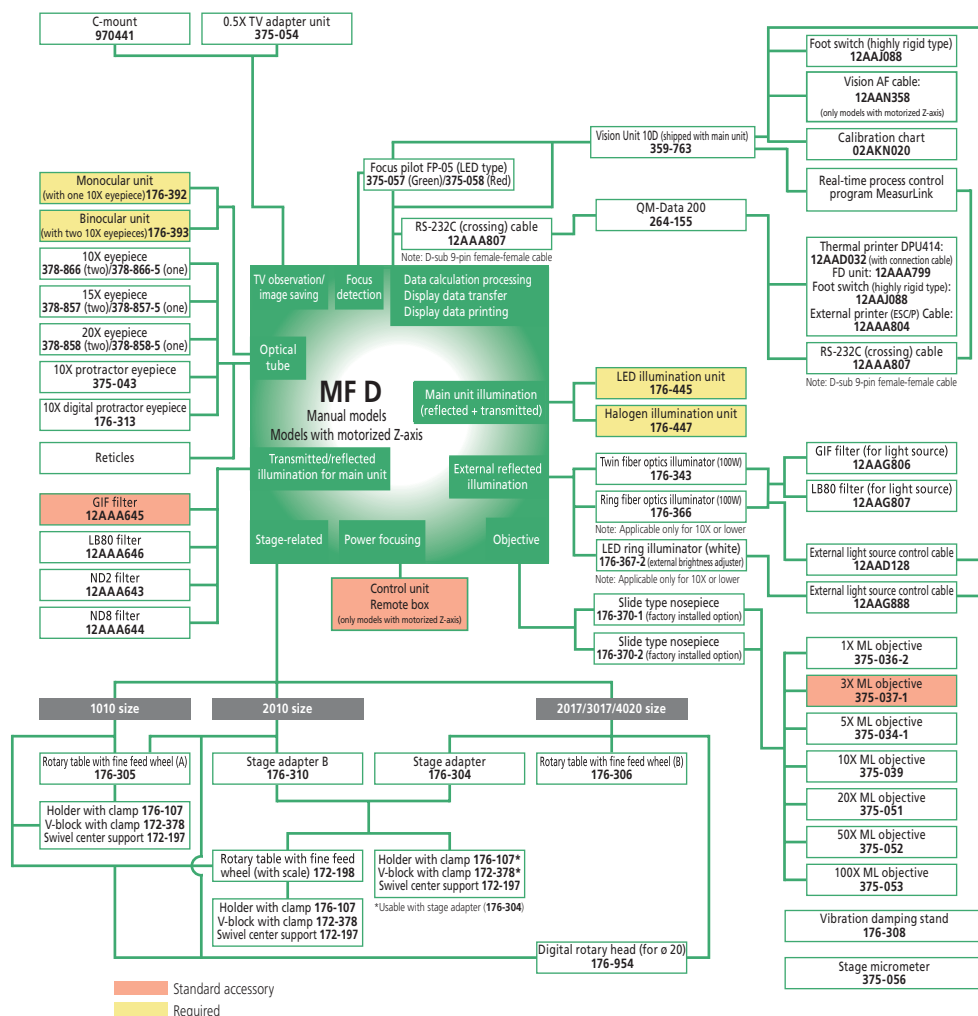
# Accessories for Measuring Microscope MF Generation D

## Series 176

### Accessories/system diagram system for MF manual and motorized Z-axis models

#### Optional accessories

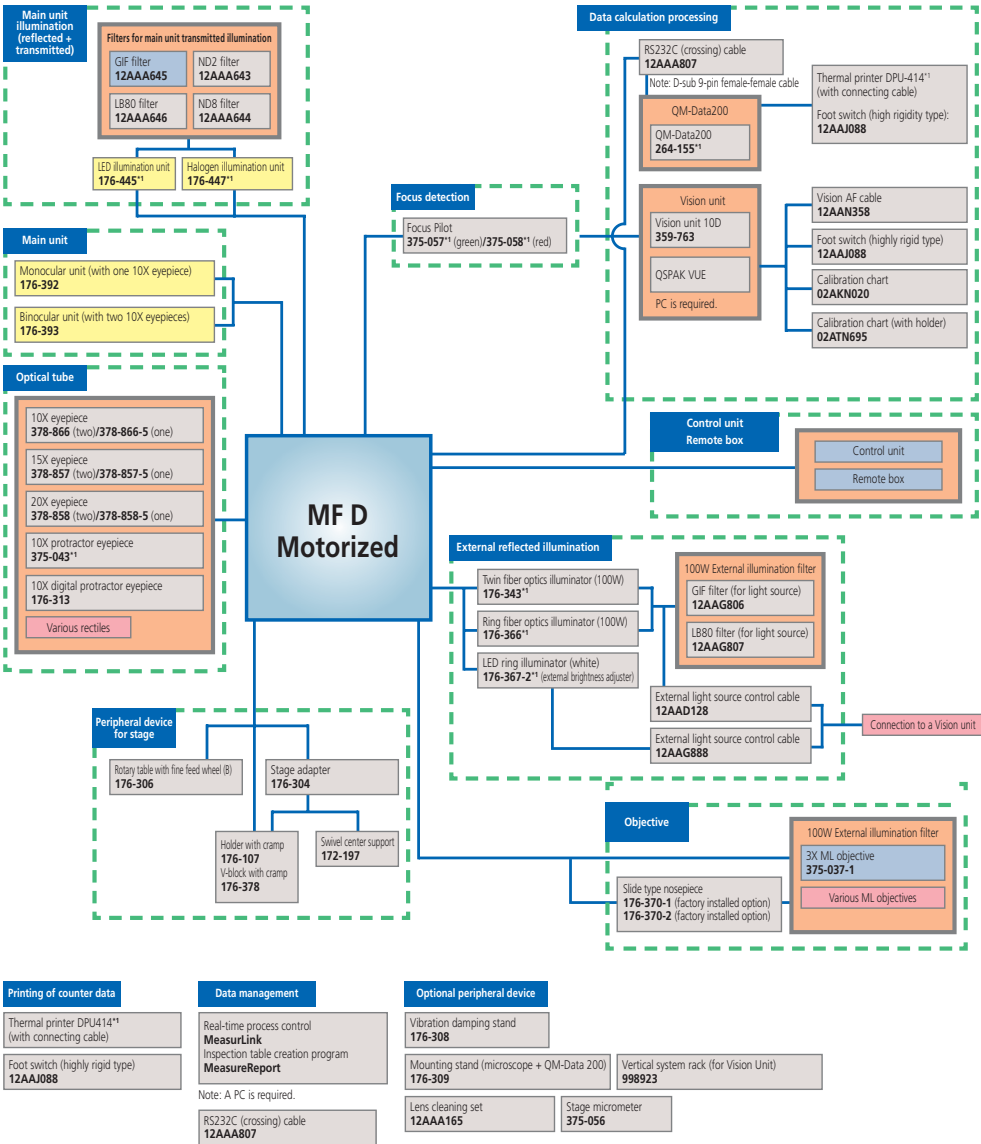
No.	Description
176-305	Rotary table with fine feed wheel ø183 mm
176-306	Rotary table with fine feed wheel ø240 mm
176-107	Holder with clamp
172-197	Swivel centre support
172-378	V-block with clamp (Max. workpiece ø25 mm)
172-198	Rotary table 100 mm with fine adjustment
12AAA807D	RS-232C cable (2m)
12AAG806	GIF filter
12AAG807	LB80 filter
<b>Eyepieces</b>	
378-856	10X eyepiece (2 pcs.)
378-856-5	10X eyepiece set (ø24 mm)
<b>Lighting</b>	
176-343D	Twin fibre-optic illuminator
176-367-2D	LED Ring Light
176-208D	LED Ring light
176-351-6	Oblique surface illumination unit
<b>Lighting (required option)</b>	
176-445D	LED illumination unit
176-447D	Halogen illumination unit
<b>Reticles</b>	
12AAG838	Cross-hair reticle (7 µm width)
12AAG846	Reticle 10x10 mm section
12AAG847	Reticle metric screw thread (P=0,25-1,0)
12AAG848	Reticle metric screw thread (P=1,25-2,0)
12AAG849	Reticle involute gear tooth (14.5°)
12AAG850	Reticle involute gear tooth (20°), module =0.1-1.0
12AAG851	Reticle unified screw thread (80-28TPI)
12AAG852	Reticle unified screw thread (24-14TPI)
12AAG853	Reticle unified screw thread (13-10TPI)
12AAG836	Cross-hair reticle (5 µm width)
12AAG873	Cross-hair reticle (3 µm width)
12AAG840	Broken cross-hair reticle and 60° angle
12AAG841	Zeiss type chart reticle
12AAG842	Reticle 20 mm scale
12AAG843	Reticle concentric circle (ø1.2 - ø18 mm)
12AAG844	Reticle 10 mm scale
12AAG839	Broken cross-hair and 45° angle
12AAG845	Reticle 5 mm scale



# Accessories for Measuring Microscope MF Generation D

Series 176

Accessories/system diagram for MF motor driven models



# Measuring Microscope MF-U Generation D Series

## Series 176

### MF-U Generation D Series: Manual models

This high-power multi-function measuring microscope gives you detailed observation with a clear and flare-less erect image and a wide field of view.

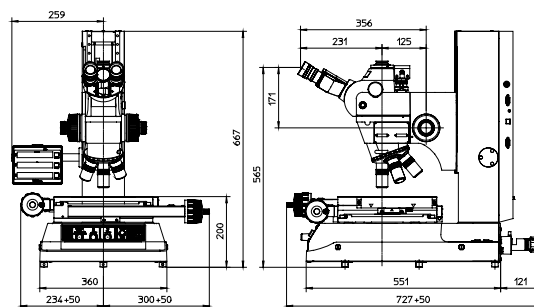
The MF-U offers you the following benefits:

- Measuring accuracy that is one of the highest in its class.
- Proven high-NA objectives from the FS optical system (long working distance type).
- Integration of metallurgical and measurement microscope functions enabling you to make high-resolution observations and high-accuracy measurements.
- Illumination unit (reflected/transmitted) gives you the option of a high-intensity LED or halogen bulb.
- The variable aperture diaphragm (reflected/ transmitted) allows observation measurement while suppressing light diffraction.
- Variety of standardized stages in sizes up to 400 × 200 mm.
- Quick-release mechanism enabling you to move the stage quickly when measuring large or numerous workpieces.
- High-magnification eyepiece observation up to 2000X.
- A good choice of optional accessories, including a Vision Unit, various digital CCD cameras or data management on a PC, promises a wide field of application and excellent measuring efficiency.

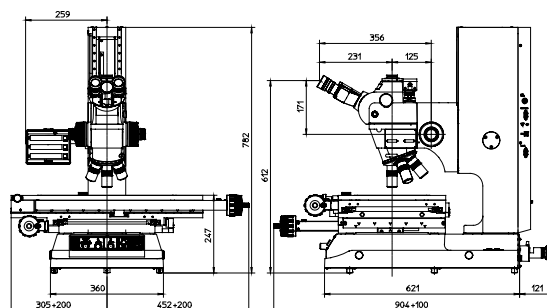


MF-UB 3017D

(turret, objectives and illumination are optional)



1010D



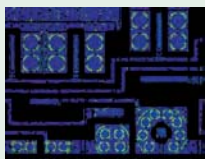
4020D



Optional 5 positions motorized turret

## Specifications

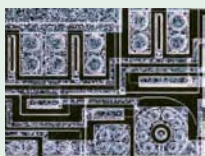
Observation image	Erect image
Optical tube	Siedentoph type (pupil distance adjustment : 51 - 76 mm), 1X tube lens, Binocular tube (depression : 30°), Reticle projection method, with TV mount, Optical path ratio (eyepiece/TV mount : 50/50)
Indication accuracy (at 20°C)	XY-axis : (2,2+0,02L) μm Z-axis : (5+0,04L) μm L : Measuring length (mm) when not loaded, JIS B 7153
Floating function	X and Y axes with Quick-release mechanism
Focusing method	Manual (coarse focusing : 10 mm/rev., fine focusing : 0,1 mm/rev.)
Power supply	220/240V AC, 50/60Hz
Eyepiece lens	10X (field No.: 24 mm) Optional : 15X, 20X
Turret (optional)	Manual or motorized
Objective lens (optional)	M / BD Plan Apo objective from 1X to 100X
Transmitted illumination optional	Light source : Halogen bulb (12V, 50W) Optical system : Telecentric illumination with adjustable aperture diaphragms Functions : Light intensity adjustable, Non-stepped brightness adjustment
Surface illumination optional	Light source : Optional halogen illumination unit (fiber-optic cold light illumination) Optical system : Koehler illumination with adjustable aperture diaphragms Functions : Light intensity adjustable, Non-stepped brightness adjustment
Display unit	Resolution: 0,001mm / 0,0005mm / 0,0001mm No. of axis : 2 axis or 3 axis Functions : Zero-setting, Direction switching, Data output (USB and RS-232C interface)



Polarized light



Differential interference contrast



Dark field



Bright field



Refer to the MF / MF-U microscopes brochure



# Measuring Microscope MF-U Generation D Series

## Series 176 - High-power Multi-function



Model 1010D



Model 2010D

### Model 1010D

XY stage travel range : 100 x 100 mm

Z-axis travel range : 150 mm

XY stage top size : 280 x 280 mm

Effective glass size : 180 x 180 mm

Max. stage loading : 10 kg

Max. workpiece height : 150 mm

Mass : 65,5 kg

Model	MF-UA1010D	MF-UB1010D	MF-UC1010D	MF-UD1010D
No.	176-871-10	176-876-10	176-881-10	176-886-10
Measurement system	X and Y axis (2 axes)	X, Y and Z axis (3 axes)	X and Y axis (2 axes)	X, Y and Z axis (3 axes)
Observation type	Bright Field (BF)	Bright Field (BF)	Bright/Dark Field (BF/DF)	Bright/Dark Field (BF/DF)

### Model 2010D

XY stage travel range : 200 x 100 mm

Z-axis travel range : 150 mm

XY stage top size : 350 x 280 mm

Effective glass size : 250 x 150 mm

Max. stage loading : 10 kg

Max. workpiece height : 150 mm

Mass : 69,5 kg

Model	MF-UA2010D	MF-UB2010D	MF-UC2010D	MF-UD2010D
No.	176-872-10	176-877-10	176-882-10	176-887-10
Measurement system	X and Y axis (2 axes)	X, Y and Z axis (3 axes)	X and Y axis (2 axes)	X, Y and Z axis (3 axes)
Observation type	Bright Field (BF)	Bright Field (BF)	Bright/Dark Field (BF/DF)	Bright/Dark Field (BF/DF)

## Optional accessories

No.	Description
375-054	0.5X camera adapter (with C-mount adapter)
970441	C-mount adapter
375-056	Stage micrometer
12AAA165	Lens cleaning set
12AAA846	Foot switch
172-378	V-block with clamp (Max. workpiece ø25 mm)
176-305	Rotary table with fine feed wheel ø183 mm
176-306	Rotary table with fine feed wheel ø240 mm
264-155D	QM-Data 200 Stand type
<b>Bulbs</b>	
12BAB345	Halogen bulb (24V/50W)
517181	Halogen bulb (24V, 100W)
12BAD602	High intensity bulb (24V/100W)
<b>DIC Units</b>	
378-076	DIC unit for 100X, SL80X, SL50X objective
378-078	DIC unit for 50X, SL20X objective
378-079	DIC unit for 20X objective
378-080	DIC unit for 10X, 5X objective
<b>Eyepieces</b>	
378-857	15X eyepiece
378-858	20X eyepiece
<b>Filters</b>	
12AAA643	ND2 colour filter
12AAA644	ND8 colour filter
12AAA645	GIF filter (transmitted / surface)
12AAA646	LB80 colour filter (transmitted / surface)
12AAG806	GIF filter
12AAG807	LB80 filter
<b>Lighting (required option)</b>	
176-343D	Twin fibre-optic illuminator
176-315D	Halogen illumination unit (12V, 100W)
176-316D	Halogen illumination unit (12V, 150W)
176-448D	Halogen illumination unit
<b>Reticles</b>	
12AAG876	Cross-hair reticle (3 µm width)
12AAG877	Cross-hair reticle (5 µm width)
12AAG878	Cross-hair reticle (7 µm width)
12AAG879	Cross-hair and 45° angle
12AAG880	Broken cross-hair and 60° angle
12AAG881	Zeiss type chart
<b>Stands</b>	
176-308	Vibration damping stand
176-107	Holder with clamp
172-197	Swivel centre support
<b>Turrets (required option)</b>	
378-018	Manual turret BF 4 mounts
378-216D	Power turret BF 5 mounts
176-211	Manual turret BF/DF 4 mounts
176-212D	Power turret BF/DF 4 mounts

# Measuring Microscope MF-U Generation D Series

## Series 176



Model 2017D



Model 3017D



Model 4020D

### Model 2017D

XY stage travel range : 200 x 170 mm  
 Z-axis travel range : 220 mm  
 XY stage top size : 410 x 342 mm  
 Effective glass size : 270 x 240 mm  
 Swivelling function (left) :  $\pm 5^\circ$   
 Max. stage loading : 20 kg  
 Max. workpiece height : 220 mm  
 Mass : 130 kg

Model	MF-UA2017D	MF-UB2017D	MF-UC2017D	MF-UD2017D
No.	176-873-10	176-878-10	176-883-10	176-888-10
Measurement system	X and Y axis (2 axes)	X, Y and Z axis (3 axes)	X and Y axis (2 axes)	X, Y and Z axis (3 axes)
Observation type	Bright Field (BF)	Bright Field (BF)	Bright/Dark Field (BF/DF)	Bright/Dark Field (BF/DF)

### Model 3017D

XY stage travel range : 300 x 170 mm  
 Z-axis travel range : 220 mm  
 XY stage top size : 510 x 342 mm  
 Effective glass size : 370 x 240 mm  
 Swivelling function (left) :  $\pm 5^\circ$   
 Max. stage loading : 20 kg  
 Max. workpiece height : 220 mm  
 Mass : 138 kg

Model	MF-UA3017D	MF-UB3017D	MF-UC3017D	MF-UD3017D
No.	176-874-10	176-879-10	176-884-10	176-889-10
Measurement system	X and Y axis (2 axes)	X, Y and Z axis (3 axes)	X and Y axis (2 axes)	X, Y and Z axis (3 axes)
Observation type	Bright Field (BF)	Bright Field (BF)	Bright/Dark Field (BF/DF)	Bright/Dark Field (BF/DF)

### Model 4020D

XY stage travel range : 400 x 200 mm  
 Z-axis travel range : 220 mm  
 XY stage top size : 610 x 342 mm  
 Effective glass size : 440 x 240 mm  
 Swivelling function (left) :  $\pm 3^\circ$   
 Max. stage loading : 15 kg  
 Max. workpiece height : 220 mm  
 Mass : 144 kg

Model	MF-UA4020D	MF-UB4020D	MF-UC4020D	MF-UD4020D
No.	176-875-10	176-880-10	176-885-10	176-890-10
Measurement system	X and Y axis (2 axes)	X, Y and Z axis (3 axes)	X and Y axis (2 axes)	X, Y and Z axis (3 axes)
Observation type	Bright Field (BF)	Bright Field (BF)	Bright/Dark Field (BF/DF)	Bright/Dark Field (BF/DF)

# Measuring Microscope MF-U Generation D Series

## Series 176

### MF-U Generation D Series: Models with motorized Z-axis movement

The MF-U Generation D version with a motorized Z-Axis. This feature renders fast and accurate Auto Focus possible when used in combination with the optional Vision Unit. The MF-U with motorized Z-axis is available in 3 stage sizes and incorporates all the functionality of the standard MF-U Generation D series.

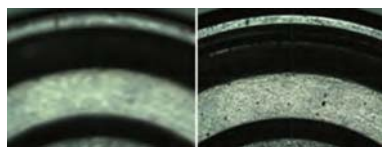
The MF-U Generation D with motorized Z-axis offers you the following benefits:

- Auto Focus function when using the optional Vision Unit.
- A measuring accuracy that is one of the highest in its class.
- Proven high-NA objectives from the FS optical system (long working distance type).
- Integration of metallurgical and measurement microscope functions enabling you to make high-resolution observations and high-accuracy measurements.
- Illumination unit (reflected/transmitted) gives you the option of a high-intensity LED or halogen bulb.
- The variable aperture diaphragm (reflected/ transmitted) allows observation measurement while suppressing light diffraction.
- Variety of 3 standardized stages in sizes up to 400 × 200 mm.
- Quick-release mechanism enabling you to move the stage quickly when measuring large or numerous workpieces.
- High-magnification eyepiece observation up to 2000X.
- A large lineup of optional accessories - including a Vision Unit, various digital CCD cameras or data management on a PC - grants a wide field of application and excellent measuring efficiency.



MF-UB 3017D

(turret, objectives and illumination are optional)



Screen image before and after Auto Focus\*  
\* When using optional Vision Unit

### Specifications

Observation image	Erect image
Optical tube	Siedentoph type (pupil distance adjustment : 51 - 76 mm), 1X tube lens, Binocular tube (depression : 30°), Reticle projection method, with TV mount, Optical path ratio (eyepiece/TV mount : 50/50)
Indication accuracy (at 20°C)	XY-axis : (2,2+0,02L) μm Z-axis : (5+0,04L) μm L : Measuring length (mm) when not loaded, JIS B 7153
Floating function	X and Y axes with Quick-release mechanism
Focusing method	Manual (coarse focusing : 10 mm/rev., fine focusing : 0,1 mm/rev.)
Power supply	220/240V AC, 50/60Hz
Eyepiece lens	10X (field No.: 24 mm) Optional : 15X, 20X
Turret (optional)	Manual or motorized
Objective lens (optional)	M / BD Plan Apo objective from 1X to 100X
Transmitted illumination optional	Light source : Halogen bulb (12V, 50W) Optical system : Telecentric illumination with adjustable aperture diaphragms Functions : Light intensity adjustable, Non-stepped brightness adjustment
Surface illumination optional	Light source : Optional halogen illumination unit (fiber-optic cold light illumination) Optical system : Koehler illumination with adjustable aperture diaphragms Functions : Light intensity adjustable, Non-stepped brightness adjustment
Display unit	Resolution: 0,001mm / 0,0005mm / 0,0001mm No. of axis : 2 axis or 3 axis Functions : Zero-setting, Direction switching, Data output (USB and RS-232C interface)
Remote Box	- Speed adjustment - Coarse/Fine Speed switching - Jog shuttle - Emergency stop switch - AF button - Counter reset button - Data output button - Power switch - Limit setting (Z-axis) Remote Box



Refer to the MF / MF-U microscopes brochure

# Measuring Microscope MF-U Generation D Series

## Series 176

### MF-U Generation D: Models with motorized Z-axis

#### 1. Bright Field Observation

Model	MF-UJ2017D	MF-UJ3017D	MF-UJ4020D
No.	176-894D	176-895D	176-896D
XY stage travel range mm	200 x 170	300 x 170	400 x 200
Effective glass size mm	270 x 240	370 x 240	440 x 240
Swiveling function (left)	±5° (left)	±5° (left)	±3° (left)
Z-axis travel range mm	220	220	220
XY stage top size mm	410 x 342	510 x 342	610 x 342
Max. stage loading kg	20	20	15

#### 2. Bright Field/ Dark Field Observation

Model	MF-UK2017D	MF-UK3017D	MF-UK4020D
No.	176-897D	176-898D	176-899D
XY stage travel range mm	200 x 170	300 x 170	400 x 200
Effective glass size mm	270 x 240	370 x 240	440 x 240
Swiveling function (left)	±5° (left)	±5° (left)	±3° (left)
Z-axis travel range mm	220	220	220
XY stage top size mm	410 x 342	510 x 342	610 x 342
Max. stage loading kg	20	20	15

#### Optional accessories

No.	Description
375-054	0.5X camera adapter (with C-mount adapter)
970441	C-mount adapter
375-056	Stage micrometer
12AAA165	Lens cleaning set
12AAA846	Foot switch
172-378	V-block with clamp (Max. workpiece ø25 mm)
176-305	Rotary table with fine feed wheel ø183 mm
176-306	Rotary table with fine feed wheel ø240 mm
264-155D	QM-Data 200 Stand type
<b>Bulbs</b>	
12BAB345	Halogen bulb (24V/50W)
517181	Halogen bulb (24V, 100W)
12BAD602	High intensity bulb (24V/100W)
<b>DIC Units</b>	
378-076	DIC unit for 100X, SL80X, SL50X objective
378-078	DIC unit for 50X, SL20X objective
378-079	DIC unit for 20X objective
378-080	DIC unit for 10X, 5X objective
<b>Eyepieces</b>	
378-857	15X eyepiece
378-858	20X eyepiece
<b>Filters</b>	
12AAA643	ND2 colour filter
12AAA644	ND8 colour filter
12AAA645	GIF filter (transmitted / surface)
12AAA646	LB80 colour filter (transmitted / surface)
12AAG806	GIF filter
12AAG807	LB80 filter
<b>Lighting (required option)</b>	
176-343D	Twin fibre-optic illuminator
176-315D	Halogen illumination unit (12V, 100W)
176-316D	Halogen illumination unit (12V, 150W)
176-448D	Halogen illumination unit
<b>Reticles</b>	
12AAG876	Cross-hair reticle (3 µm width)
12AAG877	Cross-hair reticle (5 µm width)
12AAG878	Cross-hair reticle (7 µm width)
12AAG879	Cross-hair and 45° angle
12AAG880	Broken cross-hair and 60° angle
12AAG881	Zeiss type chart
<b>Stands</b>	
176-308	Vibration damping stand
176-107	Holder with clamp
172-197	Swivel centre support
<b>Turrets (required option)</b>	
378-018	Manual turret BF 4 mounts
378-216D	Power turret BF 5 mounts
176-211	Manual turret BF/DF 4 mounts
176-212D	Power turret BF/DF 4 mounts

# Measuring Microscope MF-U Generation D Series

## Series 176

### MF-U Generation D Series: Motor driven models

All the functionality of the manual MF-U Generation D Series enhanced with motor driven axes in X, Y and Z offers the best you can expect of a measuring microscope when efficiency and operability is concerned.

The MF-U Generation D Series offers you the following benefits:

- Motor driven axis enabling you to move the stage quickly and without fatigue, ideal for measuring large or numerous workpieces.
- Proven high NA objective lenses from the FS optical system (long working distance type).
- Focussing made easy when using the optional Vision Unit.
- Models with Laser Auto Focus have by standard tracking focus functionality.
- Measuring accuracy that is one of the highest in its class.
- Illumination unit (reflected/transmitted) gives you the option of a high-intensity LED or halogen bulb.
- The variable aperture diaphragm (reflected/ transmitted) allows observation measurement while suppressing light diffraction.
- Variety of standardized stages in sizes up to 400 x 200 mm.
- High-magnification eyepiece observation up to 2000X.
- A good choice of optional accessories, including a Vision Unit, digital CCD cameras or data management on a PC, promises a wide field of application and excellent measuring efficiency.



MF-UG4020D



MF-UE2017D with LAF

#### 1) MF-U Generation D Bright Field Observation

Model No.	MF-UG2017D	MF-UG3017D	MF-UG4020D
XY stage travel range mm	200 x 170	300 x 170	400 x 200
Effective glass size mm	270 x 240	370 x 240	440 x 240
Swiveling function (left)	± 5°	± 5°	± 3°
Z-axis travel range mm	220	220	220
XY stage top size mm	410 x 342	510 x 342	610 x 342
Max. stage loading kg	20	20	15

#### 2) MF-U Generation D Bright Field/Dark Field Observation

Model No.	MF-UH2017D	MF-UH3017D	MF-UH4020D
XY stage travel range mm	200 x 170	300 x 170	400 x 200
Effective glass size mm	270 x 240	370 x 240	440 x 240
Swiveling function (left)	± 5°	± 5°	± 3°
Z-axis travel range mm	220	220	220
XY stage top size mm	410 x 342	510 x 342	610 x 342
Max. stage loading kg	20	20	15

### Specifications

Observation image	Erect image
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Refer to the MF / MF-U microscopes brochure

# Measuring Microscope MF-U Generation D Series

## 3) MF-U Generation D with Laser Auto Focus

Bright Field Observation

Model	MF-UE2017D	MF-UE3017D	MF-UE4020D
No.	176-790D	176-791D	176-792D
XY stage travel range mm	200 x 170	300 x 170	400 x 200
Effective glass size mm	270 x 240	370 x 240	440 x 240
Swiveling function (left)	± 5°	± 5°	± 3°
Z-axis travel range mm	220	220	220
XY stage top size mm	410 x 342	510 x 342	610 x 342
Max. stage loading kg	20	20	15

## 4) MF-U Generation D with Laser Auto Focus

Bright Field/Dark Field Observation

Model	MF-UF2017D	MF-UF3017D	MF-UF4020D
No.	176-793D	176-794D	176-795D
XY stage travel range mm	200 x 170	300 x 170	400 x 200
Effective glass size mm	270 x 240	370 x 240	440 x 240
Swiveling function (left)	± 5°	± 5°	± 3°
Z-axis travel range mm	220	220	220
XY stage top size mm	410 x 342	510 x 342	610 x 342
Max. stage loading kg	20	20	15



Optional turrets  
(Necessary option for MF-UD)



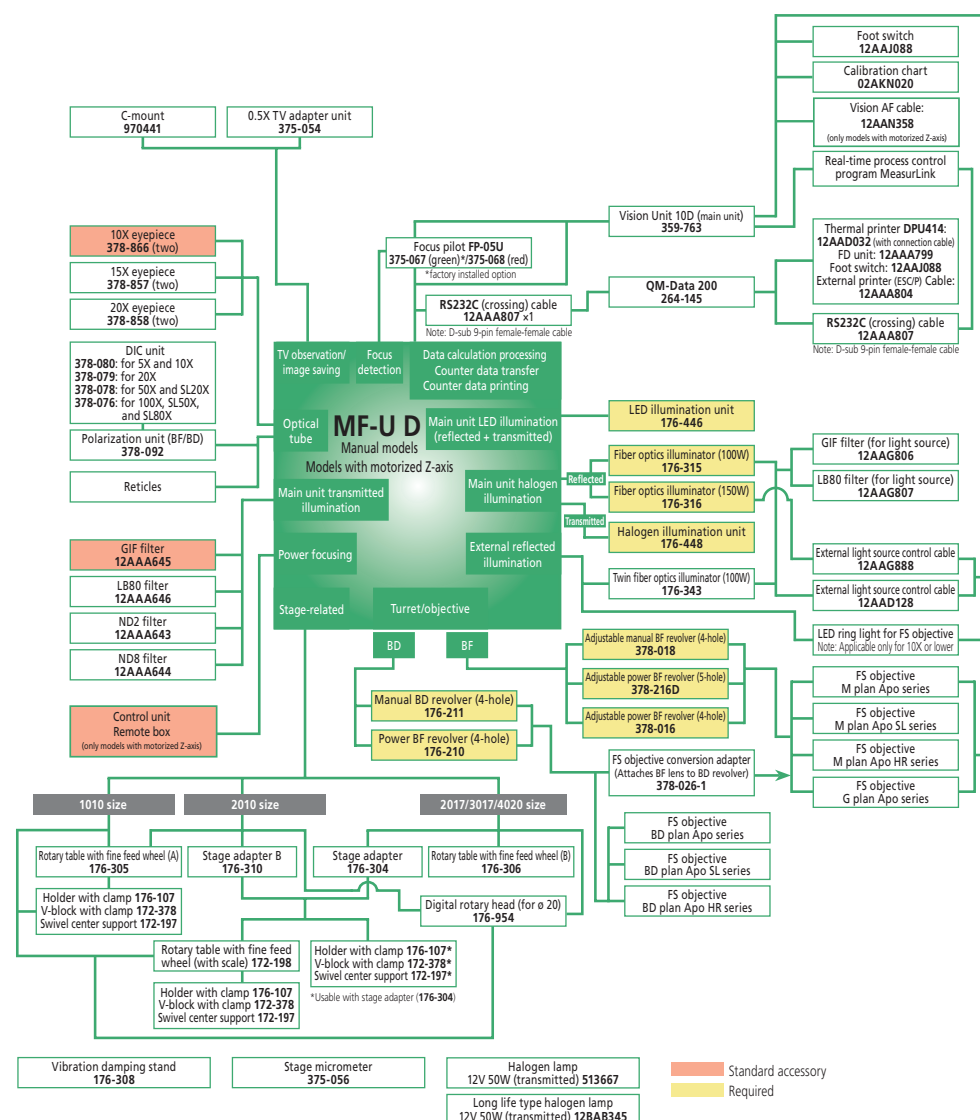
QM-Data 200



Vision Unit 10D



# Accessories for Measuring Microscope MF-U Generation D



## Optional accessories

No.	Description
375-054	0.5X camera adapter (with C-mount adapter)
970441	C-mount adapter
375-056	Stage micrometer
12AAA165	Lens cleaning set
12AAA846	Foot switch
172-378	V-block with clamp (Max. workpiece ø25 mm)
176-305	Rotary table with fine feed wheel ø183 mm
176-306	Rotary table with fine feed wheel ø240 mm

## Bulbs

12BAB345	Halogen bulb (24V/50W)
517181	Halogen bulb (24V, 100W)
12BAD602	High intensity bulb (24V/100W)

## DIC Units

378-076	DIC unit for 100X, SL80X, SL50X objective
378-078	DIC unit for 50X, SL20X objective
378-079	DIC unit for 20X objective
378-080	DIC unit for 10X, 5X objective

## Eyepieces

378-857	15X eyepiece
378-858	20X eyepiece

## Filters

12AAA643	ND2 colour filter
12AAA644	ND8 colour filter
12AAA645	GIF filter (transmitted / surface)
12AAA646	LB80 colour filter (transmitted / surface)
12AAG807	LB80 filter
12AAG806	GIF filter

## Lighting

176-343D	Twin fibre-optic illuminator
176-315D	Halogen illumination unit (12V, 100W)
176-316D	Halogen illumination unit (12V, 150W)
176-448D	Halogen illumination unit

## Reticles

12AAG876	Cross-hair reticle (3 µm width)
12AAG877	Cross-hair reticle (5 µm width)
12AAG878	Cross-hair reticle (7 µm width)
12AAG879	Cross-hair and 45° angle
12AAG880	Broken cross-hair and 60° angle
12AAG881	Zeiss type chart

## Stands

176-308	Vibration damping stand
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## Turrets (required option)

378-018	Manual turret BF 4 mounts
378-216D	Power turret BF 5 mounts
176-211	Manual turret BF/DF 4 mounts
176-212D	Power turret BF/DF 4 mounts
378-016D	Power turret BF 4 mounts

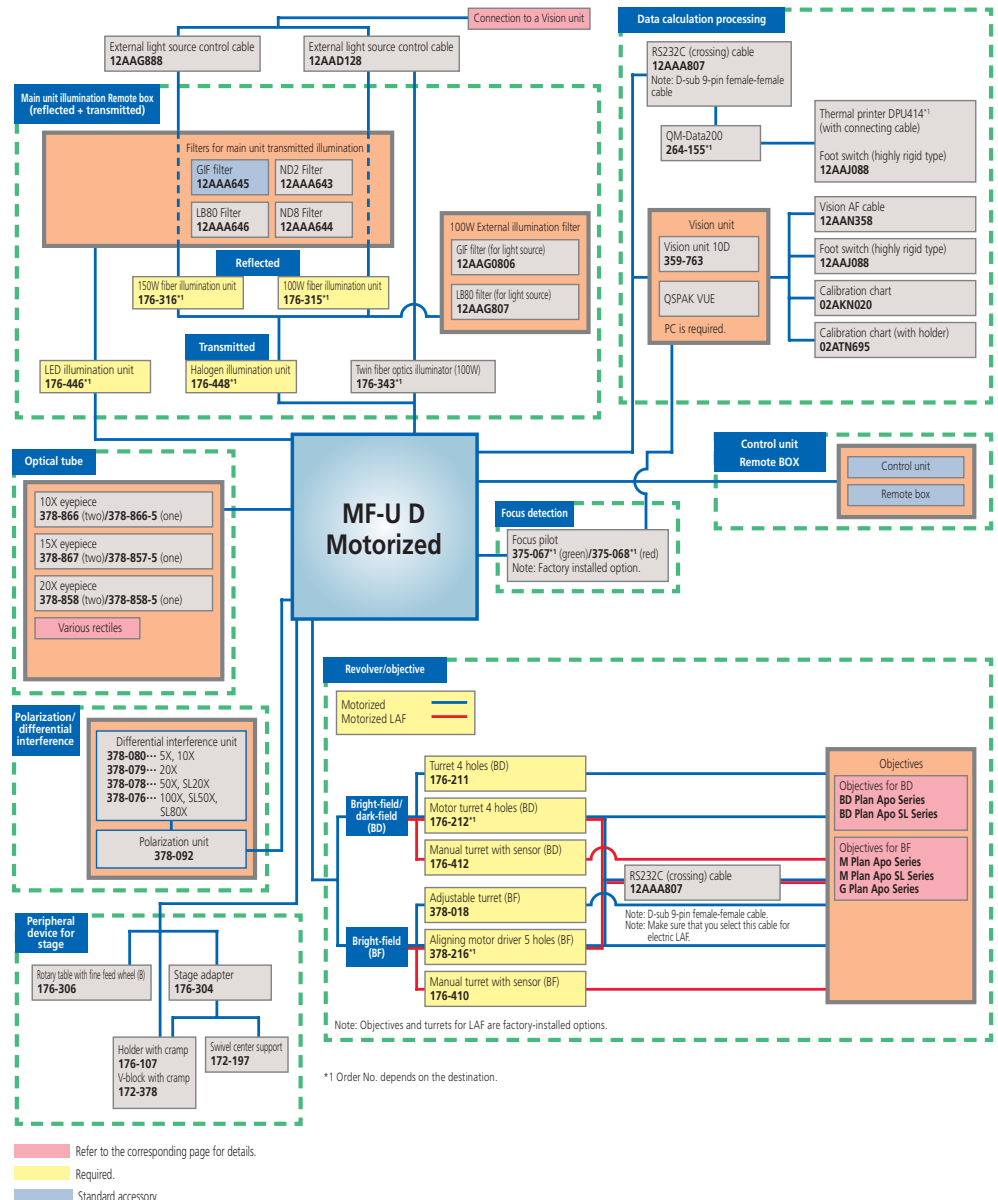
## Workpiece Fixture

176-107	Holder with clamp
172-197	Swivel centre support

# Accessories for Measuring Microscope MF-U Generation D

Series 176

Accessories/system diagram for MF-U motor driven models





# Optional Light Sources for Measuring Microscopes

## MF/MF-U Generation D

Series 176



Dual Swan-neck Light-pipe



LED Ring Light  
(for FS Objective lenses)

**Dual Swan-neck Light-pipe illuminator**  
Applicable microscopes : MF, MF-U models  
Length of fibre cable : 700 mm  
Light source : Halogen bulb (12V, 100W) (517181 : halogen bulb)  
Dimensions : Light unit 235 x 76 x 120 mm

No.  
176-343D

**Fibre-optic Ring Light**  
Applicable microscopes : MF models  
Length of fibre cable : 1000 mm  
Light source : Halogen bulb (12V, 100W) (517181 : halogen bulb)  
Dimensions : Light unit 235 x 76 x 120 mm

No.  
176-208D  
176-366CED

**LED Ring Light**  
Applicable microscopes : MF models with 1X, 3X, 5X, 10X objective  
Light source : White LED  
Length of LED cable : 1500 mm

No.  
176-367-2D



Fibre-optic Ring Light



LED Ring Light



Dual Swan-neck Light-pipe



Fibre-optic Ring Light



LED Ring Light

# Accessories for MF/MF-U Generation D

## Focus Pilot FP-05 /FP-05U

By installing this system on the camera mount of an MF series measuring microscope and projecting the focusing chart onto the workpiece surface, you can detect the focal point with high accuracy and high repeatability.

The Focus Pilot FP-05 / FP-05U offers you the following benefits:

- You can easily adjust the brightness of the image.
- You can achieve a wide view field observation on the monitor using a CCD camera (a C-mount adapter is included).
- You are offered a choice of four chart patterns, so you can select the pattern that works best with your workpiece surface texture type.



Concentric circle

Slit

## Focus Pilot

Magnification : 0,5X, Accuracy : 0,1% (within 2/3 area from the centre of field of view)

Camera adapter : C-mount (provided)

Applicable CCD camera : Up to 2/3-inch / 16,9 mm

Mass : 1,8 kg

No.	Model	Light source
375-057D	MF	Green LED
375-058D	MF	Red LED
375-067D	MF-U	Green LED
375-068D	MF-U	Red LED

## Manual Turrets for MF-U

No.	Objective lens	Remarks
176-211	Bright Field / Dark Field	4 Mounts
378-018	Bright Field	4 Mounts

## Power Turrets for MF-U

Power supply : 240V AC, 50/60 Hz

Dimensions : Turret : 164 x 65 x 137 mm

Control Box : 108 x 72 x 193 mm

No.	Objective lens	Remarks
176-212D	Bright Field / Dark Field	4 Mounts
378-016D	Bright Field	4 Mounts
378-216D	Bright Field	5 Mounts

## Stage Micrometer

No.	Range [mm]	Accuracy	Mass [g]
375-056	1	(1+L) $\mu$ m L : Measuring length (mm)	16



Focus Pilot is factory set option



Manual and Power Turrets



Stage Micrometer

# Measuring Microscope Hyper MF/MF-U Generation B Series

## Series 176

This measuring microscope has one of the highest XY measuring accuracies at 0,9+3L/1000 µm. The Hyper MF-B/MF-UB offers you the following benefits:

- One of the highest XY measuring accuracies in the world (0,9+3L/1000)<sup>1</sup> µm
- Selectable LAF (Laser Auto Focus) function.
- High operability and repeatability.
- Three-axis motorized control.
- You are offered the power-drive auto focus unit as standard.
- A range of useful fixtures is available that includes a wafer holder and swivel-centre support.

1. (L = measured length (mm) in XY plane, stage unloaded).



**Hyper MF-UF2515B**  
with optional turret and objective lenses

Measuring unit : Linear encoder  
Resolution : 0,01 µm  
Max. workpiece height : 150 mm

Model	Hyper MF-B2515B	Hyper MF-UB2515B	Hyper MF-UD2515B	Hyper MF-UE2515B	Hyper MF-UF2515B
No.	176-430D	176-431D	176-432D	176-433D	176-434D
Laser auto focus function	-	-	-	Available	Available
XY stage travel range mm	250 x 150	250 x 150	250 x 150	250 x 150	250 x 150
Effective glass size mm	300 x 200	300 x 200	300 x 200	300 x 200	300 x 200
Swiveling function (left)	±3°	±3°	±3°	±3°	±3°
Observation type	Bright Field	Bright Field	Bright Field or Bright Field/Dark Field	Bright Field	Bright Field or Bright Field/Dark Field
XY stage top size mm	460 x 350	460 x 350	460 x 350	460 x 350	460 x 350
Max. stage loading kg	30	30	30	30	30
Mass	14 kg (power unit) Hyper MF : 250 kg (main unit) Hyper MF-U : 255 kg (main unit)	14 kg (power unit) Hyper MF : 250 kg (main unit) Hyper MF-U : 255 kg (main unit)	14 kg (power unit) Hyper MF : 250 kg (main unit) Hyper MF-U : 255 kg (main unit)	14 kg (power unit) Hyper MF : 250 kg (main unit) Hyper MF-U : 255 kg (main unit)	14 kg (power unit) Hyper MF : 250 kg (main unit) Hyper MF-U : 255 kg (main unit)

## Specifications

Observation image	Erect
Optical tube	Reticle projection method, with TV mount, Optical path ratio <b>Hyper MF</b> : Monocular or binocular tube (optional depression : 25°) <b>Hyper MF-U</b> : Siedentoph type (pupil distance adjustment : 51 - 76 mm), 1X tube lens, Binocular tube (depression : 25°)
Eyepiece	<b>Hyper MF</b> : Optional 10X, 15X, 20X <b>Hyper MF-U</b> : 10X (field No. : 24 mm), Optional : 15X, 20X
Turret (optional)	<b>Hyper MF-U</b> : Motorized Objective (optional) : M / BD Plan Apo objective from 1X to 100X
Transmitted illumination	Light source : Halogen bulb (12V, 100W)(fiber-optic cold light illumination) Optical system : Telecentric illumination with adjustable aperture diaphragms Functions : Light intensity adjustable, 100 steps brightness adjustment
Surface illumination	Light source : Halogen bulb (12V, 50W) Optical system : Koehler illumination with adjustable aperture diaphragms Functions : Light intensity adjustable, 100 steps brightness adjustment
Dimensions (WxDxH)	160 x 476 x 381 mm (power unit) <b>Hyper MF</b> : 880 x 913 x 730 mm (main unit) <b>Hyper MF-U</b> : 880 x 913 x 770 mm (main unit) mm
Data output	Via RS-232C interface
Power supply	220/240V AC, 50/60 Hz
Optional Accessories	See MF accessories for Hyper MF or MF-U models



Control panel for fast traverse and three-axis positioning



Laser Auto Focus Optical Tube



Refer to the Hyper MF / MF-U brochure

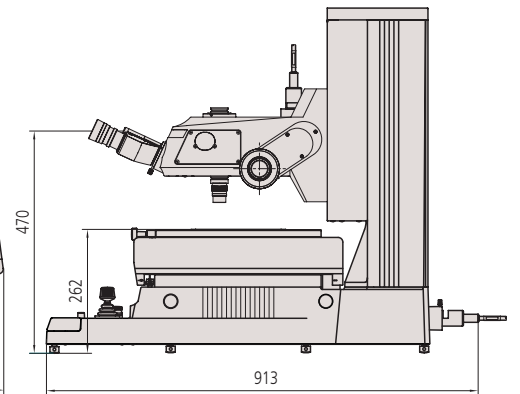
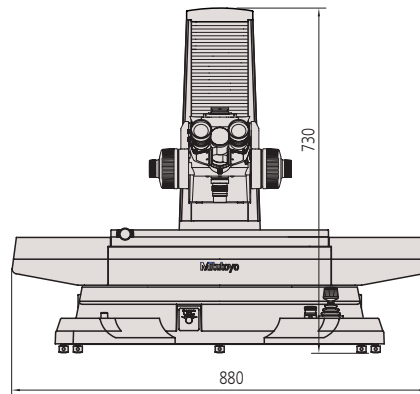
# Measuring Microscope Hyper MF/MF-U Generation B Series

## Series 176

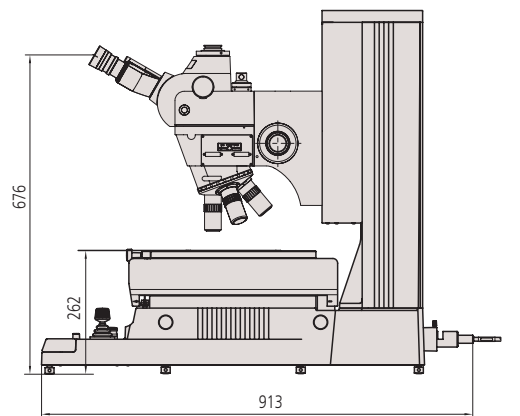
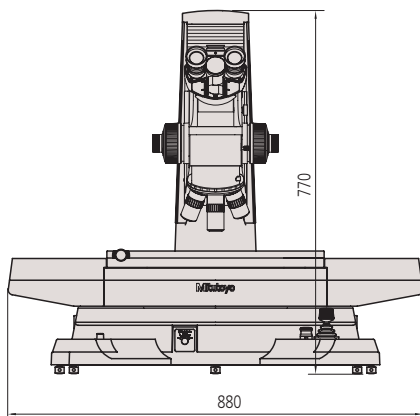
### Optional accessories

No.	Description
264-159D	Data processing unit QM-Data 200 for Hyper MF/MF-U

See MF accessories for Hyper MF models or MF-U accessories for Hyper MF-U models



Hyper MF-B2515B



Hyper MF-UB2515B



QM-Data 200  
2-D data processing unit



Vision Unit  
PC-based vision measuring system



# Vision Unit

## Series 359

This vision system retrofit for microscopes allows you to complete your measurement in one easy step with its automatic edge-detection tools and various macro icons.

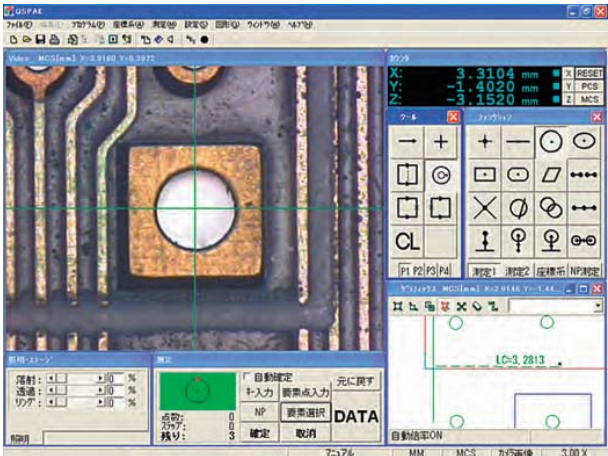
The Vision Unit offers you the following benefits:

- Easy operation due to the graphics and measurement navigation functions.
- Image data input/storage function.
- Measurement results are output to Microsoft® Excel®; this lets you generate an inspection table on the same computer.
- The unit allows you to verify that measurement results are within the tolerance zones and to carry out various types of statistical processing for each item.
- Combined use with the focus pilot gives you high accuracy in height measurements (patent pending).
- You can perform a series of measuring operations using just one screen display.
- The auto-brightness control function reproduces type and degree of illumination used.



The PC system, QSPAK VUE software and microscope are optional.

No.	Model	Description
359-763	Vision Unit 10D	For MF-D / MF-UD generation manual and motorized models
359-727	Vision Unit 9D	For MF-C generation
359-729	Vision Unit 9UD	For MF-UC generation
359-717	Vision Unit 8D	For MF-B generation
359-719	Vision Unit 8UD	For MF-UB generation
359-779	Vision Unit 7D	For Hyper MF-B / Hyper MF-UB generation
359-707	Vision Unit 6D	For MF-A generation
359-709	Vision Unit 6UD	For MF-UA generation



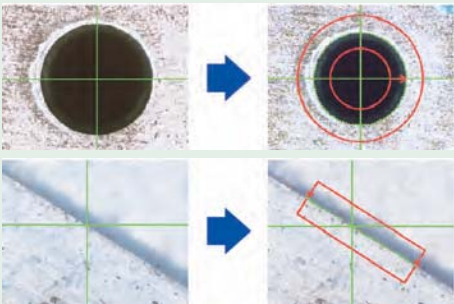
QSPAK VUE Measurement Window

## Specifications

Projected image	Inverted
Camera unit	Image sensor : 1/2" / 12,7 mm color CMOS camera Dimensions : 100 x 58 x 89 mm (W x D x H) Mass : 0,4 kg
Adapter unit	Operating software : QSPAK VUE (optional) Dimensions : 45 x 123 mm Magnification : 0,5X Mass : 0,3 kg
Magnification	19X - 1900X on 22" / 56 cm monitor (image resizable)
QSPAK VUE, optional software	<b>For observation/comparison of form</b> <ul style="list-style-type: none"><li>- Template matching function</li><li>- Manual pattern matching function</li></ul> <b>For simple measurement</b> <ul style="list-style-type: none"><li>- One-click edge detection tool function</li><li>- Smart tool function</li><li>- User macro function</li></ul> <b>Functions for repeated measurement/auto-measurement</b> <ul style="list-style-type: none"><li>- Quick navigation</li><li>- Playback</li><li>- Graphic</li><li>- External data output</li><li>- Statistical calculation</li></ul>

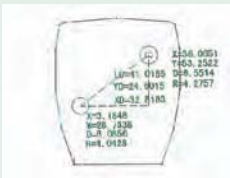
## Standard accessories

No.	Description
12AAJ088	Footswitch



## One-click Edge Detection

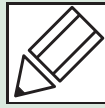
Just by clicking the mouse near the edge of a workpiece, QSPAK automatically scans the edge and detects it, showing its coordinates. This function also works with the point tool, box tool, circle tool and auto-focus tool.



## 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 calculations.

# 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  $\theta$ , 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 ( $\lambda$ ) of the illumination.

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

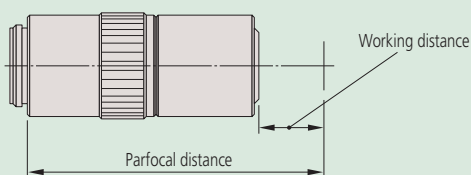
$\lambda = 0.55\mu\text{m}$  is often used as the reference wavelength

### 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.

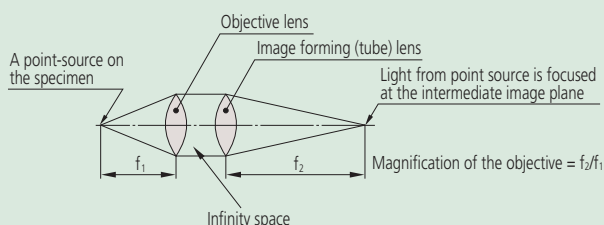
### Parfocal Distance

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 refocussing needed is minimal.



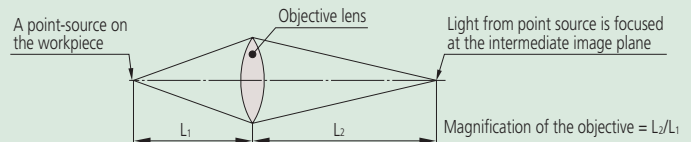
### Infinity Optical System

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  $f_1$  represents the focal length of an objective and  $f_2$  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.)

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

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

### 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:

$$DOF = \frac{\lambda}{2 \cdot (NA)^2} \quad \lambda = 0.55\mu\text{m} \text{ is often used as the reference wavelength}$$

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

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

### 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 Objective and Achromat Objective

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 Diagram

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

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)

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

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

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

### (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
0,847 cm / 1/3"	6.0	4.8	3.6
1,270 cm / 1/2"	8.0	6.4	4.8
1,693 cm / 2/3"	11.0	8.8	6.6

### (3) Monitor display magnification

$$\text{Monitor display magnification} =$$

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

# Microscope Unit FS70 Series

## Series 378 - Microscope Unit for Semiconductor Inspection

- Excellent operability with the inward rotating turret and high quality objective lenses with long working distance.
- Ideal as the microscope unit of a probe station for semiconductors.
- The L- and L4-models support YAG laser wavelength ranges from 266 up to 1064 nm allowing laser cutting of thin films and liquid crystal substrates.
- Ergonomic design with combined knob for coarse- and enlarged fine focus adjustment.



Model	FS70	FS70L	FS70L4	FS70L4
No.	378-184-1	378-184-3	378-185-1	378-185-3
Model short base	FS70-S	FS70L-S	FS70L4-S	FS70L4-S
Order No. short base model	378-184-2	378-184-4	378-185-2	378-185-4
Optical pass ratio	50/50	50/50	50/50	50/50
Tube lens	1X	1X	1X, 2X zoom	1X, 2X zoom
Camera mount	C-mount (using optional adapter B)	C-mount (using optional adapter B)	C-mount (using optional adapter B)	C-mount (using optional adapter B)
Loading (*) kg	14,5	13,6	14,1	13,2
Mass kg	6,1	7,1	6,6	7,5

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

Model	FS70L	FS70L4	FS70L4	FS70L4
No.	378-186-1	378-186-3	378-187-1	378-187-3
Model short base	FS70L-S	FS70L4-S	FS70L4-S	FS70L4-S
Order No. short base model	378-186-2	378-186-4	378-187-2	378-187-4
Optical pass ratio	100/0 or 0/100	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	Built-in laser beam filter	Built-in laser beam filter
Tube lens	1X	1X	1X	1X
Applicable laser	1064/532/355 nm	1064/532/355 nm	532/266 nm	532/266 nm
Camera mount	Use a laser with TV port.	Use a laser with TV port.	C-mount receptacle (with green filter switch)	C-mount receptacle (with green filter switch)
Objective, optional (for laser-cutting)	M/LCD Plan NIR M/LCD Plan NUV	M/LCD Plan NIR M/LCD Plan NUV	M Plan UV	M Plan UV
Loading (*) kg	14,2	13,5	13,9	13,1
Mass kg	6,4	7,2	6,7	7,5

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

### Specifications

Focus adjustment	<b>Method</b> : With concentric coarse and fine focusing wheels (right and left) <b>Range</b> : 50mm travel range, 0,1mm/rev. for fine adjustment, 3,8mm/rev. for coarse adjustment
Trinocular tube Image	Erect image
Interpupillary distance	Siedentopf type, adjustment range : 51-76mm
Field number	24
Tilt angle	0°- 20° (only - TH, - THS models)
Illumination system	Reflective illumination for bright field ( Koehler illumination, with aperture diaphragm)
Light source	12 V / 100 W fibre-optic, non-stopped adjustment, light guide length 1,5m, power consumption 150W
Objective lens (optional)	M Plan Apo, M Plan Apo SL, G Plan Apo
FS-70L/L4	<ul style="list-style-type: none"> <li>• The FS70L supports three YAG laser wavelengths (1064 nm, 532 nm and 355 nm), while the FS70L4 supports two wavelengths (532 nm and 266 nm), thus expanding the scope of laser applications, allowing laser-cutting of thin-films used in semiconductors and liquid crystal substrates. However, Mitutoyo assumes no responsibility whatever for the performance and/or safety of the laser system used with Mitutoyo microscopes. A careful examination is recommended when selecting a laser-emission unit.</li> <li>• Bright field, Differential Interference Contrast (DIC) and polarized observations are standard with the FS70Z. The FS70L and FS70L4 do not support the DIC method.</li> <li>• By employing an inward-leaning turret, the long working distance objectives provide excellent operability.</li> </ul>



Refer to the Microscope Units and objective lenses brochure



# Video Microscope Unit VMU Series

## Series 378

The VMU is a compact, lightweight and easy-to-install microscope unit for CCD camera monitoring in semiconductor fabrication facilities.

The VMU offers you the following benefits:

- The optical system features ultra-long working distance objectives and correction for the wide range of radiation wavelengths in use.
- Reflected illumination keeps your workpiece free from thermal expansion (the fibreoptic illuminator is required.)
- Also available with a laser mount or turret (objective mount).



VMU-V  
378-505

VMU-H  
378-506



VMU-LB  
378-513

VMU-L4B  
378-514

### Selection Guide to System Configuration (Depends on each system configuration)

No.	Applicable Wavelength	Vertical CCD camera mount	Horizontal CCD camera mount	YAG laser mount	Fibre optic illumination unit mount	Mass [g]
378-505	Near-infrared and visible radiation	Yes			Yes	570
378-506	Near-infrared and visible radiation		Yes		Yes	590
378-513	Near-infrared, visible, near-ultraviolet radiation	Yes		Yes	Yes	1270
378-514	Near infrared, visible, near ultraviolet and ultraviolet radiation	Yes		Yes	Yes	1300

Specifications	
Magnification of tube	1X
Reflected illumination	- Telecentric system with aperture stop system - Fibre-optic illuminator (optional) is required
Light source	Halogen bulb (21V, 150W) (optional)
Objective lenses for bright field observation (Optional accessory)	M Plan Apo, M Plan Apo SL, G Plan Apo
Objective lenses for laser cutting (Optional accessory)	M plan Apo NIR, LCD Plan Apo NIR, M Plan Apo NUV and LCD Plan Apo NUV
Objective lenses for laser machining (Optional accessory)	M Plan UV (for 378-514 only)



Refer to the microscope units and objective lenses brochure



Refer to the microscope units and objective lenses brochure

# Video Microscope Unit VMU Series

## Series 378

The WIDE VMU series takes video microscopy to the next level with a 7 times bigger field of view than conventional models. It supports both bright field and dark field observation.

The WIDE VMU offers the following benefits:

- Supported sensor size of 2-inch-equivalent, APS-C format
- Image field of ø30 mm with 1X tube lens
- Both F-mount and C-mount cameras can be mounted
- BF observations are supported by the WIDE VMU-V and -H models ,
- BD observations are supported by the WIDE VMU-BDV and -BDH models
- With the flexible orientation for camera and illumination mounting very compact arrangements can be configured.



WIDE VMU-V

WIDE VMU-H

WIDE VMU-BDV

WIDE VMU-BDH



Highly compact configuration of 4 WIDE VMU units

No.	Camera mount	Observation type	Illumination mount	Suitable objectives
378-515	Vertical	Bright field (BF)	Single port	Bright field (BF) series
378-516	Horizontal	Bright field (BF)	Single port	Bright field (BF) series
378-517	Vertical	Bright field / Dark field (BD)	Dual port	Bright field / Dark field (BD) series
378-518	Horizontal	Bright field / Dark field (BD)	Dual port	Bright field / Dark field (BD) series

Optional accessories: Motorized turret, focusing unit, polarizer

# Wide Field Eyepiece WF

## Series 378

- Extra-wide field of view type.
- Optional reticles are available.
- Applicable microscope models: MF-C, MF-UC, Hyper MF, Hyper MF-U, FS70.



### Individual

No.	Magnification	Field number	Correction range	Eye point	Mass [g]
378-856-5	10X	24	-10D to +5D	High	85
378-857-5	15X	16	-8D to +5D	Normal	40
378-858-5	20X	12	-8D to +5D	Normal	55

### Two-piece sets

No.	Magnification	Field number	Correction range	Eye point	Mass [g]
378-856	10X	24	-10D bis +5D	High	85
378-857	15X	16	-8D to +5D	Normal	40
378-858	20X	12	-8D to +5D	Normal	55

# Finity Corrected Objective Lens ML-Series

## Series 375

The Mitutoyo 375 Series finity corrected objective lenses realize clear images and long working distance.



No.	Magnification	N.A.	W.D.	D.F.
375-036-2	1X	0,03	61 mm	306 µm
375-037-1	3X	0,09	77 mm	34 µm
375-034-1	5X	0,13	61 mm	23 µm
375-039	10X	0,21	51 mm	6,2 µm
375-051	20X	0,42	20 mm	1,6 µm
375-052	50X	0,55	13 mm	0,9 µm
375-053	100X	0,7	6 mm	0,6 µm

## Optional accessories

No.	Description
516848	Reticle cross-hair
516576	Reticle broken cross-hair 90°, 60°
516578	20 mm scale (Min. reading: 0.1 mm) with cross hair reticle
516577	Reticle concentric circle Ø1.2 mm
516849	10 mm scale (Min. reading : 0.1 mm)
516850	5 mm scale (Min. reading : 0.05 mm)



Refer to the microscope units and objective lenses brochure

## Specifications

Abbreviations in product table	Mag. : Magnification N.A. : Numerical aperture W.D. : Working distance D.F. : Focal depth
--------------------------------	--

# Objective Lens M Plan Series

## Specifications

- Features**
- The long working distance type objective lenses 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 lens is an excellent optical system. This objective provides a flat, chromatic aberration-free image throughout the field of view, making it is suitable for any type of microscope.
  - Specially designed objective lenses are also available with correction for the near-infrared, near-ultraviolet and ultraviolet regions of the spectrum, or various thicknesses of LCD screen glass.
  - The mounting screw threads of objective lenses are designed to conform to JIS B-7141-1988.



Refer to the microscope units and objective lenses brochure

## Series 378

The Mitutoyo 378 Series objectives have one of the world's longest working distances and an infinity-corrected optical system. These objectives give you flexible observation at high magnifications and independent correction of chromatic aberration.



**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**



**Near-ultraviolet wavelength corrected M Plan Apo NUV objectives**



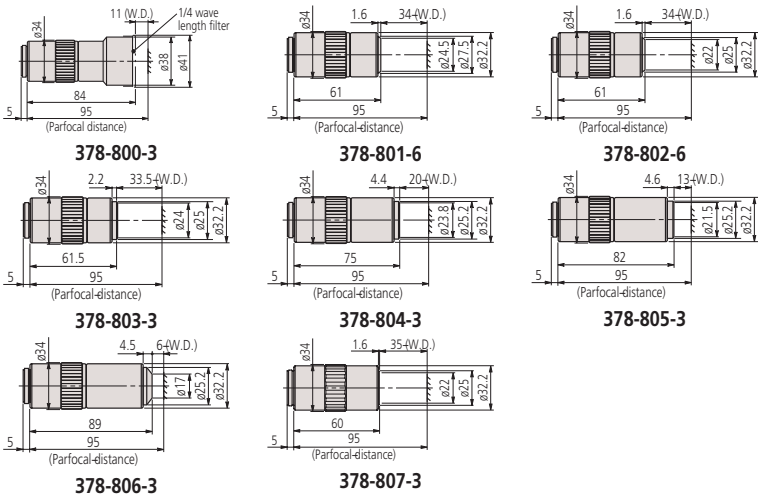
**Ultraviolet wavelength corrected M Plan UV objectives**



**Near-infrared wavelength corrected M Plan Apo NIR objectives**

# Objective Lens for Brightfield Observations FS-Series

## Series 378

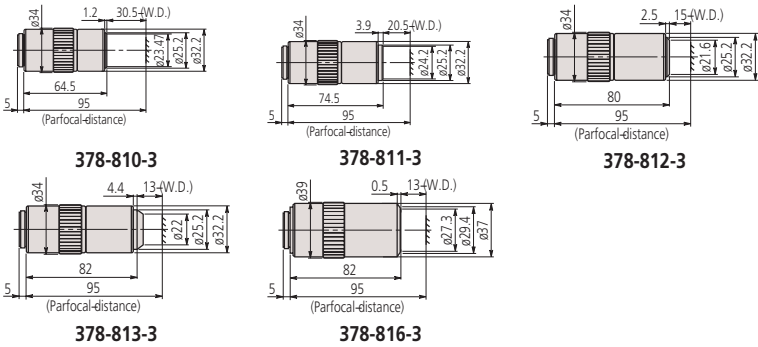


**M Plan Apo for Bright Field Observation**  
Compatible with microscope types VMU / FS-70 / MF-U / Hyper MF-U  
Note : Polarizing unit (378-074) is required when using 1X objective.

No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-800-3	1X	0,025	11 mm	200	11 μm	440 μm	ø24 mm	4,8x6,4 mm	300
378-801-6	2X	0,055	34 mm	100	5 μm	91 μm	ø12 mm	2,4x3,2 mm	220
378-802-6	5X	0,14	34 mm	40	2 μm	14 μm	ø4,8 mm	0,96x1,28 mm	240
378-807-3	7,5X	0,21	35 mm	26,67	1,3 μm	6,2 μm	ø3,6 mm	0,64x0,85 mm	240
378-803-3	10X	0,28	33,5 mm	20	1 μm	3,5 μm	ø2,4 mm	0,48x0,64 mm	230
378-804-3	20X	0,42	20 mm	10	0,7 μm	1,6 μm	ø1,2 mm	0,24x0,32 mm	270
378-805-3	50X	0,55	13 mm	4	0,5 μm	0,9 μm	ø0,48 mm	0,1x0,13 mm	290
378-806-3	100X	0,7	6 mm	2	0,4	0,6 μm	ø0,24 mm	0,05x0,06 mm	320

**M Plan Apo SL for Bright Field Observation**  
Compatible with microscope types VMU / FS-70 / MF-U / Hyper MF-U  
Note : These objectives offer extra-long working distance.

No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-810-3	20X	0,28	30,5mm	10	1 μm	3,5 μm	ø1,2mm	0,24x0,32mm	240
378-811-3	50X	0,42	20,5 mm	4	0,7 μm	1,6 μm	ø0,48 mm	0,1x0,13 mm	280
378-812-3	80X	0,5	15 mm	2,5	0,6 μm	1,1 μm	ø0,3 mm	0,06x0,08 mm	280
378-813-3	100X	0,55	13 mm	2	0,5 μm	0,9 μm	ø0,24 mm	0,05x0,06 mm	290
378-816-3	200X	0,62	13 mm	1	0,4 μm	0,7 μm	ø0,12 mm	0,025x0,03 mm	490



## Specifications

### Abbreviations in product table

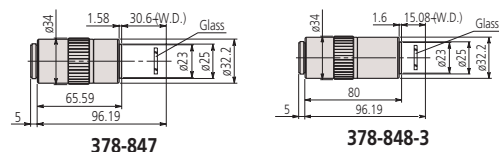
- Mag. : Magnification
- N.A. : Numerical aperture
- W.D. : Working distance
- f : Focal distance
- R : Resolving power
- D.F. : Focal depth
- F.O.V. 1 : Field of view when using ø24 mm eyepiece
- F.O.V. 2 : Field of view when using 1/2" / 12,7 mm CCD camera



Refer to the microscope units and objective lenses brochure

# Objective Lens for Brightfield Observations FS-Series

## Series 378



### Glass Thickness Corrected

#### G Plan Apo for Bright Field Observation

Compatible with microscope types VMU / FS-70 / MF-U / Hyper MF-U

Note : The G Plan Apo Series are designed for observing a workpiece through glass (thickness : 3,5 mm).

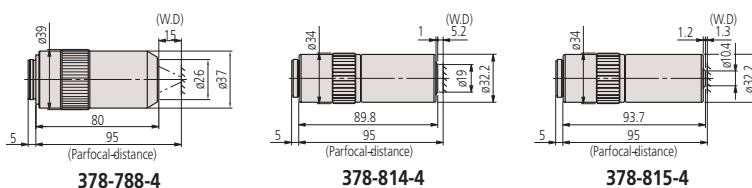
No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-847	20X	0,28	29,42 mm	10	1 µm	3,5 µm	ø1,2 mm	0,24x0,32 mm	270
378-848-3	50X	0,5	13,89 mm	4	0,6 µm	1,1 µm	ø0,48 mm	0,1x0,13 mm	320

#### M Plan Apo HR for Bright Field Observation

Compatible with microscope types VMU / FS-70 / MF-U / Hyper MF-U

Note : These objectives offer extra-high resolving power.

No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-788-4	10X	0,42	15 mm	20	0,7 µm	1,6 µm	ø2,4 mm	0,48x0,64 mm	460
378-814-4	50X	0,75	5,2 mm	4	0,4 µm	0,49 µm	ø0,48 mm	0,1x0,13 mm	400
378-815-4	100X	0,9	1,3 mm	2	0,3 µm	0,34 µm	ø0,24 mm	0,05x0,06 mm	410



### Specifications

#### Abbreviations in product table

Mag. : Magnification  
N.A. : Numerical aperture  
W.D. : Working distance  
f : Focal distance  
R : Resolving power  
D.F. : Focal depth  
F.O.V. 1 : Field of view when using ø24 mm eyepiece  
F.O.V. 2 : Field of view when using 1/2" / 12,7 mm CCD camera

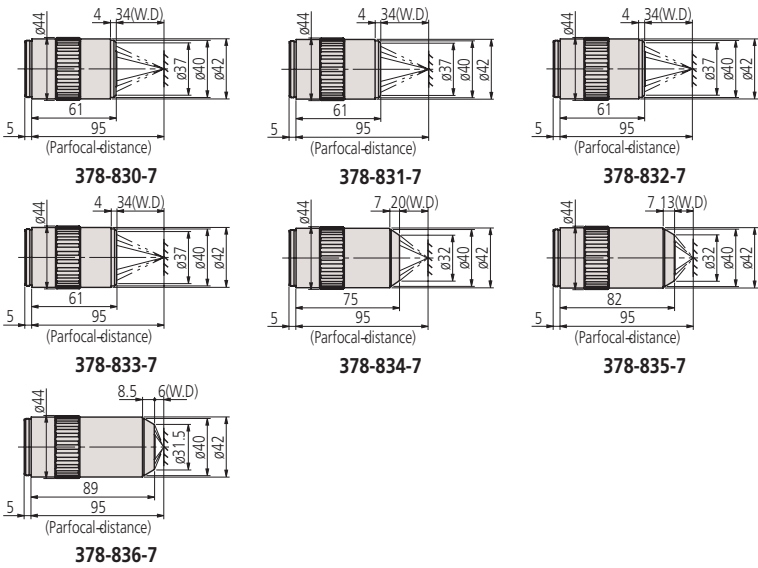


Refer to the microscope units and objective lenses brochure

# Objective Lens for Brightfield/Darkfield Observation

## FS-Series

### Series 378



#### BD Plan Apo for Bright/Dark Field Observation

Compatible with microscope types MF-U / Hyper MF-U

No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-831-7	2X	0,055	34 mm	100	5 µm	91 µm	ø12 mm	2,4x3,2 mm	340
378-832-7	5X	0,14	34 mm	40	2 µm	14 µm	ø4,8 mm	0,96x1,28 mm	350
378-830-7	7,5X	0,21	34 mm	26,67	1,3 µm	6,2 µm	ø3,6 mm	0,64x0,85 mm	350
378-833-7	10X	0,28	34 mm	20	1 µm	3,5 µm	ø2,4 mm	0,48x0,64 mm	350
378-834-7	20X	0,42	20 mm	10	0,7 µm	1,6 µm	ø1,2 mm	0,24x0,32 mm	400
378-835-7	50X	0,55	13 mm	4	0,5 µm	0,9 µm	ø0,48 mm	0,1x0,13 mm	440
378-836-7	100X	0,7	6 mm	2	0,4 µm	0,6 µm	ø0,24 mm	0,05x0,06 mm	460

#### BD Plan Apo HR for Bright/Dark Field Observation

Compatible with microscope types MF-U / Hyper MF-U

Note : These objectives offer extra-high resolving power.

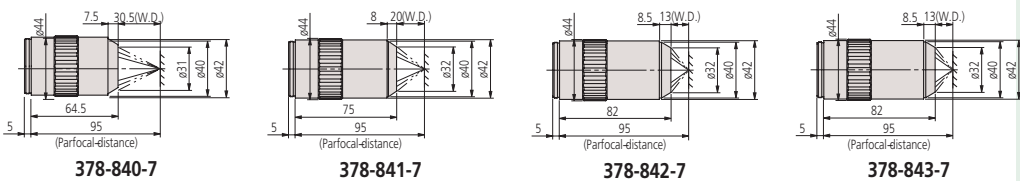
No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-845-7	50X	0,75	5,2 mm	4	0,4 µm	0,49 µm	ø0,48 mm	0,1x0,13 mm	530
378-846-7	100X	0,9	1,3 mm	2	0,3 µm	0,34 µm	ø0,24 mm	0,05x0,06 mm	545

#### BD Plan Apo SL for Bright/Dark Field Observation

Compatible with microscope types MF-U / Hyper MF-U

Note : These objectives offer extra-long working distance.

No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-840-7	20X	0,28	30,5 mm	10	1 µm	3,5 µm	ø1,2 mm	0,24x0,32 mm	350
378-841-7	50X	0,42	20 mm	4	0,7 µm	1,6 µm	ø0,48 mm	0,1x0,13 mm	410
378-842-7	80X	0,5	13 mm	41031	0,6 µm	1,1 µm	ø0,3 mm	0,06x0,08 mm	430
378-843-7	100X	0,55	13 mm	2	0,5 µm	0,9 µm	ø0,24 mm	0,05x0,06 mm	440



### Specifications

#### Abbreviations in product table

- Mag. : Magnification
- N.A. : Numerical aperture
- W.D. : Working distance
- f : Focal distance
- R : Resolving power
- D.F. : Focal depth
- F.O.V. 1 : Field of view when using ø24 mm eyepiece
- F.O.V. 2 : Field of view when using 1/2" / 12,7 mm CCD camera

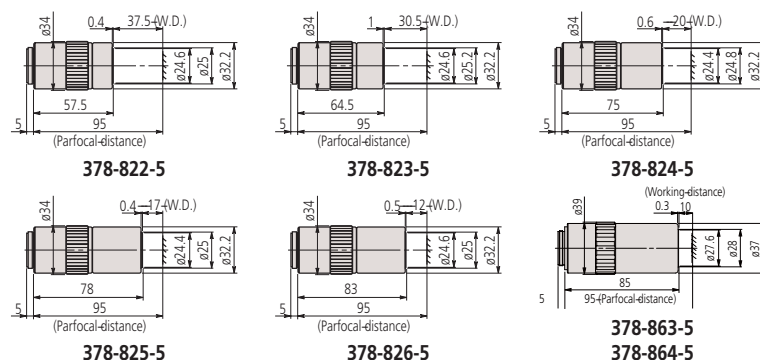


Refer to the microscope units and objective lenses brochure



# Objective Lens for NIR, NUV and UV Observation FS-Series

## Series 378



### Near-infrared wavelength Corrected

#### M Plan Apo NIR for Bright Field Observation

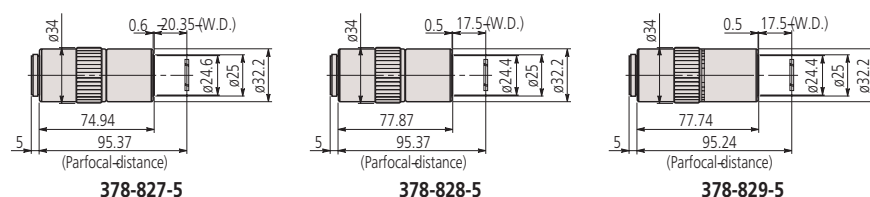
Compatible with microscope types VMU / FS-70

No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-822-5	5X	0,14	37,5 mm	40	2 μm	14 μm	ø4,8 mm	0,96x1,28 mm	220
378-823-5	10X	0,26	30,5 mm	20	1,1 μm	4,1 μm	ø2,4 mm	0,48x0,64 mm	250
378-824-5	20X	0,4	20 mm	10	0,7 μm	1,7 μm	ø1,2 mm	0,24x0,32 mm	300
378-825-5	50X	0,42	17 mm	4	0,7 μm	1,6 μm	ø0,48 mm	0,1x0,13 mm	315
378-826-5	100X	0,5	12 mm	2	0,6 μm	1,1 μm	ø0,24 mm	0,05x0,06 mm	335
378-863-5	50X	0,65	10 mm	4	0,42 μm	0,65 μm	ø0,48 mm	0,1x0,13 mm	450
378-864-5	100X	0,7	10 mm	2	0,39 μm	0,56 μm	ø0,24 mm	0,05x0,06 mm	450



Refer to the microscope units  
and objective lenses brochure

## Series 378



### Near-infrared wavelength and LCD Glass Thickness Corrected

#### LCD Plan Apo NIR for Bright Field Observation

Compatible with microscope types VMU / FS-70

Note : W.D. is just measured in air, not through an LCD glass

No.	Mag./glass thickness [mm]	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-827-5	20X/t1,1	0,4	19,98 mm	10	0,7 μm	1,7 μm	ø1,2 mm	0,24x0,32 mm	305
378-828-5	50X/t1,1	0,42	17,13 mm	3,9	0,7 μm	1,6 μm	ø0,48 mm	0,1x0,13 mm	320
378-829-5	50X/t0,7	0,42	17,26 mm	3,9	0,7 μm	1,6 μm	ø0,48 mm	0,1x0,13 mm	320
378-752-5	100X/t1,1	0,5	12,13 mm	2	0,6 μm	1,1 μm	ø0,24 mm	0,05x0,06 mm	335
378-754-5	100X/t0,7	0,5	11,76 mm	2	0,6 μm	1,1 μm	ø0,24 mm	0,05x0,06 mm	335

### Near-ultraviolet wavelength Corrected

#### M Plan Apo NUV for Bright Field Observation

Compatible with microscope types VMU / FS-70

No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-809-5	10X	0,28	30,5 mm	20	1 μm	3,5 μm	ø2,4 mm	0,48x0,64 mm	255
378-817-4	20X	0,4	17 mm	10	0,7 μm	1,7 μm	ø1,2 mm	0,24x0,32 mm	340
378-818-4	50X	0,42	15 mm	4	0,7 μm	1,6 μm	ø0,48 mm	0,1x0,13 mm	350
378-888-4	50X	0,65	10 mm	4	0,42 μm	0,65 μm	ø0,48 mm	0,1x0,13 mm	500
378-819-4	100X	0,5	11 mm	2	0,6 μm	1,1 μm	ø0,24 mm	0,05x0,06 mm	380

### Specifications

#### Abbreviations in product table

Mag. : Magnification  
N.A. : Numerical aperture  
W.D. : Working distance  
f : Focal distance  
R : Resolving power  
D.F. : Focal depth  
F.O.V. 1 : Field of view when using  
ø24 mm eyepiece  
F.O.V. 2 : Field of view when using  
1/2" / 12,7 mm CCD camera

#### M Plan Apo NIR

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

### Specifications

#### Abbreviations in product table

Mag. : Magnification  
N.A. : Numerical aperture  
W.D. : Working distance  
f : Focal distance  
R : Resolving power  
D.F. : Focal depth  
F.O.V. 1 : Field of view when  
using ø24 mm eyepiece  
F.O.V. 2 : Field of view when  
using 1/2" / 12,7 mm CCD camera

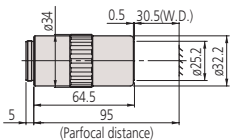


Refer to the microscope units  
and objective lenses brochure

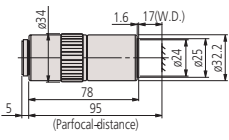


# Objective Lens for NIR, NUV and UV Observation

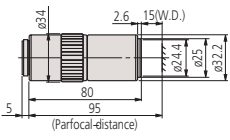
## FS-Series



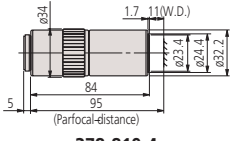
378-809-5



378-817-4

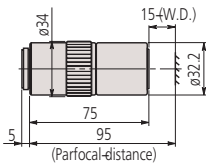


378-818-4

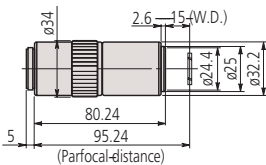


378-819-4

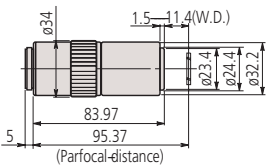
### Series 378



378-753-4



378-820-4



378-751-4

Near-ultraviolet wavelength and LCD Glass Thickness Corrected

LCD Plan Apo NUV for Bright Field Observation

Compatible with microscope types VMU / FS-70

Note : For 378-820-4, W.D. is just measured in air, not through an LCD glass

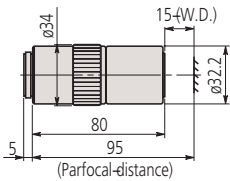
No.	Mag./glass thickness [mm]	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-753-4	50X/t1,1	0,42	14,53 mm	4	0,7 μm	1,6 μm	ø0,48 mm	0,1x0,13 mm	310
378-820-4	50X/t0,7	0,42	14,76 mm	4	0,7 μm	1,6 μm	ø0,48 mm	0,1x0,13 mm	310
378-751-4	100X/t1,1	0,5	11,03 mm	2	0,6 μm	1,1 μm	ø0,24 mm	0,05x0,06 mm	380

Ultraviolet wavelength Corrected

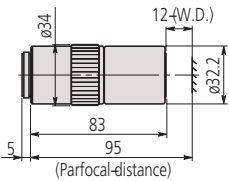
M Plan UV for Bright Field Observation

Compatible with microscope types VMU / FS-70

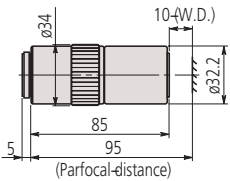
No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-844-5	10X	0,25	20 mm	20	1,1 μm	4,4 μm	ø2,4 mm	0,48x0,64 mm	310
378-837-5	20X	0,36	15 mm	10		2,1 μm	ø1,2 mm	0,24x0,32 mm	330
378-838-5	50X	0,4	12 mm	4	0,7 μm	1,7 μm	ø0,48 mm	0,1x0,13 mm	400
378-839-5	80X	0,55	10 mm	41031	0,5 μm	0,9 μm	ø0,3 mm	0,06x0,08 mm	380



378-837-5



378-838-5



378-839-5

### Specifications

#### Abbreviations in product table

- Mag. : Magnification
- N.A. : Numerical aperture
- W.D. : Working distance
- f : Focal distance
- R : Resolving power
- D.F. : Focal depth
- F.O.V. 1 : Field of view when using ø24 mm eyepiece
- F.O.V. 2 : Field of view when using 1/2" / 12,7 mm CCD camera



Refer to the microscope units  
and objective lenses brochure

# Measuring Projector PJ-A3000 Series

## Series 302

The PJ-A3000 Series profile projector is a medium-sized model that gives you excellent versatility and easy operation.

The PJ-A3000 offers you the following benefits:

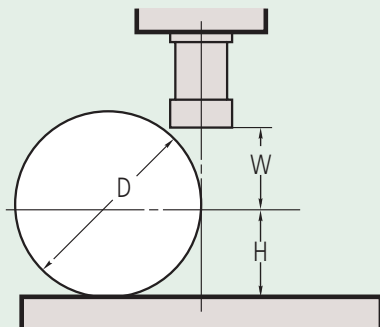
- The easy-to-read digital XY counter is located near the projection screen to minimize eye movement.
- You can measure angles easily with the digital readout protractor screen.



302-701-1D

## Specifications

Projected image	Inverted
Projector screen	Effective diameter : 315 mm Screen material : Fine-ground glass Screen rotation : $\pm 360^\circ$ , fine feed and clamp Angle display : Digital counter (LED) Resolution : 1' or 0,01° (switchable) Range : $\pm 370^\circ$ ABS/INC mode switching, Zero Set Reference lines : Cross-hairs
Projection lens	10X (172-202) Optional : 20X, 50X, 100X
Magnification accuracy	Contour illumination : $\pm 0,1\%$ or better Surface illumination : $\pm 0,15\%$ or better
Contour illumination	Light source : Halogen bulb (24V, 150W) Optical system : Telecentric Functions : 2-step (High/Low) brightness switch, Heat-absorbing filter, Cooling fan
Surface illumination	Light source : Halogen bulb (24V, 150W) Optical system : Vertical illumination with adjustable condenser lens Functions : Heat-absorbing filter, Cooling fan
Focusing	Manual
Resolution	0,001 mm (0,001 mm : digital head)
Power supply	220 - 240V AC, 50/60Hz



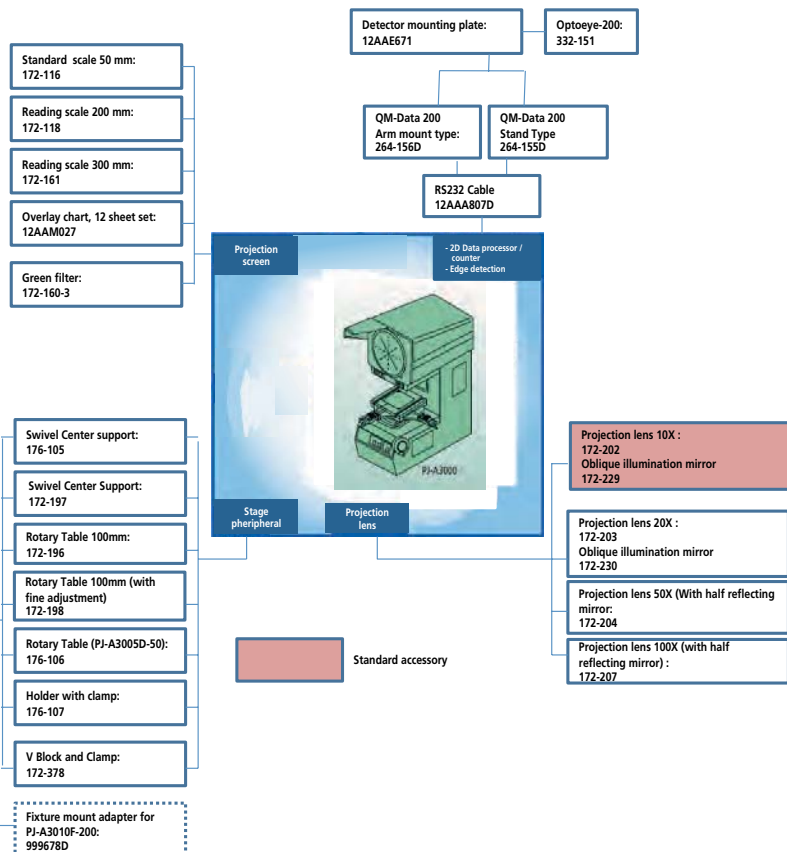
D : Max. workpiece diameter  
W : Working distance  
H : Max. workpiece height

	Magnification			
	10X	20X	50X	100X
View field	$\phi 31.5$	$\phi 15.7$	$\phi 6.3$	$\phi 3.1$
W	66 (20)	32.5 (2)	12.6	5
H	-50 models* 123.5	123.5	123.5	123.5
	-100 models 91	91	91	91
	-150 models 103.5	103.5	103.5	103.5
	200 models 92.5	92.5	92.5	92.5
D	-50 models* 224 (198)	87 (61)	27	10
	-100 models 182	87 (61)	27	10
	-150 models 207 (198)	87 (61)	27	10
	200 models 185	87 (61)	27	10

( ) When using surface illumination



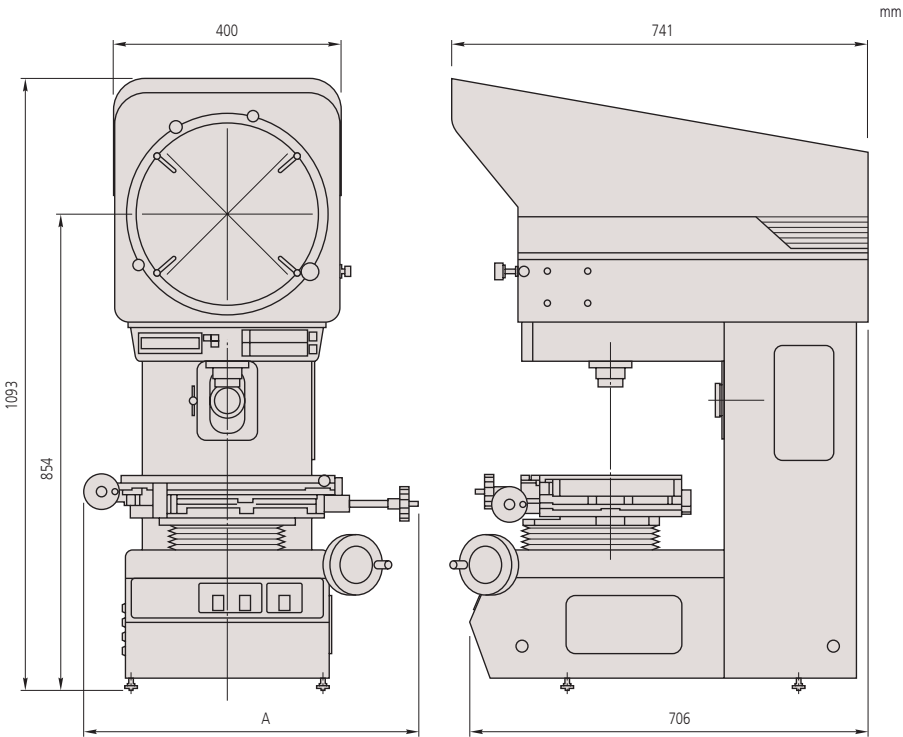
Refer to the PJ-A3000 brochure



# Measuring Projector PJ-A3000 Series

## Series 302 - Metric model

Metric XY stage 50 x 50 or 150 x 50 or 100 x 100 or 200 x 100 mm				
Model	PJ-A3005D-50	PJ-A3005F-150	PJ-A3010F-100	PJ-A3010F-200
No.	302-704-1D	302-702-1D	302-703-1D	302-701-1D
XY stage [mm]	50 x 50	150 x 50	100 x 100	200 x 100
Measuring method	Digimatic micrometer head	Linear encoder	Linear encoder	Linear encoder
Quick-release mechanism	—	X and Y axes	X and Y axes	X and Y axes
XY stage table top size [mm]	152 x 152	280 x 152	250 x 250	380 x 250
XY stage effective area [mm]	82 x 82	185 x 84	142 x 142	266 x 170
Stage glass No.	380405	381349	12BAE041	382762
Swiveling function	—	—	—	±3°
Max stage loading [kg]	10	8	10	8
Mass kg	107	116	112	140



A = 593 mm : 302-701-1D, A = 446 mm : 302-702-1D  
A = 427 mm : 302-703-1D



### Standard accessories

No.	Description
172-202	Projection lens 10X
383876	Protective hood
512305	Halogen bulb (24V, 150W)

### Optional accessories

No.	Description
172-116	Standard scale 50 mm
172-160-3	Green filter
172-161	Reading scale 300 mm
172-197	Swivel centre support
172-203	Projection lens 20X
172-204	Projection lens 50X
172-207	Projection lens 100X
172-229	Oblique illumination mirror 10X Projection lens
172-230	Oblique illumination mirror 20X Projection lens
172-378	V-block with clamp (Max. workpiece ø25 mm)
176-107	Holder with clamp
172-118	Reading scale 200 mm
172-160-2	Green filter
176-105	Swivel centre support
999678D	Fixture mount adapter
512305	Halogen bulb (24V, 150W)
12AAE671	Detector mounting plate for ø250 to ø350 mm
332-151	Optoeye-200
176-106	Rotary table 66 mm
172-196	Rotary table 100 mm
172-198	Rotary table 100 mm with fine adjustment
264-155D	QM-Data 200 Stand type
264-156D	QM-Data 200 Arm mount type

176-106 : for stage 150 x 50 mm  
172-196 and 172-198 : for stage 100 x 100 and 200 x 100 mm

METRIC - (INCH/METRIC)		
302-708D - (302-714E)	302-701D - (302-711E)	
302-704D - (302-718E)	302-702D - (302-712E)	
302-708D - (302-719E)	302-703D - (302-713E)	
302-709D	302-705D	
	302-706D	
	302-707D	
176-106	X	—
172-196	—	X*
172-198	—	X*
176-105	X	X*
172-197	—	X*
176-107	X	X*
172-378	X	X*

\* Fixture mount adapter (999678) is required for 302-701-1D



# Measuring Projector PJ-H30 Series

## Series 303

This measuring projector has adjustable incident illumination.

The PJ-H30 offers you the following benefits:

- By rotating the condenser lens and changing the angle of the mirror in the objective, you can represent even poorly reflecting surfaces optimally.
- Improved light intensity of a projected subject thanks to the new optical contour illumination system.
- High measuring accuracy (above JIS standard).
- Measuring stage with rapid single-handed adjustment on both axes enabling you to switch smoothly between quick positioning and fine adjustment.
- Constant current power supply unit with acceleration control to maximize the service life of the halogen lamp.
- Easily read digital counter with large digit display.
- The PJ-H30D models also offer you a built-in precision edge detector (Optoeye).
- RS-232C output.

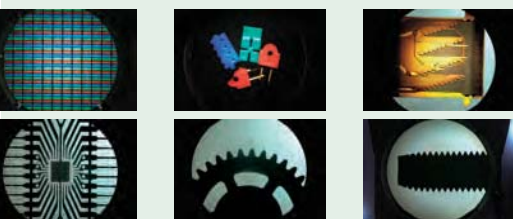
## Specifications

Accuracy	(3+0,02L) $\mu$ m L : Max length measurement
Projected image	Erect
Projector screen	Effective diameter : 306 mm Screen material : Fine-ground glass Screen rotation : $\pm 360^\circ$ , fine adjustment and clamp Angle display : Digital counter (LED) Resolution : 1' or 0,01° (switchable) Range : $\pm 370^\circ$ ABS/INC mode switching, Zero Set Reference lines : Cross-hairs
Projection lens	10X (172-472) Optional : 5X, 20X, 50X, 100X
Magnification accuracy	Contour illumination : $\pm 0,1\%$ or better Surface illumination : $\pm 0,15\%$ or better
Contour illumination	Light source : Halogen bulb (24V, 150W) Optical system : Telecentric zoom Functions : Continuously variable 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 : Continuously variable brightness adjustment, Heat-absorbing filter, Cooling fan
Power supply	220V AC, 50/60Hz
Resolution	0,001 mm

Unit: mm					
	Magnification				
	5X	10X	20X	50X	100X
View field	$\phi 61.2$	$\phi 30.6$	$\phi 15.3$	$\phi 6.12$	$\phi 3.06$
H	105	105	105	105	105
W	66	70.5	56.5	50	50
D	148	197	137	114	114



303-735-1D



Profile Projector brochure on request



Vertical / oblique switchable surface illumination



Vertical illumination



Oblique illumination



1010B



2010B



2017B

# Measuring Projector PJ-H30 Series

## Series 303

### Model 1010B - 100 x 100 mm

XY stage table size : 300 x 240 mm

XY stage effective area : 180 x 150 mm

Stage glass No. : **380412**

Swiveling function :  $\pm 3^\circ$

Max stage loading : 10 kg

Mass : 176 kg

Model	PJ-H30A	PJ-H30D
No.	<b>303-712-1D</b>	<b>303-732-1D</b>
Focusing	Manual	Power focus
Edge detector	Optional	Built-In

### Model 2010B - 200 x 100 mm

XY stage table size : 350 x 280 mm

XY stage effective area : 250 x 150 mm

Stage glass No. : **382762**

Swiveling function :  $\pm 3^\circ$

Max stage loading : 10 kg

Mass : 178 kg

Model	PJ-H30A	PJ-H30D
No.	<b>303-713-1D</b>	<b>303-733-1D</b>
Focusing	Manual	Power focus
Edge detector	Optional	Built-In

### Model 2017B - 200 x 170 mm

XY stage table size : 410 x 342 mm

XY stage effective area : 270 x 240 mm

Stage glass No. : **12BAD363**

Swiveling function :  $\pm 5^\circ$

Max stage loading : 20 kg

Mass : 205 kg

Model	PJ-H30A	PJ-H30D
No.	<b>303-714-1D</b>	<b>303-734-1D</b>
Focusing	Manual	Power focus
Edge detector	Optional	Built-In

### Model 3017B - 300 x 170 mm

XY stage table size : 510 x 342 mm

XY stage effective area : 370 x 240 mm

Stage glass No. : **12BAD330**

Swiveling function :  $\pm 5^\circ$

Max stage loading : 20 kg

Mass : 212 kg

Model	PJ-H30A	PJ-H30D
No.	<b>303-715-1D</b>	<b>303-735-1D</b>
Focusing	Manual	Power focus
Edge detector	Optional	Built-In



# Measuring Projector PJ-H30 Series

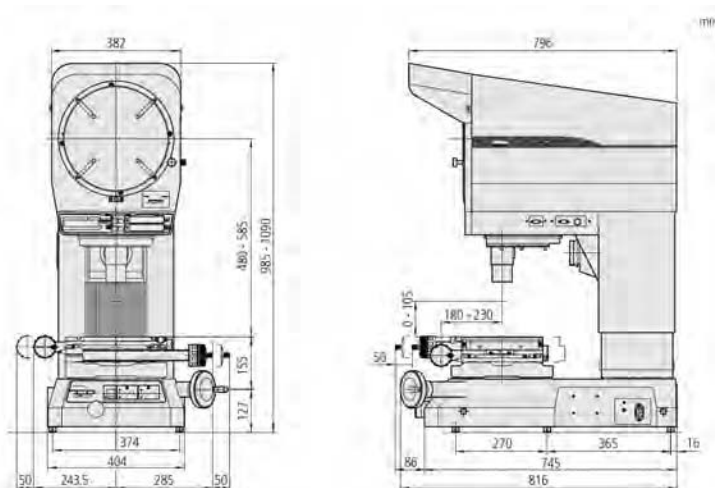
## Series 303

### Optional accessories

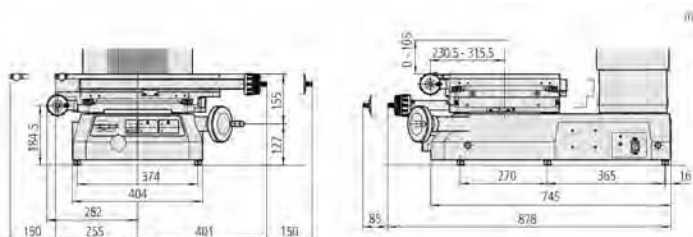
No.	Description
332-151	Optoeye-200
12AAE671	Detector mounting plate for ø250 to ø350 mm
12AAG983	Detector mounting bracket for PJ-H30A/PJ-H30E
12AAG981	Green filter
172-116	Standard scale 50 mm
172-118	Reading scale 200 mm
172-161	Reading scale 300 mm
172-271	Projection lens 5X
172-473	Projection lens 20X
172-474	Projection lens 50X
172-475	Projection lens 100X
176-105	Swivel centre support
172-197	Swivel centre support
172-198	Rotary table 100 mm with fine adjustment
172-378	V-block with clamp (Max. workpiece ø25 mm)
176-305	Rotary table with fine feed wheel ø183 mm
176-306	Rotary table with fine feed wheel ø240 mm
011534	Cleaner for optics
12AAA807D	RS-232C cable (2m)
12AAG982	Mounting stand for QM-Data 200
264-155D	QM-Data 200 Stand type
264-156D	QM-Data 200 Arm mount type



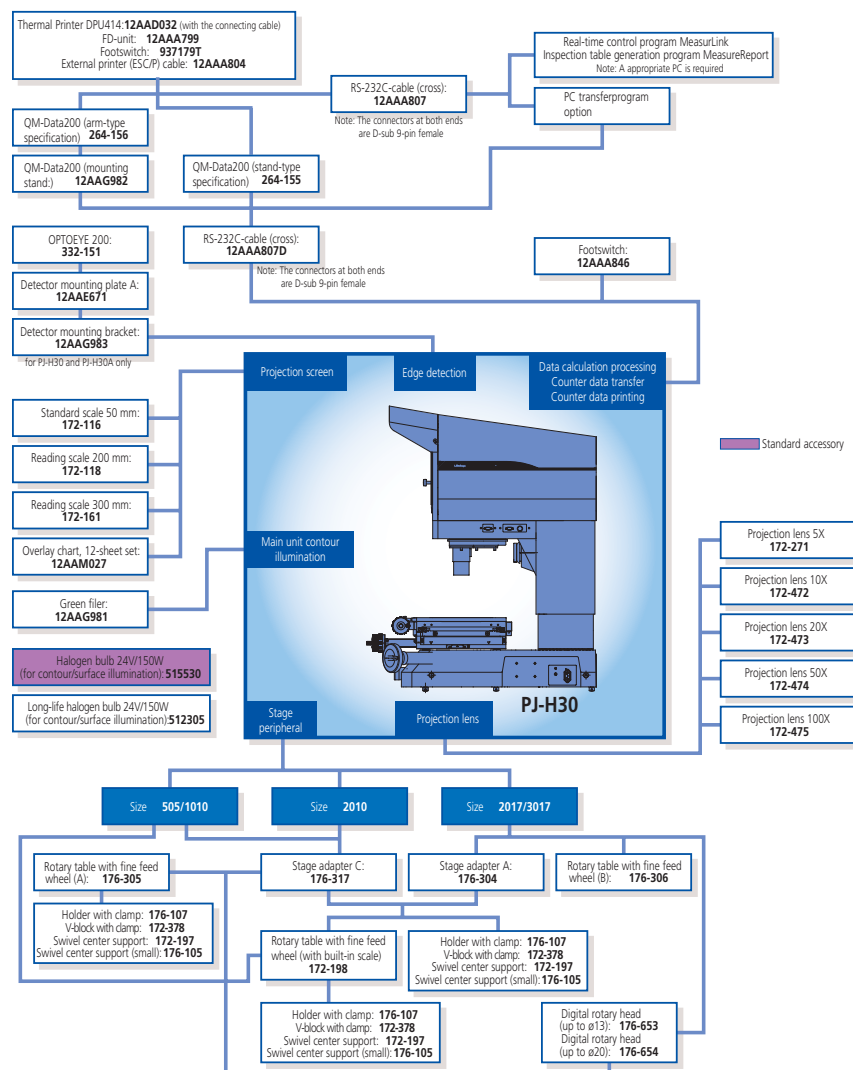
264-155D  
QM-Data 200



1010B model



3017B model





# Measuring Projector PV-5110

## Series 304

- This measuring projector is a robust stand-alone device.
- The large rotatable screen guarantees you good observation and easy measuring.



304-919D  
Counter is optional



KA Counter



QM-Data 200



OPTOEYE 200

Specifications	
Projected image	Inverted
Projector screen	Effective diameter : 508 mm Screen material : Fine-ground glass Screen rotation : $\pm 360^\circ$ , fine adjustment and clamp Angle reading : Digital counter (LED) Resolution : 1' or 0,01° (switchable) Range : $\pm 370^\circ$ ABS/INC mode switching, Zero Set Reference lines : Cross-hairs
Projection lens	10X (172-402) Optional : 5X, 20X, 50X, 100X
Magnification accuracy	Contour illumination : $\pm 0,1\%$ or better Surface illumination : $\pm 0,15\%$ or better
Contour illumination	Light source : Halogen bulb (24V, 150W) Optical system : Telecentric zoom Functions : 2-step (High/Low) brightness switch, Heat-absorbing filter, Cooling fan
Surface illumination	Light source : Halogen bulb (24V, 150W) Optical system : Vertical illumination Functions : Adjustable condenser lens, Oblique illumination (for 5X, 10X and 20X), Heat-absorbing filter, Cooling fan
Focusing	Manual
Resolution	0,001 mm
Power supply	220 - 240V AC, 50/60Hz
Mass	210 kg

	Magnification				
	5X	10X	20X	50X	100X
View field	$\phi 101.6$	$\phi 50.8$	$\phi 25.4$	$\phi 10.16$	$\phi 5.08$
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



Profile Projector brochure on request

# Measuring Projector PV-5110

## Series 304 - Accessories/Dimensions

### Standard accessories

No.	Description
172-402	10X projection lens set including : 172-409 Objective 172-410 Condenser
512305	Halogen bulb (24V, 150W)
12AAF182	Digital counter stand
382762	Stage glass 280x180
172-422	Surface illumination unit

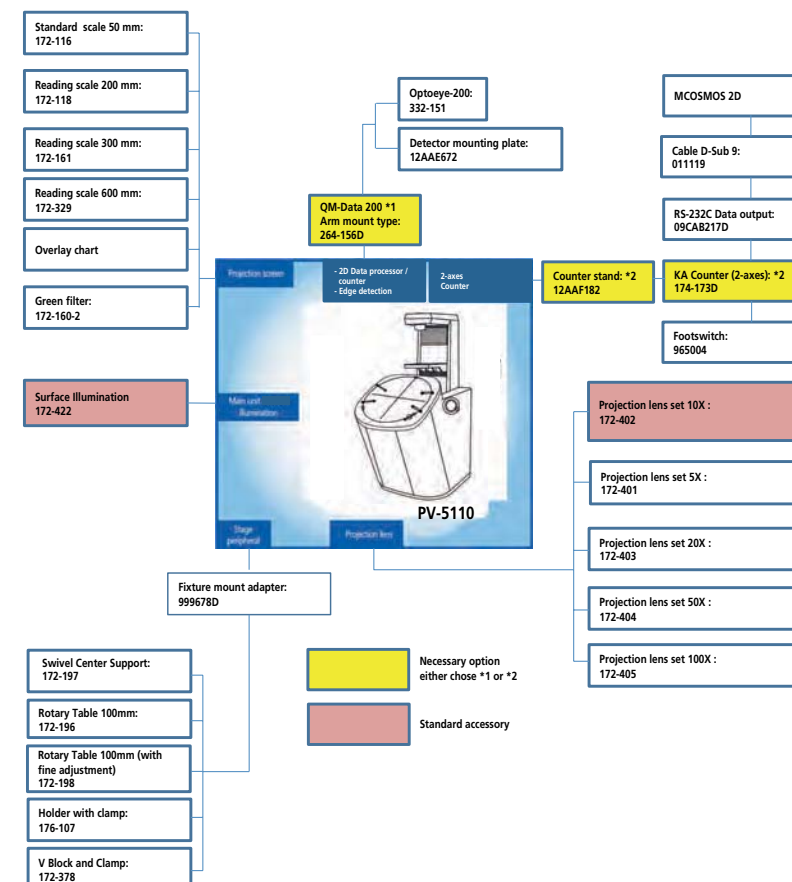
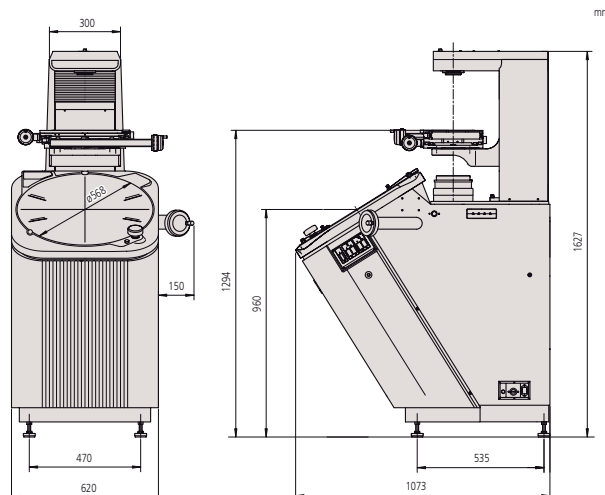
### Optional accessories

No.	Description
172-401	5X projection lens set including : 172-406 Objective 172-407 Condenser 932602 Adapter for objective
172-403	20X projection lens set including : 172-411 Objective 172-412 Condenser
172-404	50X projection lens set including : 172-413 Objective 172-414 Condenser
172-405	100X projection lens set including : 172-415 Objective 172-414 Condenser
172-116	Standard scale 50 mm
172-330	Standard scale 80 mm
172-161	Reading scale 300 mm
172-329	Reading scale 600 mm
172-160-2	Green filter
172-319	Canopy
510189	Protective hood
172-198	Rotary table 100 mm with fine adjustment
172-197	Swivel centre support
176-107	Holder with clamp
172-378	V-block with clamp (Max. workpiece ø25 mm)
011534	Cleaner for optics
174-173D	KA-Counter 2 axes
12AAE672	Optoeye mounting plate for ø500 to ø600 mm screen
264-156D	QM-Data 200 Arm mount type



172-319

Model	PV-5110
No.	304-919D
XY stage [mm]	200 x 100
Measuring method	Linear encoder
Quick-release mechanism	X and Y axes
XY stage table top size [mm]	380 x 250
XY stage effective area [mm]	266 x 170
Stage glass No.	382762
Swiveling function	±3°
Max stage loading [kg]	5



# Measuring Projector PH-A14

Series 172

## Measuring Projector PH-A14

- Due to the PH-A14's horizontal-beam illumination, you can easily measure larger and heavier workpieces including toothed racks and punching tools.
- You can use the projector for a wide range of applications due to its generous 203 x 102 mm stage travel and 45 kg allowable stage loading.



172-810-20D  
With optional evaluation unit QM-Data 200



KA Counter

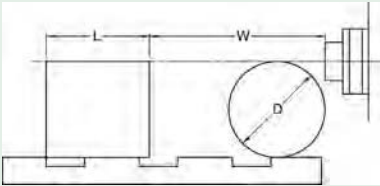


QM-Data 200



OPTOEYE 200

Specifications	
Projected image	Inverted
Projector screen	Effective diameter : 356 mm Screen material : Fine-ground glass Screen rotation : $\pm 360^\circ$ , fine adjustment and clamp Angle reading : Vernier, graduation : 1' Resolution : 1' or 0,01° (switchable) Range : $\pm 370^\circ$ Reference lines : Cross-hairs
Projection lens	10X (172-011) Optional : 20X, 50X, 100X
Magnification accuracy	Contour illumination : $\pm 0,1\%$ or better Surface illumination : $\pm 0,15\%$ or better
Contour illumination	Light source : Halogen bulb (24V, 150W) Optical system : Telecentric Functions : Heat-absorbing filter, Cooling fan
Surface illumination	Light source : Halogen bulb (24V, 150W) Optical system : Vertical illumination Functions : Adjustable condenser lens, Heat-absorbing filter, Cooling fan
Focusing	Manual
Resolution	0,001 mm (using optional KA counter)
Power supply	220 - 240V AC, 50/60Hz
Mass	140 kg



L : Max. workpiece width  
W : Working distance  
D : Max. workpiece diameter

PH-A14		mm			
		Magnification			
		10X	20X	50X	100X
View field		35.6	17.3	7.12	3.56
L		235	235	80	109
W		93	40	14.6	9.5
D		130	116	30.4	19

# Measuring Projector PH-A14

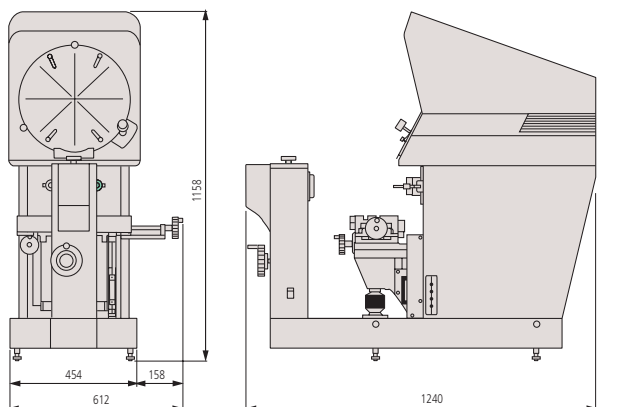
## Series 172 - Accessories/Dimensions

### Standard accessories

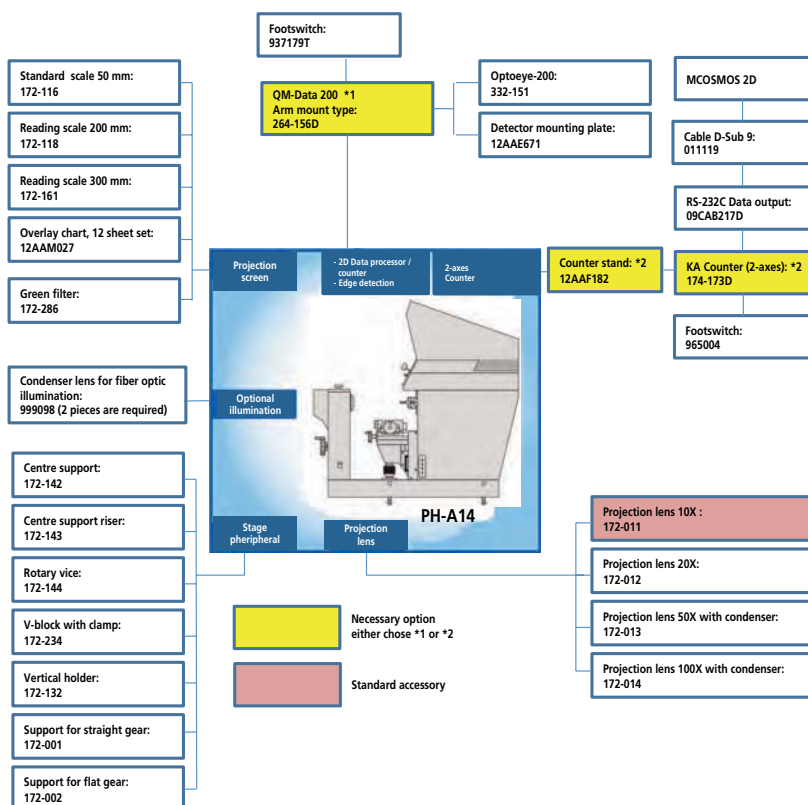
No.	Description
172-011	Lens 10X for Profile Projector PH-A14
512305	Halogen bulb (24V, 150W)

### Optional accessories

No.	Description
174-173D	KA-Counter 2 axes
172-013	Lens 50X for Profile Projector PH-A14
172-012	Lens 20X for Profile Projector PH-A14
172-014	Lens 100X for Profile Projector PH-A14
172-116	Standard scale 50 mm
172-118	Reading scale 200 mm
172-286	Green filter
172-143	Centre support riser
172-144	Rotary vice (Max. workpiece ø60 mm)
172-234	V-block with clamp (Max. workpiece ø50 mm)
172-132	Vertical holder
172-161	Reading scale 300 mm
172-001	Support for straight gear
172-002	Support for flat gear
172-142	Centre support
011534	Cleaner for optics
332-151	Optoeye-200
12AAE671	Detector mounting plate for ø250 to ø350 mm
264-156D	QM-Data 200 Arm mount type
12AAF182	Digital counter stand



Model	PH-A14
No.	172-810-20D
XY stage [mm]	203 x 102
Measuring method	Linear encoder
XY stage table top size [mm]	407 x 153
Max stage loading [kg]	45



# Measuring Projector PH-3515F

Series 172

## Measuring Projector PH-3515F

- Due to the PH-3515F's horizontal-beam illumination, you can easily measure larger and heavier workpieces including toothed racks and punching tools. You can use the projector for a wide range of applications due to its generous 254 x 152 mm stage travel and 45 kg allowable stage loading.

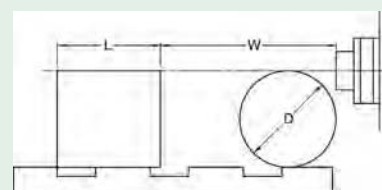


172-868D

Model	PH-3515F
No.	172-868D
XY stage [mm]	254 x 152
Measuring method	Linear encoder
Quick-release mechanism	X axis
XY stage table top size [mm]	450 x 146
Swiveling function	±10°
Max stage loading [kg]	45

### Specifications

Projected image	Erect
Projector screen	Effective diameter : 353 mm Screen material : Fine-ground glass Screen rotation : ±360°, fine feed and clamp Angle display : Digital counter (LED) Resolution : 1' or 0,01° (switchable) Range : ±370° ABS/INC mode switching, Zero Set Reference lines : Cross-hairs
Projection lens	10X (172-184) Optional : 5X, 20X, 50X, 100X
Magnification accuracy	Contour illumination : ±0,1% or better Surface illumination : ±0,15% or better
Contour illumination	Light source : Halogen bulb (24V, 150W) Optical system : Telecentric system Functions : 2-step (High/Low) brightness adjustment, Heat-absorbing filter, Cooling fan
Surface illumination	Light source : Halogen bulb (24V, 150W) Optical system : Vertical illumination Functions : Adjustable condenser lens, 2-step (High/Low) brightness adjustment, Heat-absorbing filter, Cooling fan
Focusing	Manual
Resolution	0,001 mm
Power supply	220 - 240V AC, 50/60Hz
Mass	150 kg



L : Max. workpiece width

W : Working distance

D : Max. workpiece diameter

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

( ) When using surface illumination



# Measuring Projector PH-3515F

## Series 172 - Accessories/Dimensions

### Standard accessories

No.	Description
383228	Protective hood
172-184	Projection lens 10X
512305	Halogen bulb (24V, 150W)
12BAA637	Halogen bulb (24V, 200W)

### Optional accessories

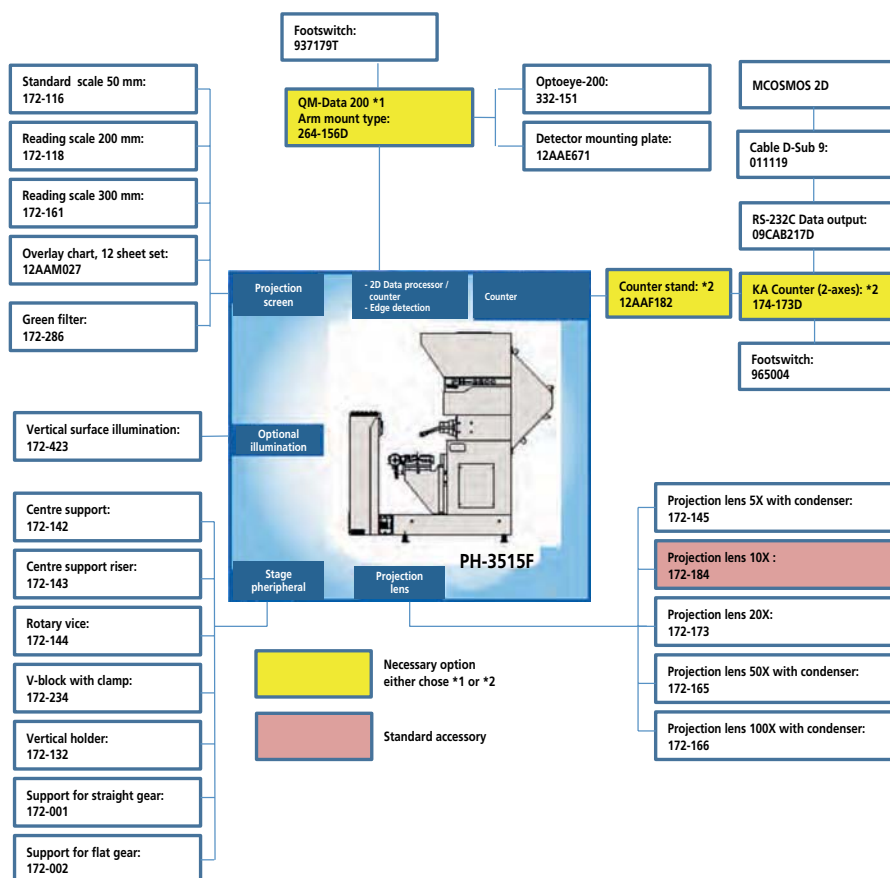
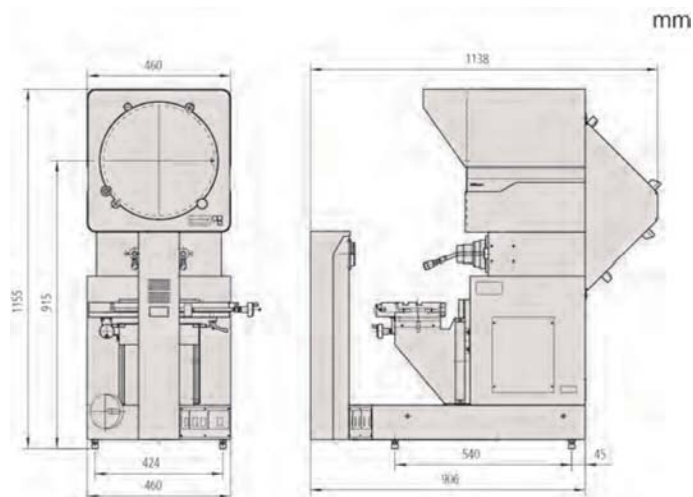
No.	Description
172-145	Projection lens 5X with condenser
172-173	Projection lens 20X with condenser
172-165	Projection lens 50X with condenser
172-166	Projection lens 100X with condenser
172-423	Vertical surface illumination unit
172-116	Standard scale 50 mm
172-118	Reading scale 200 mm
172-161	Reading scale 300 mm
172-286	Green filter
172-142	Centre support
172-143	Centre support riser
172-144	Rotary vice
	(Max. workpiece ø60 mm)
172-234	V-block with clamp
	(Max. workpiece ø50 mm)
172-132	Vertical holder
12AAM027	Overlay chart set (12 sheets)
	(No. 12AAM587 to 12AAM598)
12AAF182	Digital counter stand
011534	Cleaner for optics
174-173D	KA-Counter 2 axes
332-151	Optoeye-200
12AAE671	Detector mounting plate for ø250 to ø350 mm
264-156D	QM-Data 200 Arm mount type



KA Counter



QM-Data 200





# Data Processing Unit QM-Data 200

## Series 264

The Data Processing Unit QM 200 has been especially designed to process measurement data generated by a profile projector or measuring microscope.

The QM-Data 200 offers you the following benefits:

- Measuring instructions, measuring values and calculation results for various operations are shown on the back-lit LCD in a clear, easy to understand style.
- You can also print measuring results, either on a small and convenient thermal printer (available as a special option) or on an ESC/P printer and continuous paper.
- By connecting an optional floppy disk drive newly created part programs, you can store and/or load measurement results as well as calculation results.



Stand-mount type

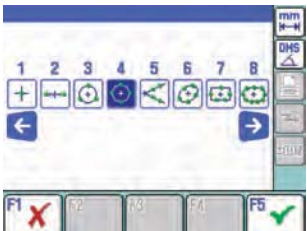


Arm-mount type

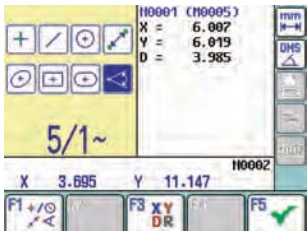
No.	Mass [kg]	Description
264-155D	2,9	Stand-mount type
264-156D	2,8	Arm-mount type
264-159D	2,9	Stand-mount type for Hyper MF / MF-U



Intuitive panel design



Clear function icons



Coloured LCD display with backlight



Guided measurements

Specifications	
Resolution	1 / 0,1
Dimensions [mm]	260 x 242 x 310 : Stand-mount type 318 x 153 x 275 : Arm-mount type
Screen	Colour graphic TFT LCD (320 x 240 dots, with background lighting)
Program functions	Part program creation, execution, editing
Power supply	100/240V AC, 50/60 Hz
Statistical processing	Number of data, maximum value, minimum value, mean value, standard deviation, range, histogram
Measuring of Geometric Elements	Maximum of 1000 elements, point, line, circle, distance, ellipse, rectangular hole, slotted hole, intersection and intersecting angle and point & angle, plus a number of functions for evaluation, e.g. perpendicularity and parallelism are provided.
Measurement result file output	CSV format; MUX-10F format
Data output	USB, RS-232C, Printer
Display language	Japanese/English/German/French/Italian/Spanish/Portuguese/Czech/Traditional Chinese/Simplified Chinese/Korean/Turkish/Swedish/Polish/Dutch/Hungarian
Functions	<b>Mitutoyo's AI Function :</b> The AI function (AI=Artificial Intelligence) renders choosing the element type before measuring obsolete. Point measurements are analysed by the QM-Data and the results for basic elements calculated, thus accelerating the measuring procedure.  <b>Customized Operation :</b> Macro functions and the creation of part programs speed up single and repetition measurements. Additionally macro commands and part programs as well as frequently used standard operations can be stored as user menus.
Data input	USB, RS-232C, X/Y/Z-axis signal, Footswitch

### Optional accessories

No.	Description
12AAD033	Thermal printer (with connection cable)
908353-1	Printer paper for thermal printer
I-1525612	Cable for printer (2 m)
937179T	Footswitch
12AAA807D	RS-232C cable (2m)
011119	Signal cable RS-232C D-SUB 25 to D-SUB 9 (2m)

# Edge Detection Sensor OPTOEYE 200

## Specifications

Image detection	Directivity : All directions
Min. diameter	2 mm on the screen
Min. width	1 mm on the screen
Applicable illumination	Type : Surface/Contour illumination Range : 30 to 2000 Lux on the screen Bright-Dark field difference : 20 Lux
Function	Automatic detection of feature edges for use in measurement

## Optional accessories

No.	Description
12AAE671	Detector mounting plate for ø250 to ø350 mm
12AAE672	Optoeye mounting plate for ø500 to ø600 mm screen



## Series 332

This edge sensor allows you to make accurate measurements whatever your skill level by automatically detecting edges used in measurement.

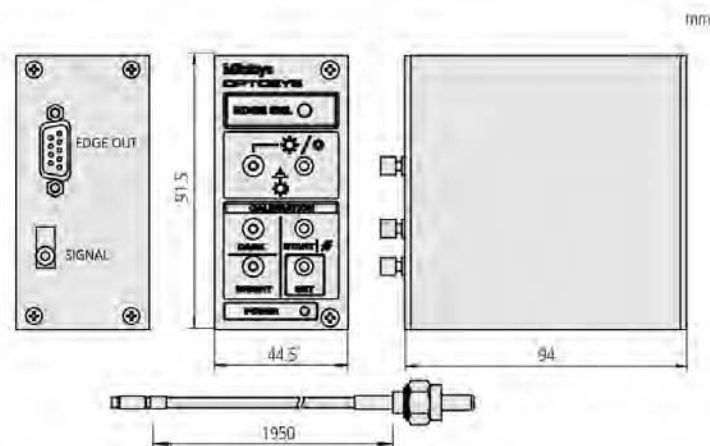
The Optoeye 200 offers you the following benefits:

- Optoeye 200 reduces the effect of operator skill level on accuracy by automatically detecting edges used in measurement.
- PJ-H30: You can use the Optoeye edge detector on models PJ-H30A (requires adapter plate 12AAG983). The PJ-H30D models have a built-in edge detector.
- PV-5110, PJ-3515F and PJ-A14: You can use the Optoeye edge detector in conjunction with the QM-Data 200.
- PJ-A3000: You can use the Optoeye edge detector on models 302-701/302-702/302-703 in conjunction with the QM-Data 200.
- When you are using the Optoeye all projector scales must be connected to QM-Data 200 directly and built-in counters can no longer be used (except PJ-H30D type).



332-151

No.	Description
332-151	Edge detection sensor OPTOEYE 200



# Accessories for Measuring Projectors

## Group 1

### For measuring projectors

These standard overlay charts increase the range of application and the efficiency of Mitutoyo profile projectors.

This chart set offers you the following benefits:

- The charts are supplied in sizes ø250, 300, 340, 500 and 600 mm to suit the screens of Mitutoyo projectors.
- A large range of scales and profiles is provided that enables you to test workpiece features quickly and easily. You can test length, height, parallelism, angle, radius, taper, bore position, diameter, as well as all standardized thread and tooth profiles.
- All charts are made of a distortion-free special plastics compound and are provided with a protective coating.

#### Combination chart

Angle : Divisions at 10° and 30' intervals at **178mm/7"** diameter increasing to **381mm/15"** intervals at **279mm/11"** diameter.

Features : All purpose chart for checking diameters, angles, radii and linear divisions

No.	Diameter [mm]
512651	250
512652	300
512653	340
512654	500
512655	600

#### Grid/protractor chart

Angle : 15° increments

Features : Ideal for checking diameters, concentricity of diameters, radii, angles and cams.

No.	Diameter [mm]
201380	250
201386	300
201392	340
512621	500
511843	600

#### Radius/protractor chart

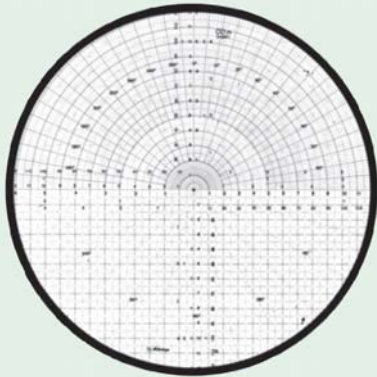
Angle : Divisions at 1° and 30' intervals at **178mm/7"** diameter increasing to **381mm/15"** intervals at **279mm/11"** diameter.

Features : Ideal for checking diameters, concentricity of diameters, radii, angles, radii and cams

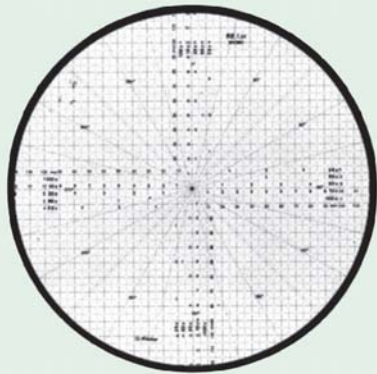
No.	Diameter [mm]
201383	250
201389	300
201395	340
512624	500
511846	600

### Additional Specifications

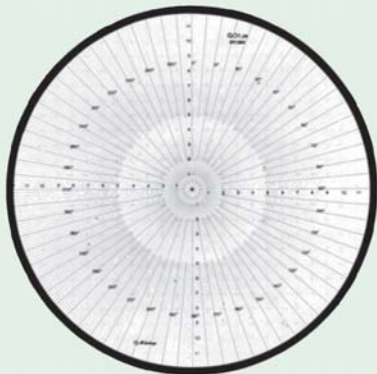
Grid divisions	10X : 0,1 mm
	20X : 0,05 mm
	50X : 0,02 mm
	100X : 0,01 mm



Combination chart



Grid/protractor chart



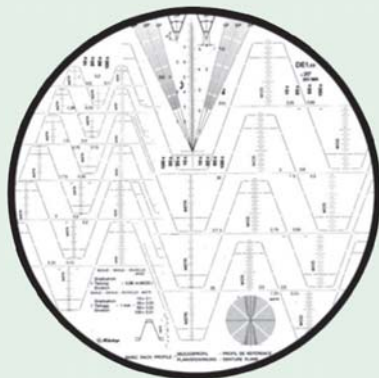
Radius/protractor chart

# Accessories for Measuring Projectors

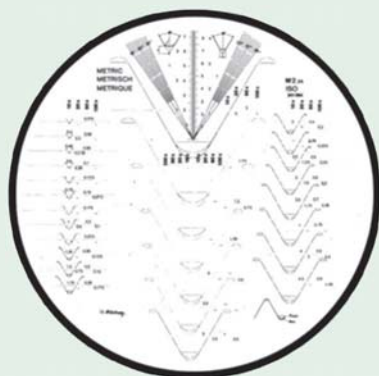
## Additional Specifications

Grid divisions

10X : 0,1 mm  
20X : 0,05 mm  
50X : 0,02 mm  
100X : 0,01 mm



Involute gear teeth



ISO Metric threads



Protractor chart



Radius chart

## Group 1

### For measuring projectors

These standard overlay charts increase the range of application and the efficiency of Mitutoyo profile projectors.

This chart set offers you the following benefits:

- The charts are supplied in sizes ø250, 300, 340, 500 and 600 mm to suit the screens of Mitutoyo projectors.
- A large range of scales and profiles is provided that enables you to test workpiece features quickly and easily. You can test length, height, parallelism, angle, radius, taper, bore position, diameter, as well as all standardized thread and tooth profiles.
- All charts are made of a distortion-free special plastics compound and are provided with a protective coating.

### Involute gear teeth

No.	Diameter [mm]
201385	250
201391	300
201397	340
512626	500
511848	600

### ISO Metric threads

No.	Diameter [mm]
201384	250
201390	300
201396	340
512625	500
511847	600

### Protractor chart

Angle : Divisions at 1° and 30' intervals at 178mm/7" diameter increasing to 381mm/15" intervals at 279mm/11" diameter.

**Features :** Dedicated chart especially designed for checking angles with exceptional clarity. Suitable for use at any magnification.

No.	Diameter [mm]
201381	250
201387	300
201393	340
512622	500
511844	600

### Radius chart

**Features :** Dedicated chart especially designed for checking radii, diameters and concentricity with exceptional clarity.

No.	Diameter [mm]
201382	250
201388	300
201394	340
512623	500
511845	600



# Accessories for Measuring Projectors

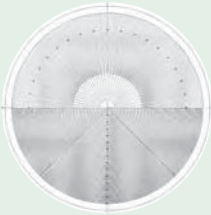
Group 2 - Makes inspection of projected images an easy process.

## Metric

Description	ø 300 mm No.
Concentric circles 1 mm pitch	12AAM589
Concentric circles at 1 mm pitch with radial index 1° increments	12AAM596
Crossed lines with 0,5 mm pitch	12AAM592
Crossed lines with 1 mm graduation and concentric circles 5 mm pitch	12AAM588
Grid chart (10 x 10 mm)	12AAM591
Grid chart (1 mm pitch)	12AAM593
Horizontal for 20X, vertical for 50X with 1 mm graduations	12AAM590
Horizontal lines 1 mm pitch	12AAM595
Metric threads 0,075 - 0,225 mm, 100X involute gear teeth : 20° MOD 0,2-1, 14,5° MOD 0,2-1	12AAM598
Metric threads 0,2-2 mm, unified threads 28-12 TPI 20X Whitworth threads 20-10 TPI 20X	12AAM597
Radial index 1° increments	12AAM594
Radial index 1° increments (upper) concentric circle 1 mm pitch (lower)	12AAM587

## Optional accessories

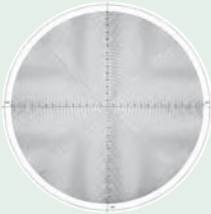
No.	Description
12AAM027	Overlay chart set (12 sheets) (No. 12AAM587 to 12AAM598)



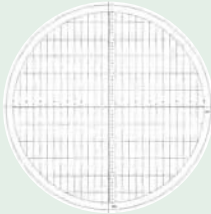
12AAM587



12AAM588



12AAM589



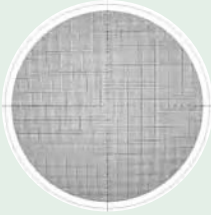
12AAM590



12AAM591



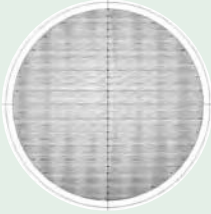
12AAM592



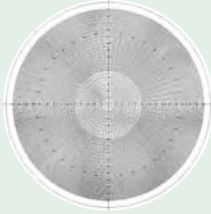
12AAM593



12AAM594



12AAM595



12AAM596



12AAM597



12AAM598

# Accessories for Measuring Projectors

## Workpiece Fixtures

For Profile Projectors and Measuring Microscopes



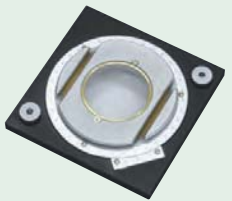
172-142



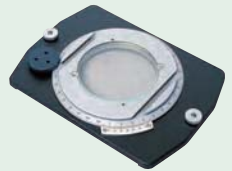
172-143



176-107



176-106



172-198



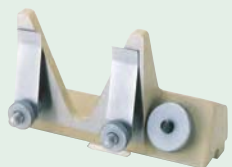
172-144



172-197



172-234 - 172-378



172-132

### Centre Support

No.	Max. workpiece height [mm]	Mass [kg]
172-142	120	3,3

### Centre Support Riser

No.	Max. workpiece height [mm]	Mass [kg]
172-143	240	3,3

### Holder with Clamp

No.	Max. workpiece height [mm]	Mass [kg]
176-107	35	0,42

### Rotary Tables

No.	Effective glass dia. [mm]	Angular resolution °	Fine feed	Mass [kg]
176-106	66	6		1,7
172-198	96	1	Available	2,4
172-196	100	1		2,5
176-305	182		Available	5,5
176-306	238		Available	6,5

### Rotary Vice

No.	Rotary range	Width of jaws [mm]	Angle graduations °	Max. workpiece height [mm]	Mass [kg]
172-144	360°	40	5	60	2,8

### Swivel Centre Support

No.	Max workpiece dia. [mm]	Swivel range	Max. workpiece length [mm]	Mass [kg]
176-105	70 (45 ) when swiveled 10°	±10°	140	2,4
172-197	80 (65) when swiveled 10°	±10°	140	2,5

### V-Block with Clamp

No.	Max workpiece dia. [mm]	Width of block [mm]	Mass [kg]
172-378	25	41	0,8
172-234	50	60	1,24

### Vertical Holder

No.	Mass [kg]
172-132	1,3