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Cold-light Illuminator

Cold-light Illuminator and Conductors



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



Cold-Light Illuminator

No.	Input	Output	Light brightness control	Filter insertion	Dimensions [mm]	Mass [kg]	Price [€]
011079-1	50VA	35W	Stepless	Lateral	168 x 120 x 268	1,3	419,00

Swan neck light Conductor

No.	Arm diameter [mm]	Arm length [mm]	Price [€]
011080-1	4	550	451,00

Consumable spares

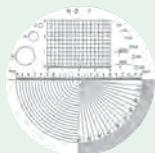
No.	Description	Price €
011315	Lamp 10,8V, 30W, GX5,3 for 011079-1	77,00

Specifications

Measuring plate diameter	30 mm
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Optional accessories

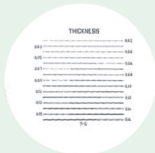
No.	Description	Price €
950757	Magnifier holder with illumination (without battery)	49,00
353489	Battery LR14	7,00



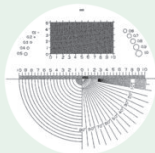
183-102



183-103



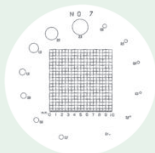
183-104



183-105



183-107



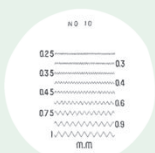
183-108



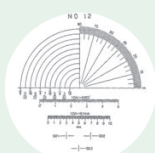
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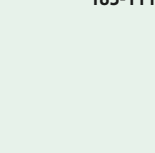
183-110



183-111



183-113



183-115

Precision Magnifier

Series 183

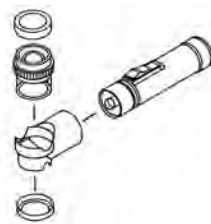
This magnifier is ideal for a variety of measuring tasks.

With the Precision Magnifier you can:

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



183-101



950757
(optional illuminator)

Pocket Comparators

No.	Dimensions [mm]	Magnification	Field of View [mm]	Mass [g]	Price [€]
183-101	Ø 37 x 48	8X	24,5	40	63,00
183-131	Ø 37 x 45	10X	24,5	42	91,00

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

No.	Set compilation	Price [€]
183-902	183-101, 183-102, 183-106, 183-107, 183-112, 183-113, 183-114	260,00
183-903	183-101, 183-102, 183-106, 183-107, 183-109, 183-113, 183-115	260,00
183-904	183-101, 183-102	92,00

Reticles for Pocket Comparators

No.	Description	Price [€]
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)	36,00
183-103	Angle, radius, length, diameter	36,00
183-104	Thickness 0,02 – 0,16 mm (Pitch 0,01 mm)	36,00
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)	36,00
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 – 3/8"	36,00
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	36,00
183-109	Scale 0 – 20 mm (Reading 0,1 mm)	36,00
183-110	Angle 0 – 180° (Reading 1°) Radius 0 – 10 mm (Reading 0,5 mm)	36,00
183-111	Thread pitches 0,25; 0,3; 0,35; 0,4; 0,45; 0,6; 0,75; 0,9; 10 mm	36,00
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)	36,00
183-115	ISO-Thread pitches 0,25; 0,3; 0,35; 0,4; 0,45; 0,5; 0,7; 0,8; 1 mm	36,00



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]	Price [€]
183-201	ø14,5 x 125	25X	3,4	17	90,00

Series 183 - Freestanding model



183-202



183-203

No.	Dimensions [mm]	Magnification	Field of View [mm]	Mass [g]	Price [€]
183-202	ø31,5 x 115	25X	3,3	90	191,00
183-203	ø31,5 x 100	50X	1,6	82	224,00

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]	Price [€]
183-301	ø32 x 43	7X	25	17	24,00
183-302	ø32 x 40	10X	24	18	26,00
183-303	ø32 x 30	15X	10	23	30,00
183-304	ø45 x 70	8 - 16X zoom	10-20	149	411,00

Measuring Microscope TM-500 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-500 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 making this microscope ideal for use in areas where you have very limited space.
- It comes with a choice of adjustable-intensity transmitted or incident illumination.

Specifications

Observation image	Erect
Angle reading	Range : 360° Minimum reading : 6' (by vernier)
Objective lens	2X (176-138) Working distance: 67 mm Optional: 5X, 10X
Eyepiece	15X (176-116), View field ø13 mm Optional : 10X, 20X
Total magnification	30X
Transmitted illumination	Light source : Tungsten bulb (24V, 2W) Functions : With green filter, Light intensity adjustable
Surface illumination	Light source : Tungsten bulb (24V, 2W) Functions : Light intensity adjustable
Power supply	220/240V AC, 50/60Hz
Mass	TM-505: 13,5 [kg] TM-510: 14,5 [kg]

Standard accessories

No.	Description
176-116	Eyepiece 15X (field of view ø13 mm)
176-138	Objective lens 2X
176-206	XY stage 50 x 50 mm (TM-505)
176-207	XY stage 100 x 50 mm (TM-510)
176-126	Eyepiece reticle cross hairs

Consumable spares

No.	Description	Price €
383038D	Halogen bulb (24V, 2W)	5,00



TM-505 fitted with optional analogue micrometer heads



TM-505 fitted with optional digimatic micrometer heads



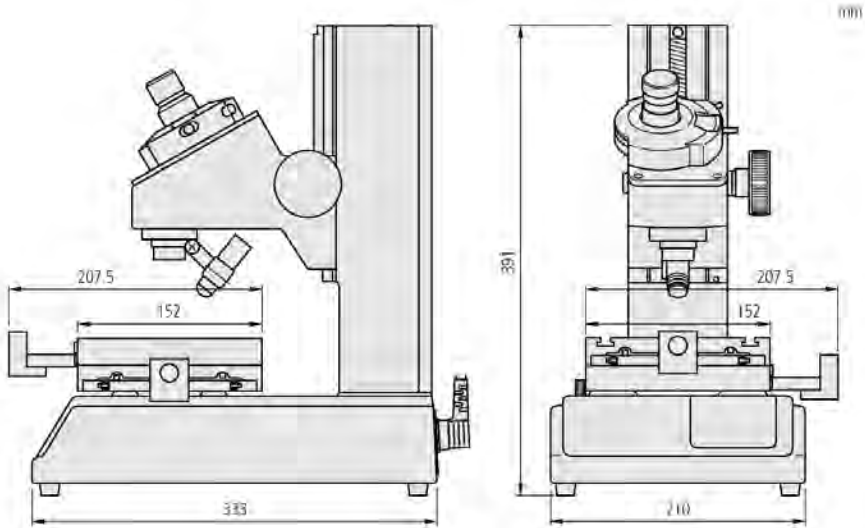
Angle reading

Measuring Microscope TM-500 Series

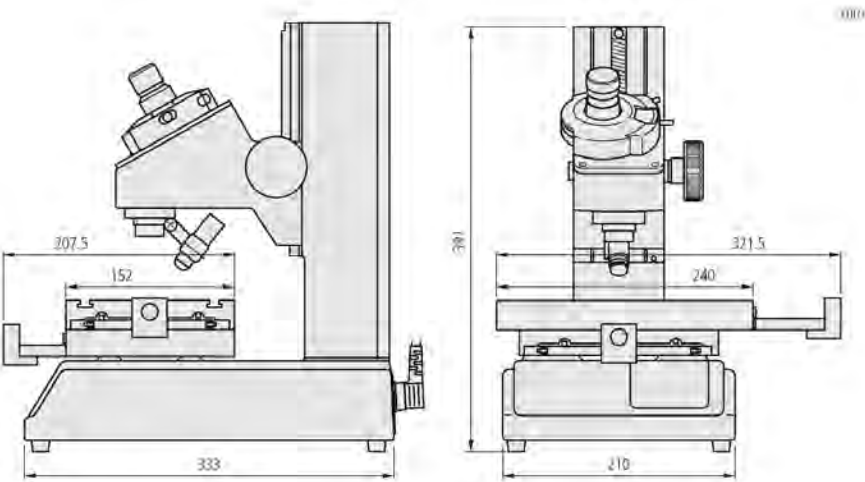
Series 176

Dimensions

Model	TM-505	TM-510
No.	176-816D	176-817D
Price [€]	4403,00	5783,00
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-505



TM-510

Accessories for Measuring Microscope TM-500

Optional accessories

No.	Description	Price €
176-115	Eyepiece 10X (field of view ø13 mm)	197,00
176-116	Eyepiece 15X (field of view ø13 mm)	197,00
176-117	20X eyepiece (view field ø10 mm)	217,00
176-139	Objective lens 5X (W.D : 33 mm, N.A. : 0.10)	313,00
176-137	Objective lens 10X (W.D : 14 mm, N.A. : 0.14)	313,00
152-390	Micrometer head for X-axis 50 mm	229,00
152-389	Micrometer head for Y-axis 50 mm	229,00
176-204	Dial indicator attachment for Z-axis measurement	217,00
176-106	Rotary table 66 mm	796,00
176-105	Swivel centre support	950,00
172-197	Swivel centre support	824,00
172-378	V-block with clamp (Max. workpiece ø25 mm)	313,00
176-107	Holder with clamp	266,00
990561	Workpiece clip (2 pcs./set)	59,00
176-366CED	Fibre-optic ring light	2029,00
164-163	Digital micrometer head 50 mm	742,00
959149	Digimatic cable with data switch (1 m)	38,00
959150	Digimatic cable with data switch (2 m)	44,00
06ADV380C	USB Input tool Direct cable with data switch (2 m)	100,00
02AZD790C	U-WAVE Data Cable with data switch	90,00
12AAE044	Ring-type unit connecting ring (for TM-500)	109,00
176-203	Twin-bulb reflected illumination unit	281,00
176-344CED	Bifurcated fibre illumination	1360,00
611635-031	Steel Individual Metric Gauge Block 25 mm Grade 1	28,00
611675-031	Steel Individual Metric Gauge Block 50 mm Grade 1	37,00
172-196	Rotary table 100 mm	955,00
172-198	Rotary table 100 mm with fine adjustment	976,00

176-106 : for stage 50 x 50 mm

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

Series 176

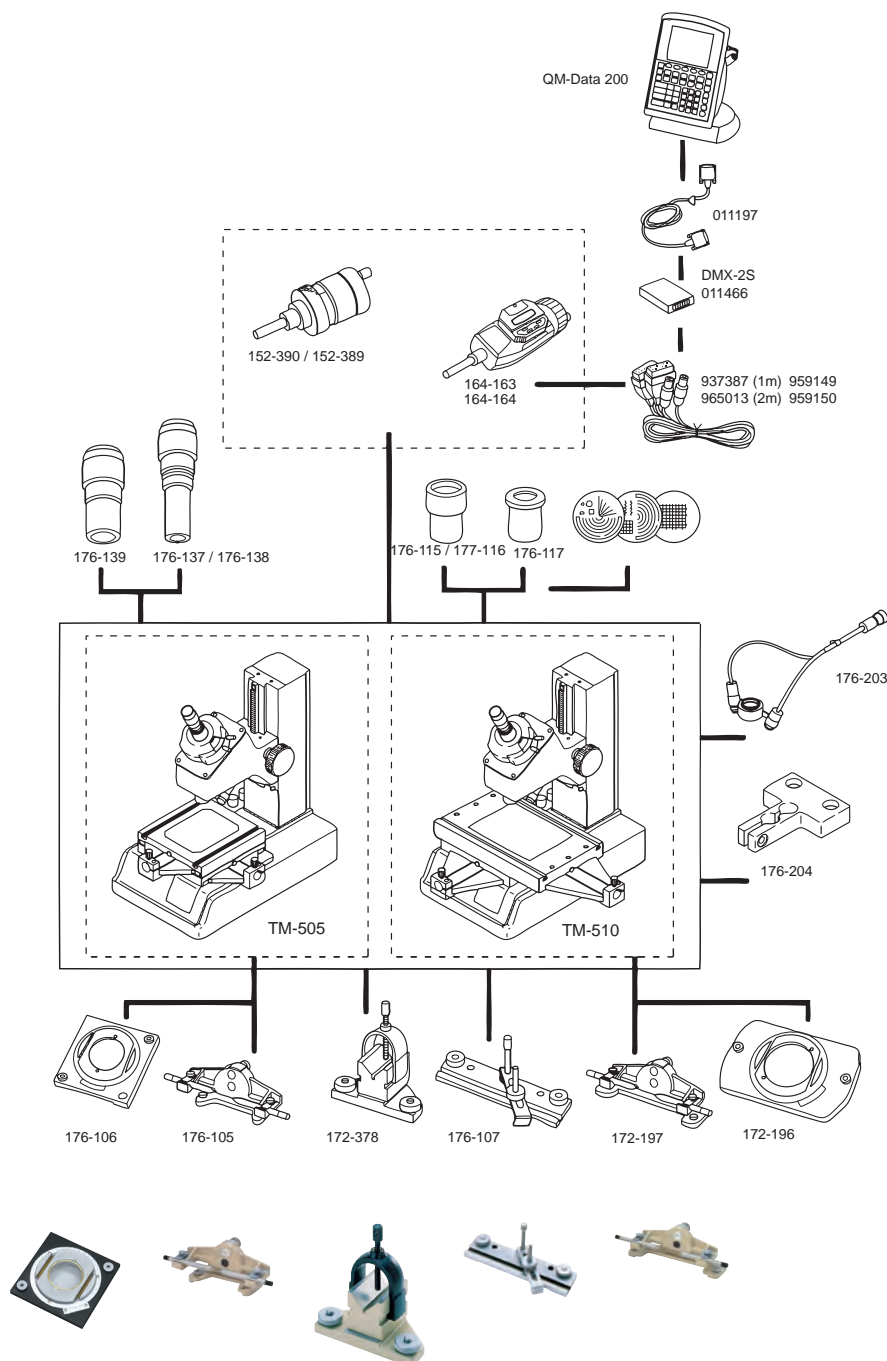
Accessories

Objective Lenses and Eyepieces

No.	Objective lens	Eyepiece 10X (176-115)	Eyepiece 15X (176-116)	Eyepiece 20X (176-117)	Price [€]
176-137	10X	100X (1,3 mm)	150X (1,3 mm)	200X (1 mm)	313,00
176-138	2X ⁽¹⁾	20X (6,5 mm)	30X (6,5 mm)	40X (5 mm)	236,00
176-139	5X	50X (2,6 mm)	75X (2,6 mm)	100X (2 mm)	313,00

⁽¹⁾ Standard accessory

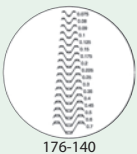
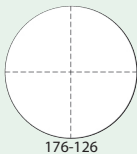
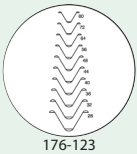
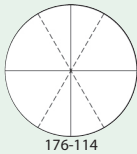
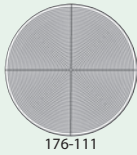
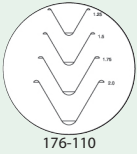
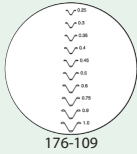
The number in brackets is the diameter of the field of view



Accessories for Measuring Microscope TM-500

Series 176

Reticles		
No.	Remarks	Price [€]
176-109	Metric screw threads (pitch = 0,25 - 1 mm)	91,00
176-110	Metric screw threads (pitch = 1,25 - 2 mm)	91,00
176-111	Concentric circle (up to ø 4 mm, 0,05 mm increment)	106,00
176-112	20° involute gear teeth (normal rack type)	91,00
176-114	60° angle	91,00
176-123	Unified screw threads (80 - 28TPI)	91,00
176-124	Unified screw threads (24 - 14TPI)	91,00
176-125	Unified screw threads (13 - 10TPI)	91,00
176-126	Cross-hair (standard accessory)	91,00
176-140	ISO metric screw threads (0,075 - 0,7 mm)	91,00
176-141	ISO metric screw threads (0,75 - 2 mm)	91,00



Measuring Microscope Series MF Generation D

Series 176

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 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.

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



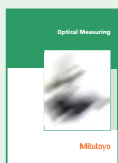
Reticle mounts
(standard accessories)



176-392
Optional monocular



176-393
Optional binocular



Refer to the MF / MF-U microscopes brochure



176-863-10
MF-2017D model



1010D
100x100 mm



2010D
200x100 mm



3017D
300x170 mm



4020D
400x200 mm



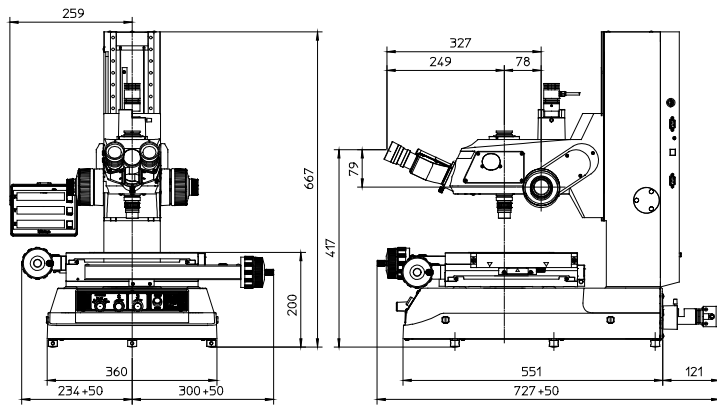
Using optional slide type nosepiece
with 2-lens mount
(factory-fit option)

Measuring Microscope Series MF Generation D

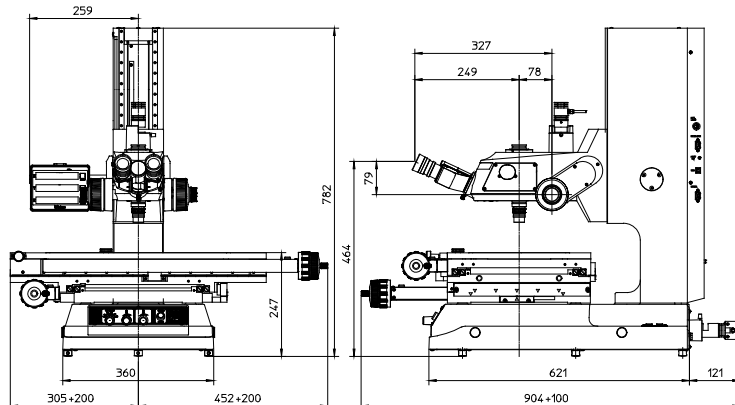
Series 176

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
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



1010D



4020D



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
Eyepieces	
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)
Filters	
12AAA643	ND2 colour filter
12AAA644	ND8 colour filter
12AAA645	GIF filter (transmitted / surface)
12AAA646	LB80 colour filter (transmitted / surface)
Mounts	
176-314-1	Slide type nosepiece (2-mount / parfocal) factory-fit option
176-314-2	Slide type nosepiece (2-mount / mag. adjusted) factory-fit option
970441	C-mount adapter
Objective Lenses	
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)

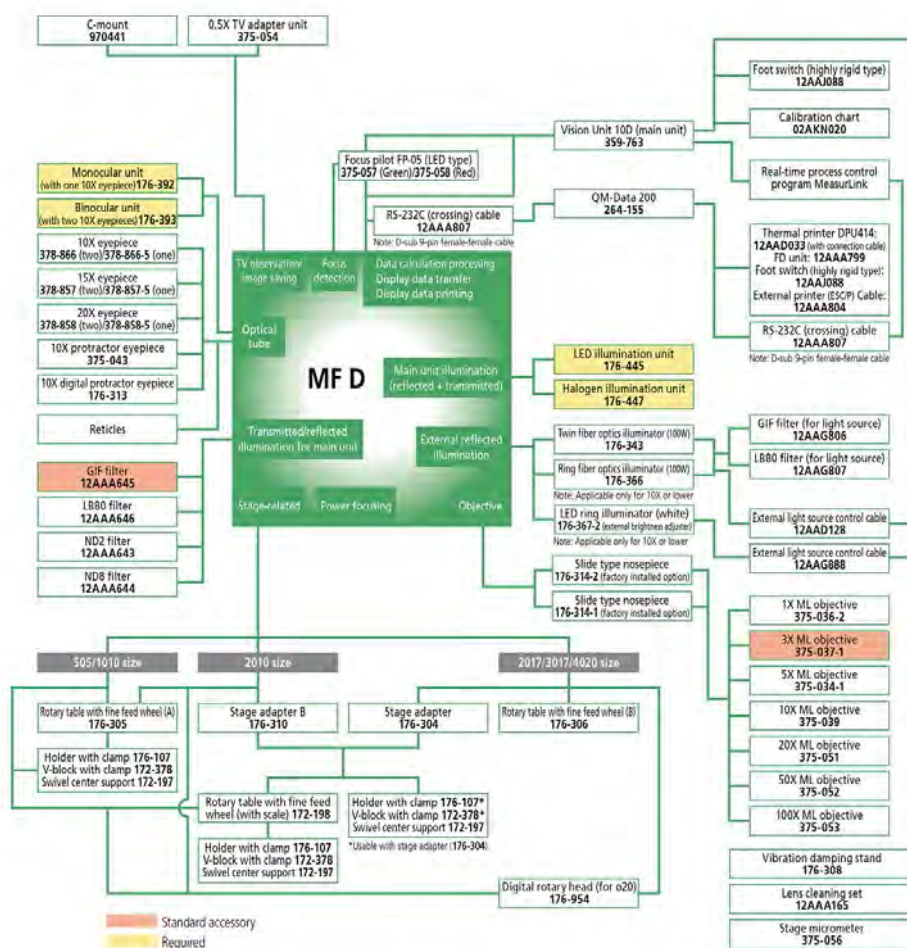
Accessories for Measuring Microscope Series MF Generation D

Series 176

Accessories/Diagram system

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
Eyepieces	
378-856	10X eyepiece (2 pcs.)
378-856-5	10X eyepiece set (ø24 mm)
Lighting	
176-343D	Twin fibre-optic illuminator
176-367-2D	LED Ring Light
176-366CED	Fibre-optic ring light
176-351-6	Oblique surface illumination unit
Lighting (required option)	
176-445D	LED illumination unit
176-447D	Halogen illumination unit
Reticles	
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



Measuring Microscope Series MF-U Generation D

Series 176

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.

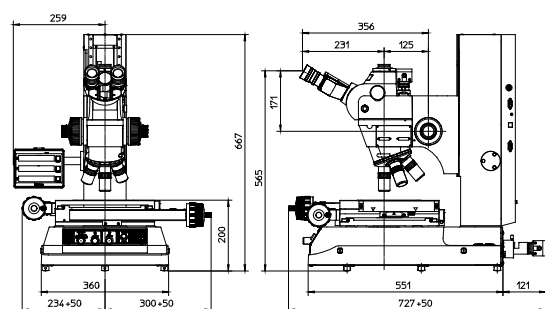
The MF-U offers you the following benefits:

- 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.

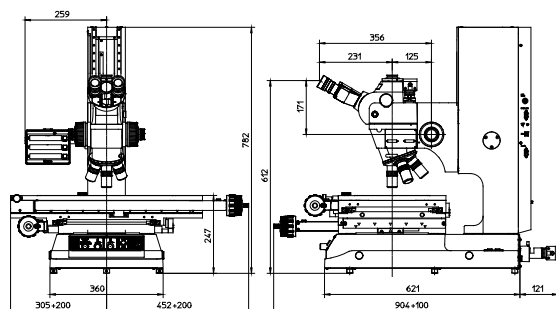


MF-UB 3017D

(turret, objectives and illumination are optional)



1010D



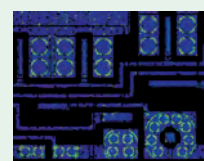
4020D



Optional 5 positions motorized turret

Specifications

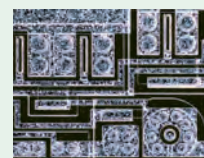
Observation image	Erect image
Optical tube	Siedentoph type (pupil distance adjustment : 51 - 76 mm), 1X tube lens, Binocular tube (depression : 30°), Reticle projection method, with TV mount, Optical path ratio (eyepiece/TV mount : 50/50)
Indication accuracy (at 20°C)	XY-axis : (2,2+0,02L) μm Z-axis : (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)



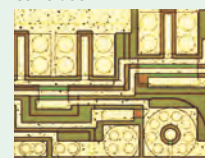
Polarized light



Differential interference contrast



Dark field



Bright field



Refer to the MF / MF-U microscopes brochure

Measuring Microscope Series MF-U Generation D

Series 176 - High-power Multi-function

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
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)
12AAG806	GIF filter
12AAG807	LB80 filter
Lighting (required option)	
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
176-107	Holder with clamp
172-197	Swivel centre support
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



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 No.	MF-UA1010D 176-871-10	MF-UB1010D 176-876-10	MF-UC1010D 176-881-10	MF-UD1010D 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 No.	MF-UA2010D 176-872-10	MF-UB2010D 176-877-10	MF-UC2010D 176-882-10	MF-UD2010D 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)

Measuring Microscope Series MF-U Generation D

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)

Optional Light Sources for Measuring Microscopes MF D-Series / MF-U D-Series

Series 176



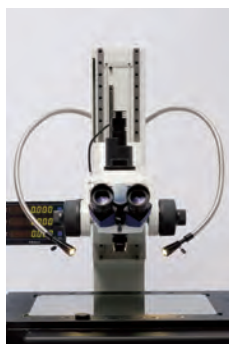
Dual Swan-neck Light-pipe



Fibre-optic Ring Light



LED Ring Light



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.

Price
[€]

176-366CED 2029,00

LED Ring Light

Applicable microscopes : MF models with 1X, 3X, 5X, 10X objective

Light source : White LED

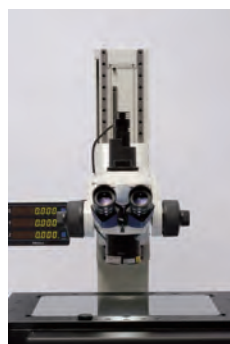
Length of LED cable : 1500 mm

No.

176-367-2D



Fibre-optic Ring Light



LED Ring Light

Accessories for MF D-Series / MF-U D-Series

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-D	Green LED
375-058D	MF-D	Red LED
375-067D	MF-UD	Green LED
375-068D	MF-UD	Red LED

Manual Turrets for MF-UD

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

Power Turrets for MF-UD

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) μ m L : Measuring length (mm)	16



Focus Pilot is factory set option



Manual and Power Turrets

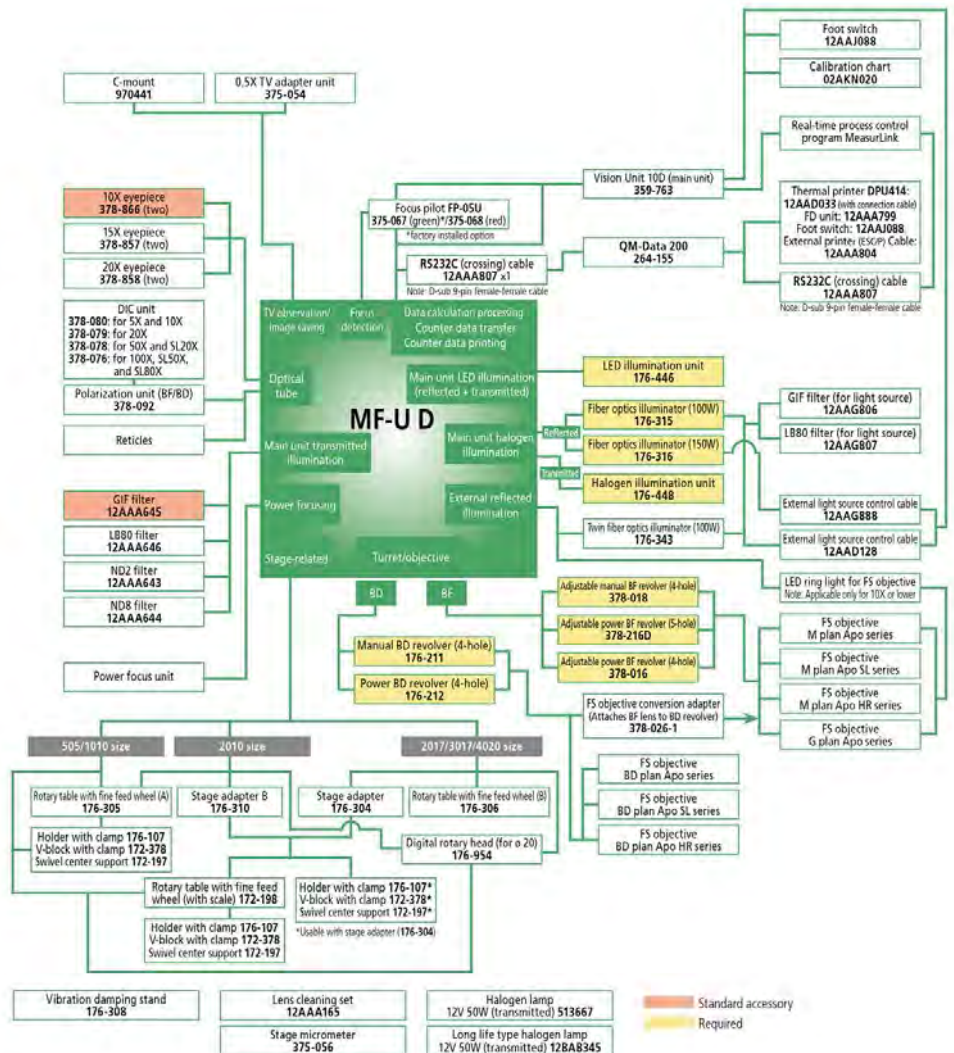


Stage Micrometer

Accessories for Measuring Microscope MF-U D-Series

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
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



Measuring Microscope MF D-Series

Series 176

Motor Driven Measuring Microscopes MF-D Series

All the functionality of the MF-C 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-D

MF Generation D

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
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

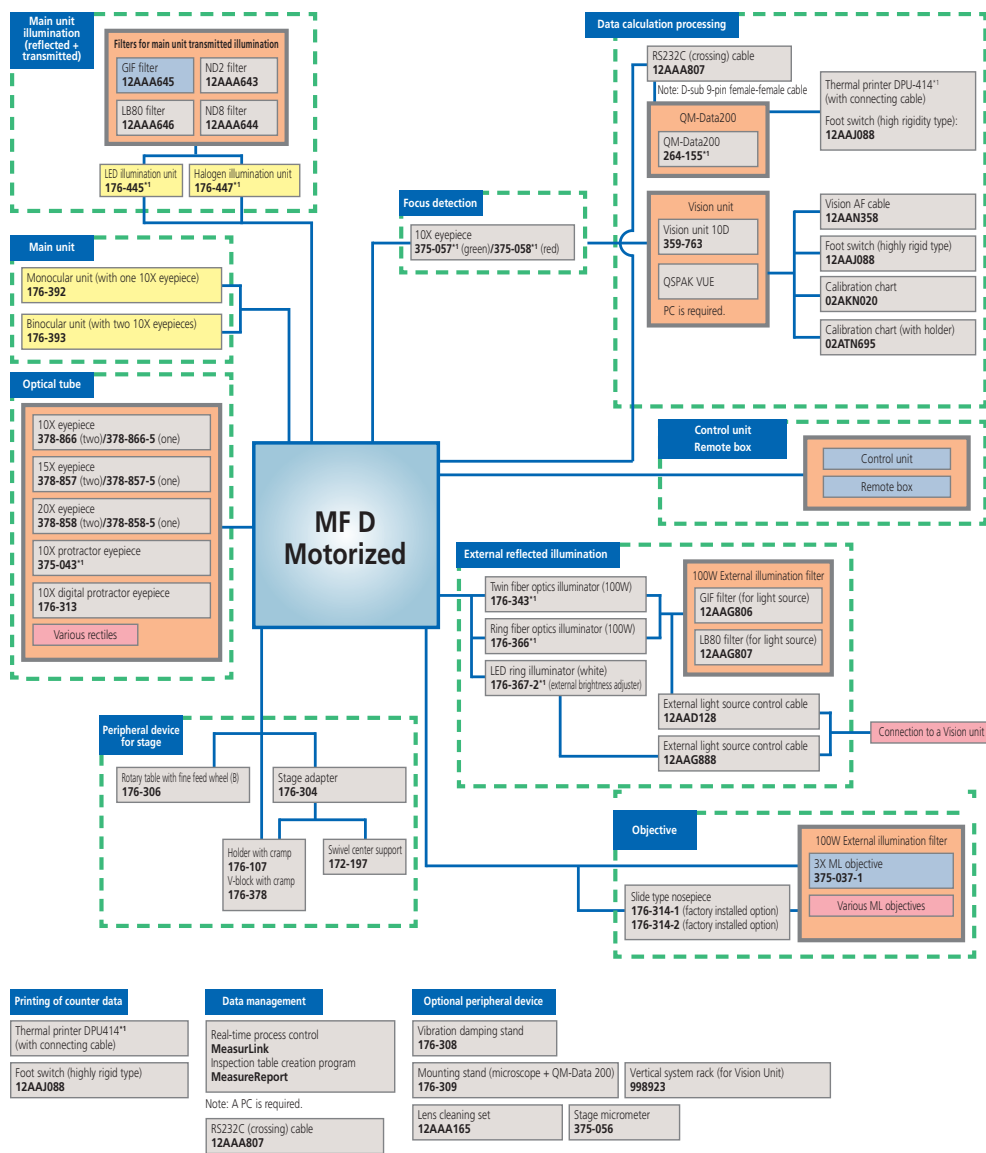


176-393
Optional binocular

See Measuring Microscope MF-C Series for optional accessories

Measuring Microscope MF D-Series

Series 176



Measuring Microscope MF-U D-Series

Series 176

Motor Driven Measuring Microscopes MF-UD Series

All the functionality of the MF-UC 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-UD 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-UD Generation



MF-UD Generation with LAF

1) MF-UD Bright Field Observation

Model	MF-UG2017D	MF-UG3017D	MF-UG4020D
No.	176-784D	176-785D	176-786D
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
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-UD Bright Field/Dark Field Observation

Model	MF-UH2017D	MF-UH3017D	MF-UH4020D
No.	176-787D	176-788D	176-789D
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
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



Refer to the MF / MF-U microscopes brochure
See Measuring Microscope MF-UC Series for optional accessories

Measuring Microscope MF-U D-Series

3) MF-UD 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
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-UD 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
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)

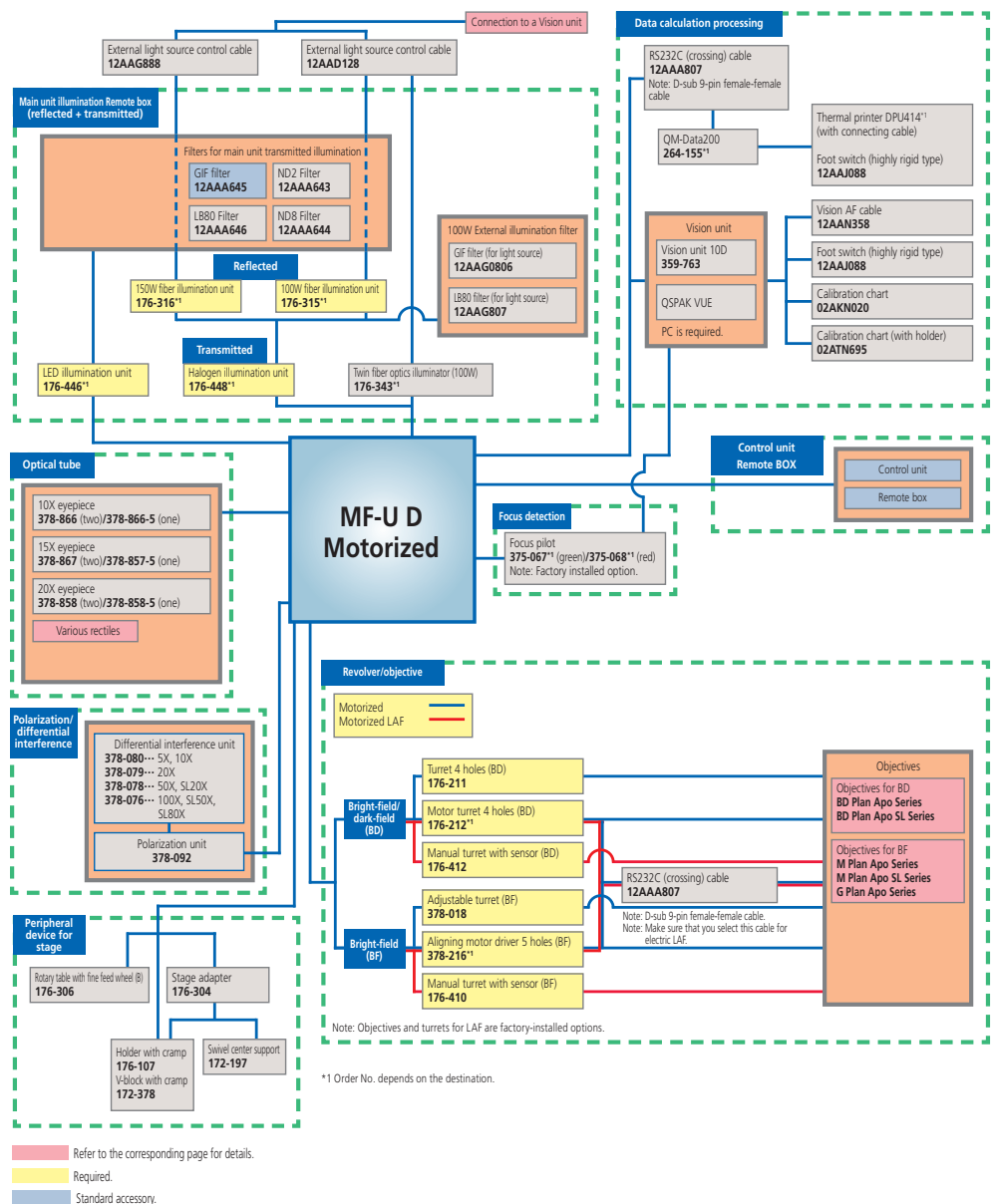


QM-Data 200



Vision Unit 10D

Series 176



Measuring Microscope Hyper Series MF / MF-U Generation B

Series 176

This measuring microscope has one of the highest XY measuring accuracies at $0,9+3L/1000 \mu\text{m}$. The Hyper MF-B/MF-UB offers you the following benefits:

- One of the highest XY measuring accuracies in the world ($0,9+3L/1000$)¹ 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 : $0,01 \mu\text{m}$
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
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

Specifications

Observation image	Erect
Optical tube	Reticle projection method, with TV mount, Optical path ratio Hyper MF : Monocular or binocular tube (optional depression : 25°) Hyper MF-U : Siedentoph type (pupil distance adjustment : 51 - 76 mm), 1X tube lens, Binocular tube (depression : 25°)
Eyepiece	Hyper MF : Optional 10X, 15X, 20X Hyper MF-U : 10X (field No. : 24 mm), Optional : 15X, 20X
Turret (optional)	Hyper MF-U : 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) Hyper MF : 880 x 913 x 730 mm (main unit) Hyper MF-U : 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

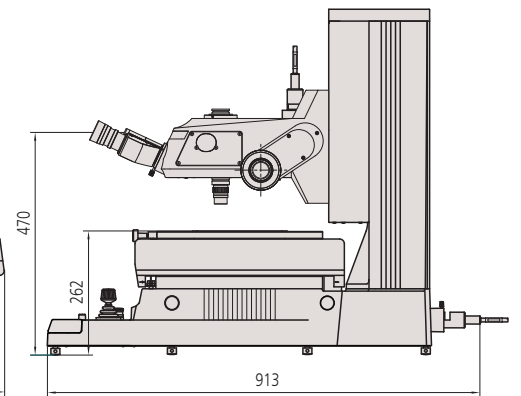
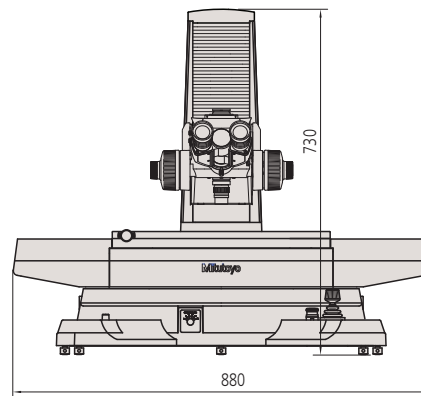
Measuring Microscope Hyper Series MF / MF-U Generation B

Series 176

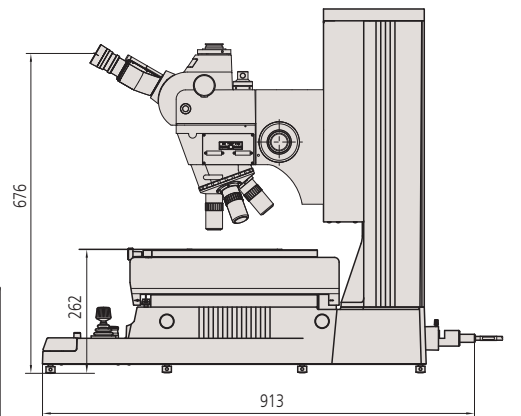
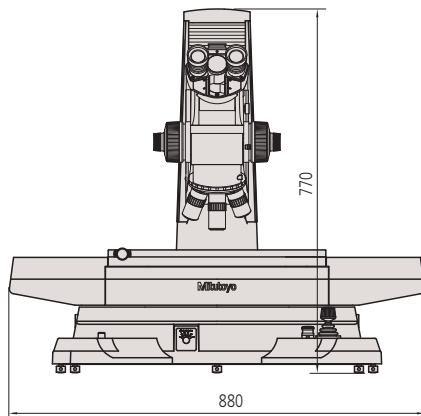
Optional accessories

No.	Description
264-149D	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.

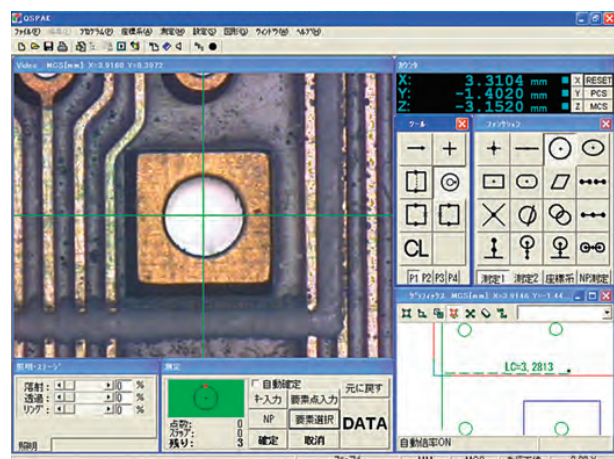
The Vision Unit offers you the following benefits:

- 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



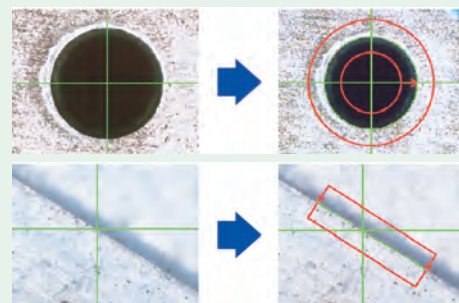
QSPAK VUE Measurement Window

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	For observation/comparison of form <ul style="list-style-type: none"> - Template matching function - Manual pattern matching function For simple measurement <ul style="list-style-type: none"> - One-click edge detection tool function - Smart tool function - User macro function Functions for repeated measurement/auto-measurement <ul style="list-style-type: none"> - Quick navigation - Playback - Graphic - External data output - Statistical calculation

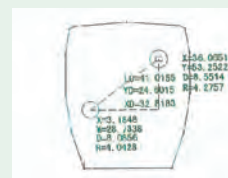
Standard accessories

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 θ , which is the half-angle of the maximum cone of light that can enter the lens.

Resolving Power (R)

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

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

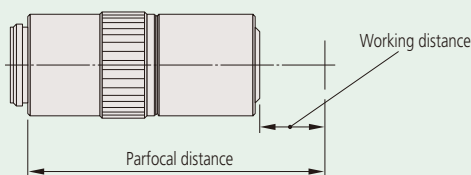
$\lambda = 0.55\mu\text{m}$ is often used as the reference wavelength

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.

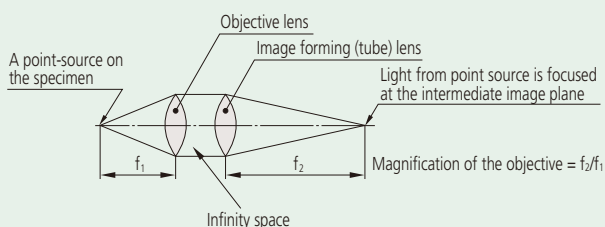
Parfocal Distance

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.



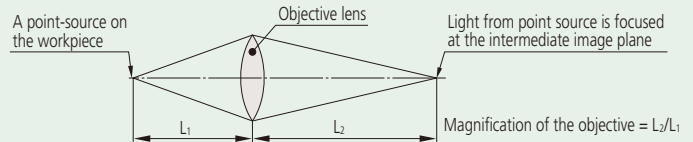
Infinity Optical System

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

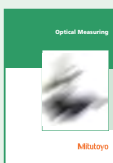
(3) Monitor display magnification

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

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

Specifications

Focus adjustment	Method : With concentric coarse and fine focusing wheels (right and left) Range : 50mm travel range, 0,1mm/rev. for fine adjustment, 3,8mm/rev. for coarse adjustment
Trinocular tube Image	Erect image
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"> 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. Bright field, Differential Interference Contrast (DIC) and polarized observations are standard with the FS70Z. The FS70L and FS70L4 do not support the DIC method. By employing an inward-leaning turret, the long working distance objectives provide excellent operability.



Refer to the Microscope Units and objective lenses brochure

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 prober 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.



FS70Z



FS70L



FS70L4

Model	FS70	FS70-TH	FS70Z	FS70Z-TH
No.	378-184-1	378-184-3	378-185-1	378-185-3
Model short base	FS70-S	FS70-THS	FS70Z-S	FS70Z-THS
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	FS70L-TH	FS70L4	FS70L4-TH
No.	378-186-1	378-186-3	378-187-1	378-187-3
Model short base	FS70L-S	FS70L-THS	FS70L4-S	FS70L4-THS
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.

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

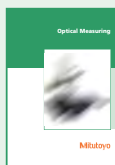
Specifications	
Magnification of tube	1X
Reflected illumination	- Telecentric system with aperture stop system - Fibre-optic illuminator (optional) is required
Light source	Halogen bulb (21V, 150W) (optional)
Objective lenses for bright field observation (Optional accessory)	M Plan Apo, M Plan Apo SL, 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

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

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, F570.



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.

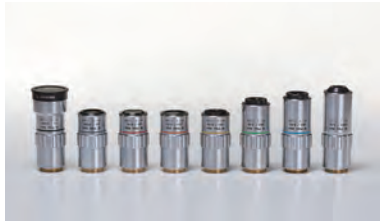


No.	Magnification	N.A.	W.D.	D.F.
375-036-2	1X	0,03	61 mm	306 µm
375-037-1	3X	0,09	77 mm	34 µm
375-034-1	5X	0,13	61 mm	23 µm
375-039	10X	0,21	51 mm	6,2 µm
375-051	20X	0,42	20 mm	1,6 µm
375-052	50X	0,55	13 mm	0,9 µm
375-053	100X	0,7	6 mm	0,6 µm

Objective Lens M Plan Series

Series 378

The Mitutoyo 378 Series objectives have one of the world's longest working distances and an infinity-correction 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

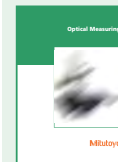


Near-infrared wavelength corrected M Plan Apo NIR objectives

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

Objective Lens for Brightfield Observations FS-Series

Specifications

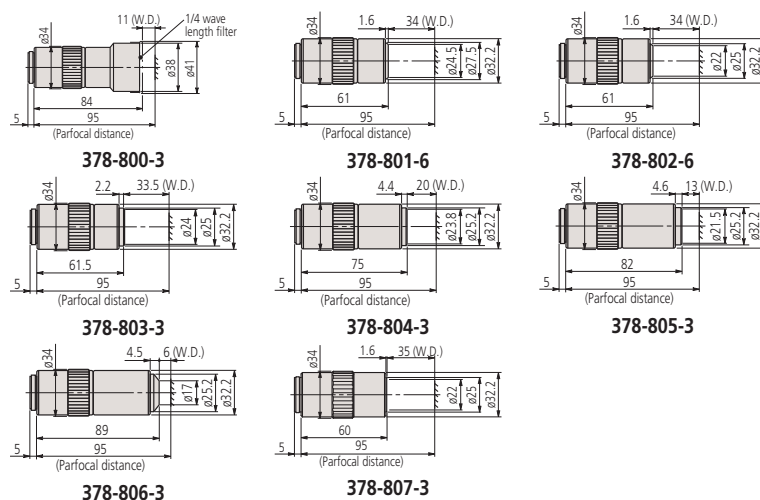
Abbreviations in product table

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 $\phi 24$ 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

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.

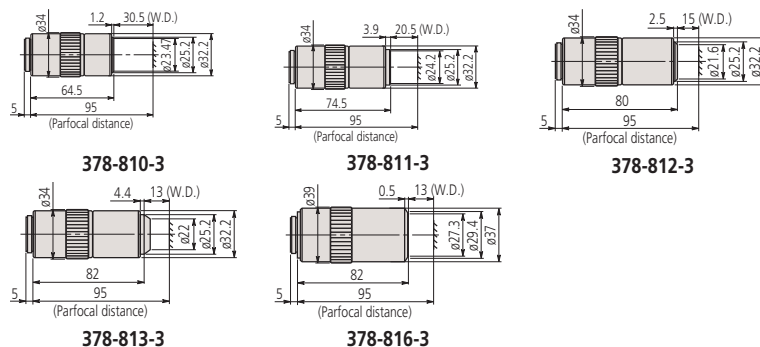
No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-800-3	1X	0,025	11 mm	200	11 μ m	440 μ m	$\phi 24$ mm	4,8x6,4 mm	300
378-801-6	2X	0,055	34 mm	100	5 μ m	91 μ m	$\phi 12$ mm	2,4x3,2 mm	220
378-802-6	5X	0,14	34 mm	40	2 μ m	14 μ m	$\phi 4,8$ mm	0,96x1,28 mm	240
378-803-3	7,5X	0,21	35 mm	26,67	1,3 μ m	6,2 μ m	$\phi 3,6$ mm	0,64x0,85 mm	240
378-803-3	10X	0,28	33,5 mm	20	1 μ m	3,5 μ m	$\phi 2,4$ mm	0,48x0,64 mm	230
378-804-3	20X	0,42	20 mm	10	0,7 μ m	1,6 μ m	$\phi 1,2$ mm	0,24x0,32 mm	270
378-805-3	50X	0,55	13 mm	4	0,5 μ m	0,9 μ m	$\phi 0,48$ mm	0,1x0,13 mm	290
378-806-3	100X	0,7	6 mm	2	0,4 μ m	0,6 μ m	$\phi 0,24$ 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

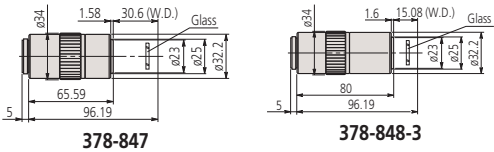
Note : These objectives offer extra-long working distance.

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 μ m	3,5 μ m	$\phi 1,2$ mm	0,24x0,32mm	240
378-811-3	50X	0,42	20,5 mm	4	0,7 μ m	1,6 μ m	$\phi 0,48$ mm	0,1x0,13 mm	280
378-812-3	80X	0,5	15 mm	2,5	0,6 μ m	1,1 μ m	$\phi 0,3$ mm	0,06x0,08 mm	280
378-813-3	100X	0,55	13 mm	2	0,5 μ m	0,9 μ m	$\phi 0,24$ mm	0,05x0,06 mm	290
378-816-3	200X	0,62	13 mm	1	0,4 μ m	0,7 μ m	$\phi 0,12$ mm	0,025x0,03 mm	490



Objective Lens for Brightfield Observations FS-Series

Series 378



Glass Thickness Corrected G Plan Apo for Bright Field Observation

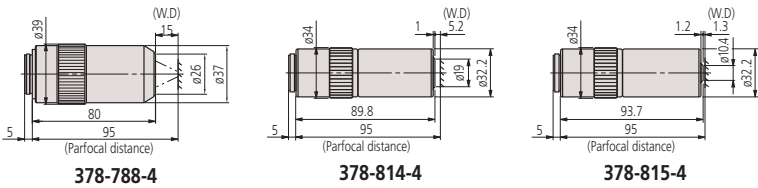
Compatible with microscope types VMU / FS-70 / MF-U / Hyper MF-U
Note : The G Plan Apo Series are designed for observing a workpiece through glass (thickness : 3,5 mm).

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

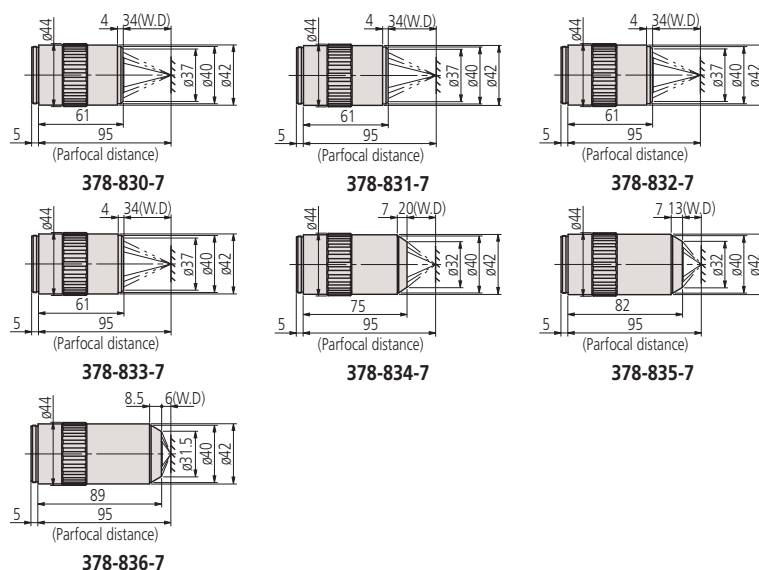
Mag. : Magnification
N.A. : Numerical aperture
W.D. : Working distance
f : Focal distance
R : Resolving power
D.F. : Focal depth
F.O.V. 1 : Field of view when
using ø24 mm eyepiece
F.O.V. 2 : Field of view when
using 1/2" / 12,7 mm CCD camera



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.

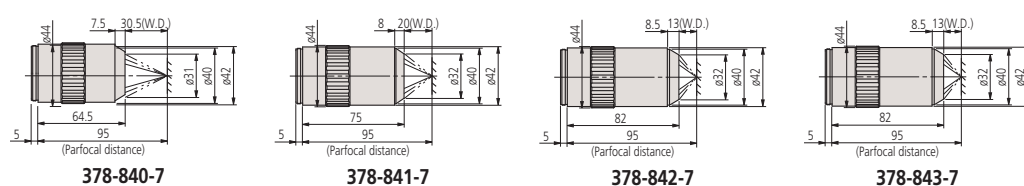
No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-845-7	50X	0,75	5,2 mm	4	0,4 μm	0,49 μm	ø0,48 mm	0,1x0,13 mm	530
378-846-7	100X	0,9	1,3 mm	2	0,3 μm	0,34 μm	ø0,24 mm	0,05x0,06 mm	545

BD Plan Apo SL for Bright/Dark Field Observation

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

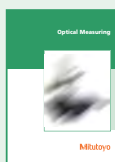
Note : These objectives offer extra-long working distance.

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

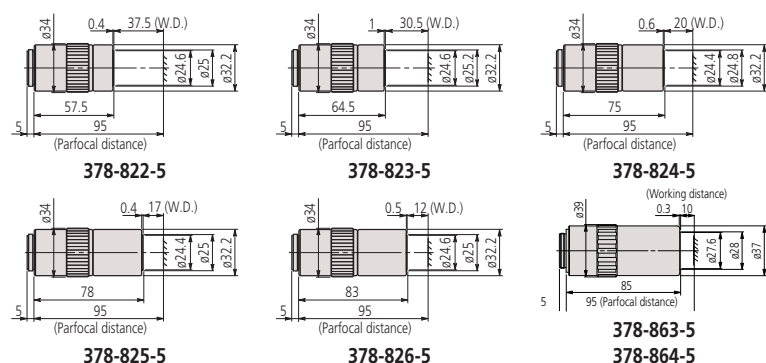
Mag. : Magnification
N.A. : Numerical aperture
W.D. : Working distance
f : Focal distance
R : Resolving power
D.F. : Focal depth
F.O.V. 1 : Field of view when
using ø24 mm eyepiece
F.O.V. 2 : Field of view when
using 1/2" / 12,7 mm CCD camera



Refer to the microscope units
and objective lenses brochure

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

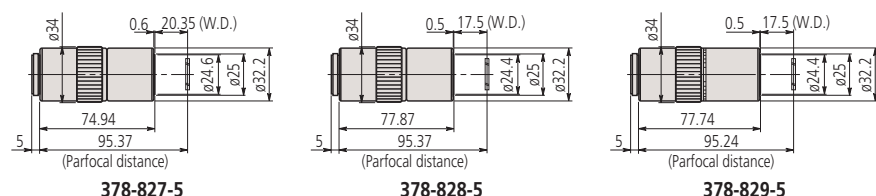
Series 378



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

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

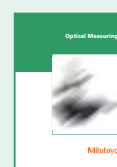
Specifications

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.



Refer to the microscope units and objective lenses brochure
Specifications

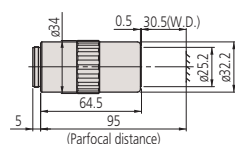
Abbreviations in product table

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

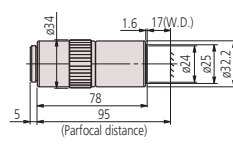


Refer to the microscope units and objective lenses brochure

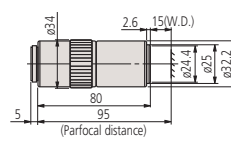
Objective Lens for NIR, NUV and UV Observation FS-Series



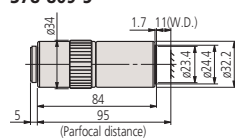
378-809-5



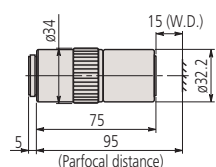
378-817-4



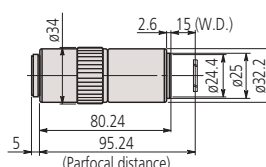
378-818-4



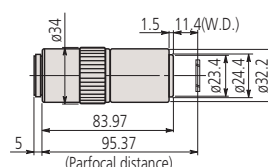
378-819-4



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

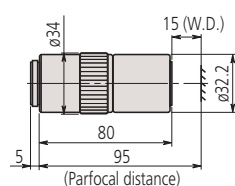
No.	Mag./glass thickness [mm]	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-753-4	50X/t1,1	0,42	14,53 mm	4	0,7 µm	1,6 µm	ø0,48 mm	0,1x0,13 mm	310
378-820-4	50X/t0,7	0,42	14,76 mm	4	0,7 µm	1,6 µm	ø0,48 mm	0,1x0,13 mm	310
378-751-4	100X/t1,1	0,5	11,03 mm	2	0,6 µm	1,1 µm	ø0,24 mm	0,05x0,06 mm	380

Ultraviolet wavelength Corrected

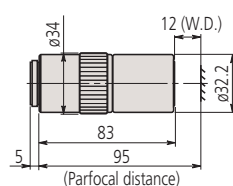
M Plan UV for Bright Field Observation

Compatible with microscope types VMU / FS-70

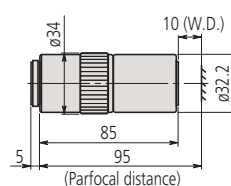
No.	Magnification	N.A.	W.D.	f	R	D.F.	F.O.V. 1	F.O.V. 2	Mass [g]
378-844-5	10X	0,25	20 mm	20	1,1 µm	4,4 µm	ø2,4 mm	0,48x0,64 mm	310
378-837-5	20X	0,36	15 mm	10		2,1 µm	ø1,2 mm	0,24x0,32 mm	330
378-838-5	50X	0,4	12 mm	4	0,7 µm	1,7 µm	ø0,48 mm	0,1x0,13 mm	400
378-839-5	80X	0,55	10 mm	41031	0,5 µm	0,9 µm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



378-837-5



378-838-5

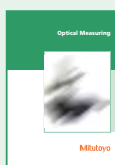


378-839-5

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



302-704-1D



302-702-1D



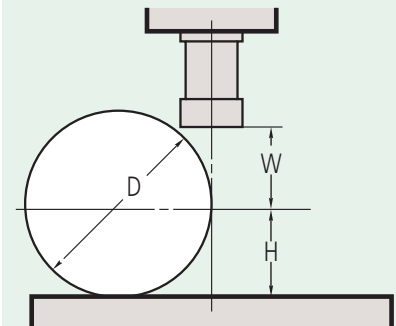
302-703-1D



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 (990948) 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 [μm]	0,001 mm (0,001 mm : digital head)
Power supply	220 - 240V AC, 50/60Hz



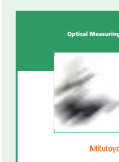
D : Max. workpiece diameter

W : Working distance

H : Max. workpiece height

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

() When using surface illumination



Refer to the PJ-A3000 brochure

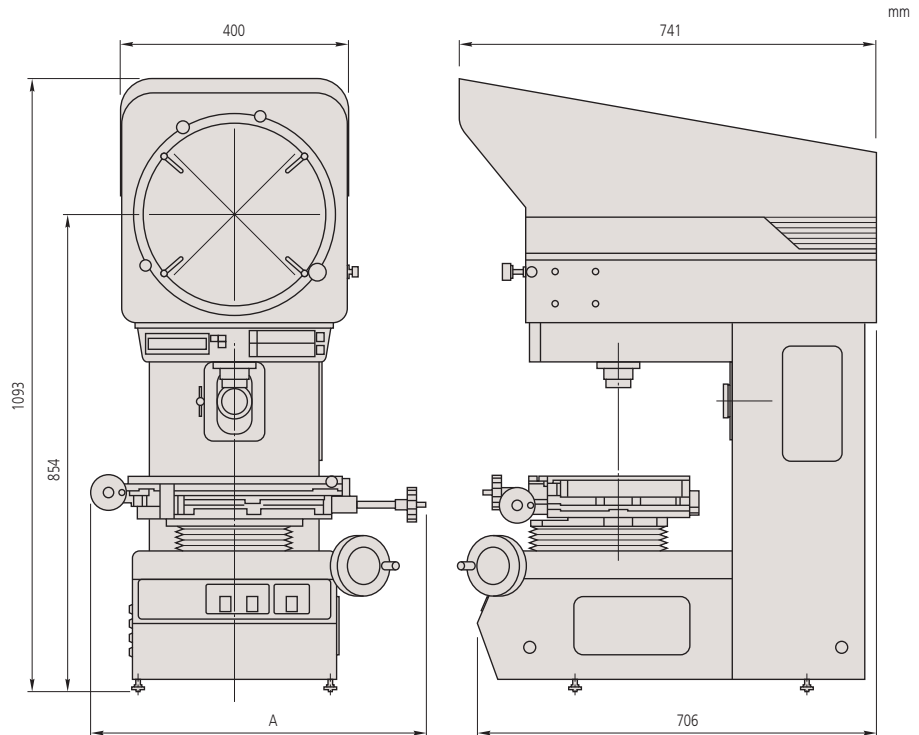
Measuring Projector PJ-A3000 Series

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
Price [€]	9756,00	11330,00	10887,00	12875,00
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	Price €
172-116	Standard scale 50 mm	170,00
172-160-3	Green filter	148,00
172-161	Reading scale 300 mm	340,00
172-197	Swivel centre support	824,00
172-203	Projection lens 20X	775,00
172-204	Projection lens 50X	1014,00
172-207	Projection lens 100X	1014,00
172-229	Oblique illumination mirror 10X Projection lens	101,00
172-230	Oblique illumination mirror 20X Projection lens	80,00
172-378	V-block with clamp (Max. workpiece ø25 mm)	313,00
176-107	Holder with clamp	266,00
172-118	Reading scale 200 mm	281,00
172-160-2	Green filter	85,00
176-105	Swivel centre support	950,00
999678D	Fixture mount adapter	469,00
512305	Halogen bulb (24V, 150W)	13,00
12AAE671	Detector mounting plate for ø250 to ø350 mm	40,00
332-151	Optoeye-200	1473,00
176-106	Rotary table 66 mm	796,00
172-196	Rotary table 100 mm	955,00
172-198	Rotary table 100 mm with fine adjustment	976,00
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)		
302-7005 - (302-714E)	302-7010 - (302-711E)	
302-7040 - (302-718E)	302-7020 - (302-712E)	
302-7080 - (302-719E)	302-7030 - (302-713E)	
302-7090	302-7050	
	302-7060	
	302-7070	
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



264-155D, QM-Data 200



OPTOEYE-200

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.



303-735-1D



Vertical / oblique switchable surface illumination



Vertical illumination



Oblique illumination



1010B



2010B

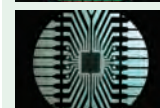
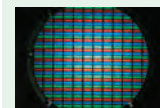


2017B

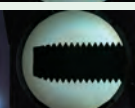
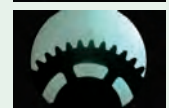
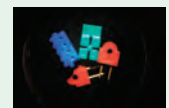
Specifications

Accuracy	(3+0,02L) μ 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 [μ m]	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



Profile Projector brochure on request



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.	303-712-1D	303-732-1D
Price [€]	17980,00	22215,00
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.	303-713-1D	303-733-1D
Price [€]	20600,00	23793,00
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.	303-714-1D	303-734-1D
Price [€]	22250,00	25441,00
Focusing	Manual	Power focus
Edge detector	Optional	Built-In

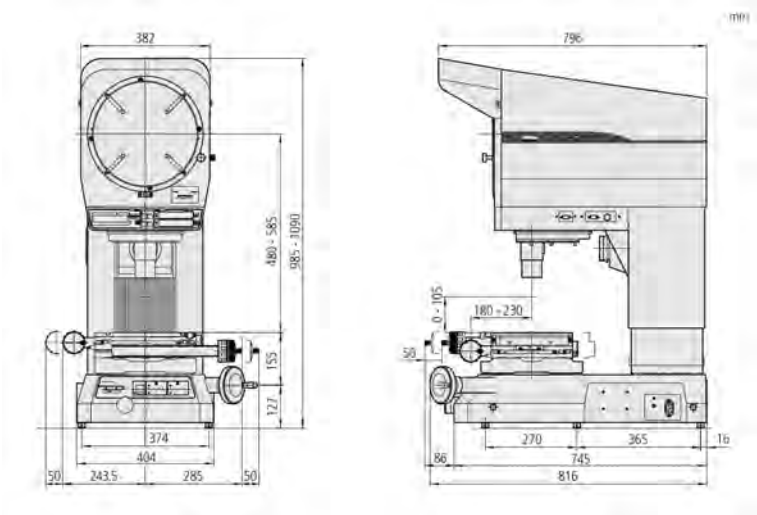
Model 3017B - 300 x 170 mm

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

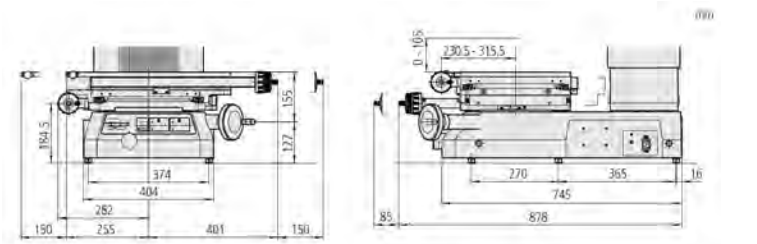
Model	PJ-H30A	PJ-H30D
No.	303-715-1D	303-735-1D
Price [€]	25750,00	28943,00
Focusing	Manual	Power focus
Edge detector	Optional	Built-In

Measuring Projector PJ-H30 Series

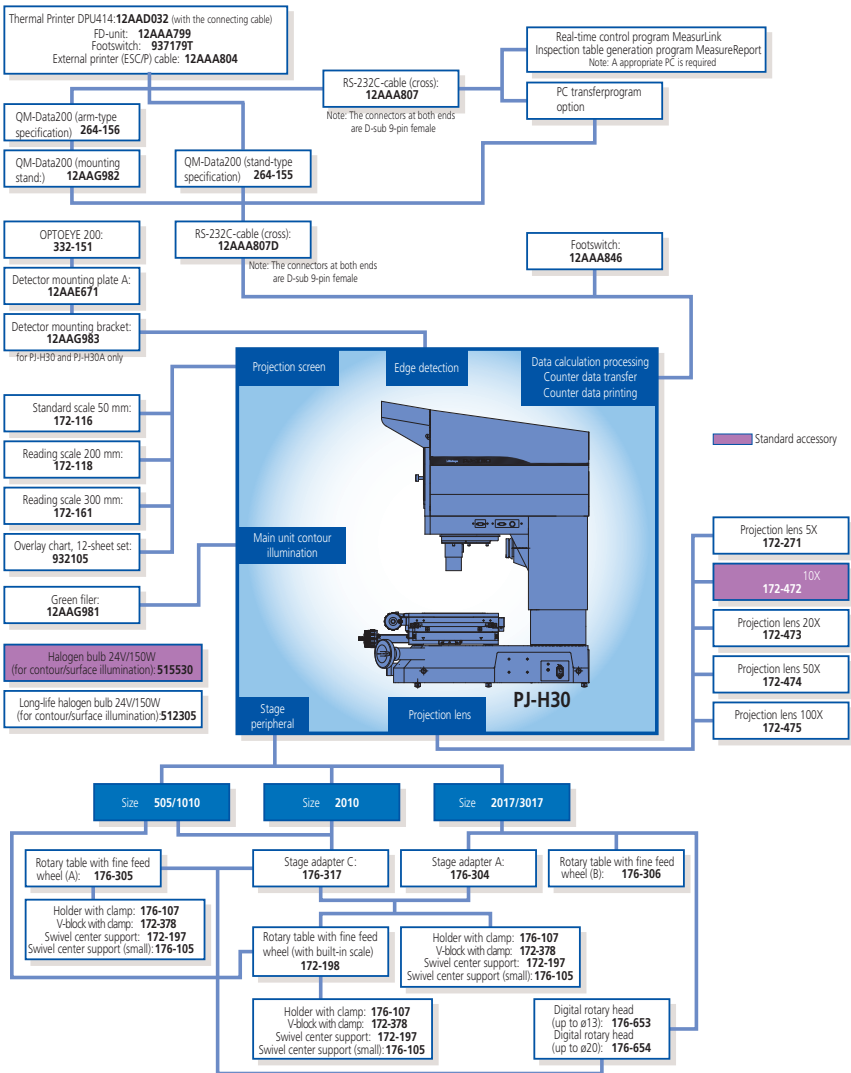
Series 303



1010B model



3017B model



Standard accessories

No.	Description
172-472	Lens 10X
383876	Protective hood
512305	Halogen bulb (24V, 150W)

Optional accessories

No.	Description	Price €
332-151	Optoeye-200	1473,00
12AAE671	Detector mounting plate for ø250 to ø350 mm	40,00
12AAG983	Detector mounting bracket for PJ-H30A/PJ-H30E	43,00
12AAG981	Green filter	290,00
172-116	Standard scale 50 mm	170,00
172-118	Reading scale 200 mm	281,00
172-161	Reading scale 300 mm	340,00
172-271	Projection lens 5X	1804,00
172-473	Projection lens 20X	1389,00
172-474	Projection lens 50X	1433,00
172-475	Projection lens 100X	1443,00
176-105	Swivel centre support	950,00
172-197	Swivel centre support	824,00
172-198	Rotary table 100 mm with fine adjustment	976,00
172-378	V-block with clamp (Max. workpiece ø25 mm)	313,00
176-305	Rotary table with fine feed wheel ø183 mm	1857,00
176-306	Rotary table with fine feed wheel ø240 mm	2408,00
011534	Cleaner for optics	19,00
12AAA807D	RS-232C cable (2m)	56,00
12AAG982	Mounting stand for QM-Data 200	737,00
264-155D	QM-Data 200 Stand type	
264-156D	QM-Data 200 Arm mount type	



264-155D
QM-Data 200

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.

Specifications

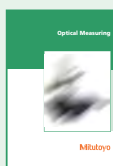
Projected image	Inverted
Projector screen	Effective diameter : 508 mm Screen material : Fine-ground glass Screen rotation : $\pm 360^\circ$, fine adjustment and clamp Angle reading : Digital counter (LED) Resolution : $1'$ or $0,01^\circ$ (switchable) Range : $\pm 370^\circ$ ABS/INC mode switching, Zero 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 [μm]	0,001 mm
Power supply	220 - 240V AC, 50/60Hz
Mass	210 kg



304-919D
Counter is optional

	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



KA Counter

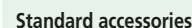


QM-Data 200



OPTOEYE 200

Series 304 - Accessories/Dimensions

[illegible]

Optional accessories

No.	Description	Price €
172-401	5X projection lens set including : 172-406 Objective 172-407 Condenser 932602 Adapter for objective	5729,00
172-403	20X projection lens set including : 172-411 Objective 172-412 Condenser	1671,00
172-404	50X projection lens set including : 172-413 Objective 172-414 Condenser	1719,00
172-405	100X projection lens set including : 172-415 Objective 172-414 Condenser	1835,00
172-116	Standard scale 50 mm	170,00
172-330	Standard scale 80 mm	234,00
172-161	Reading scale 300 mm	340,00
172-329	Reading scale 600 mm	695,00
172-160-2	Green filter	85,00
172-319	Canopy	1056,00
510189	Protective hood	93,00
172-198	Rotary table 100 mm with fine adjustment	976,00
172-197	Swivel centre support	824,00
176-107	Holder with clamp	266,00
172-378	V-block with clamp (Max. workpiece ø25 mm)	313,00
011534	Cleaner for optics	19,00
174-173D	KA-Counter 2 Axis	530,00
12AAE672	Optoeye mounting plate for ø500 to ø600 mm screen	56,00
264-156D	QM-Data 200 Arm mount type	



172-319

Measuring Projector PH-A14

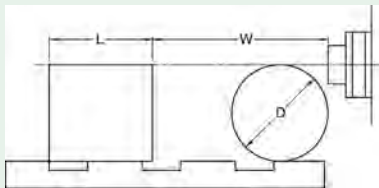
Series 172

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.

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 [μm]	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



172-810-20D

With optional evaluation unit QM-Data 200



KA Counter

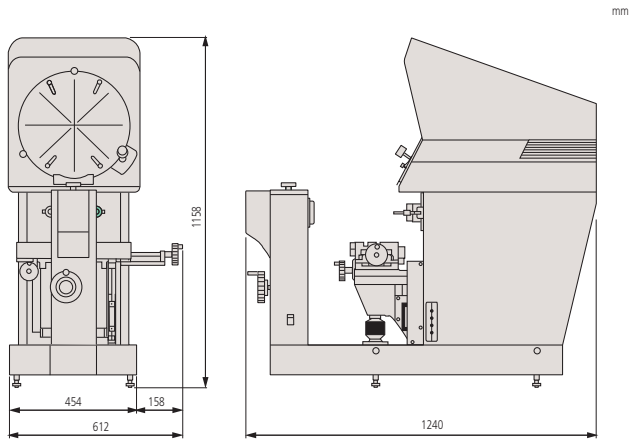
QM-Data 200



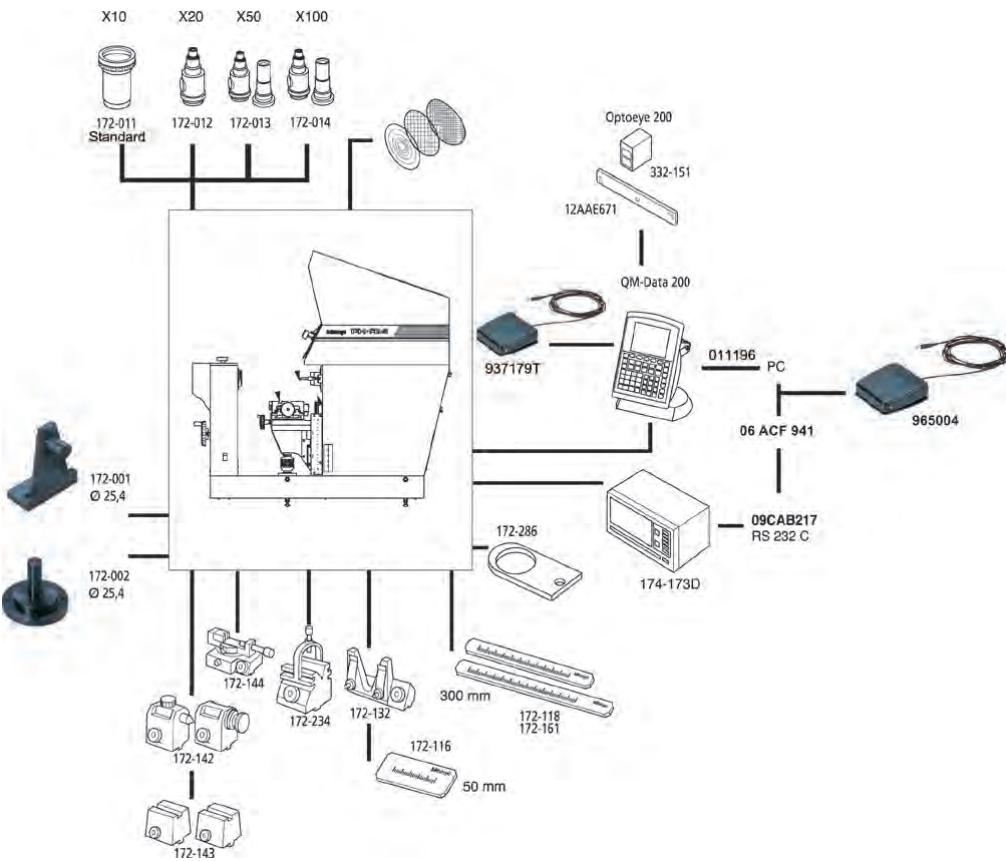
OPTOEYE 200

Measuring Projector PH-A14

Series 172 - Accessories/Dimensions



Model	PH-A14
No.	172-810-20D
Price [€]	8168,00
XY stage [mm]	203 x 102
Measuring method	Linear encoder
XY stage table top size [mm]	407 x 153
Max stage loading [kg]	45



Standard accessories

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

Optional accessories

No.	Description	Price €
174-173D	KA-Counter 2 Axis	530,00
172-013	Lens 50X for Profile Projector PH-A14	1083,00
172-012	Lens 20X for Profile Projector PH-A14	560,00
172-014	Lens 100X for Profile Projector PH-A14	1719,00
172-116	Standard scale 50 mm	170,00
172-118	Reading scale 200 mm	281,00
172-286	Green filter	222,00
172-143	Centre support riser	509,00
172-144	Rotary vice (Max. workpiece ø60 mm)	923,00
172-234	V-block with clamp (Max. workpiece ø50 mm)	568,00
172-132	Vertical holder	382,00
172-161	Reading scale 300 mm	340,00
172-001	Support for straight gear	838,00
172-002	Support for flat gear	1008,00
172-142	Centre support	976,00
011534	Cleaner for optics	19,00
332-151	Optoeye-200	1473,00
12AAE671	Detector mounting plate for ø250 to ø350 mm	40,00
264-156D	QM-Data 200 Arm mount type	
12AAF182	Digital counter stand	91,00

Measuring Projector PH-3515F

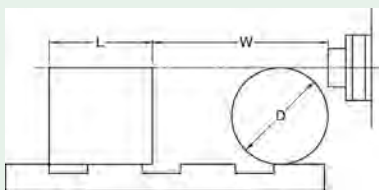
Series 172

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.

Specifications

Projected image	Inverted
Projector screen	Effective diameter : 353 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 (172-184) 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 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

PH-3515F		mm				
		Magnification				
		5X	10X	20X	50X	100X
View field		70.6	35.3	17.65	7.06	3.5
L		175	235	235	80	109
W		160 (64)	93 (35)	40	14.6	9.5
D		152.4	152.4	116	30.4	19

() When using surface illumination

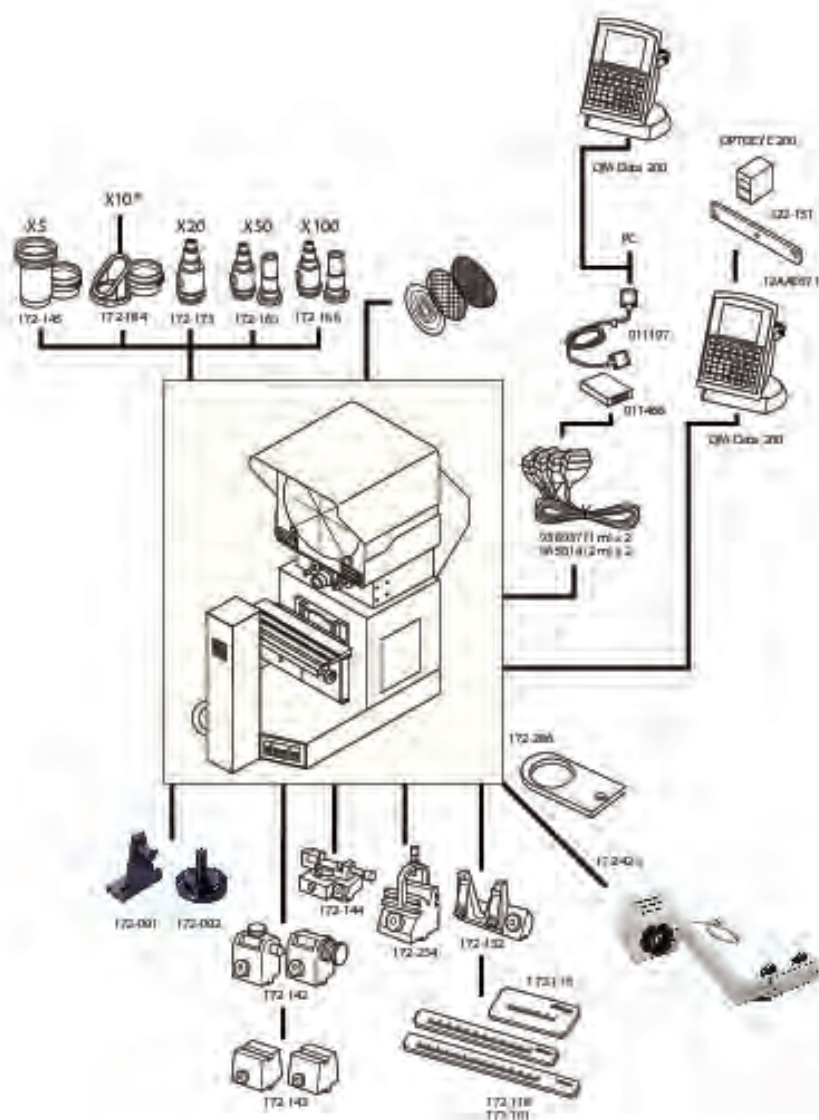
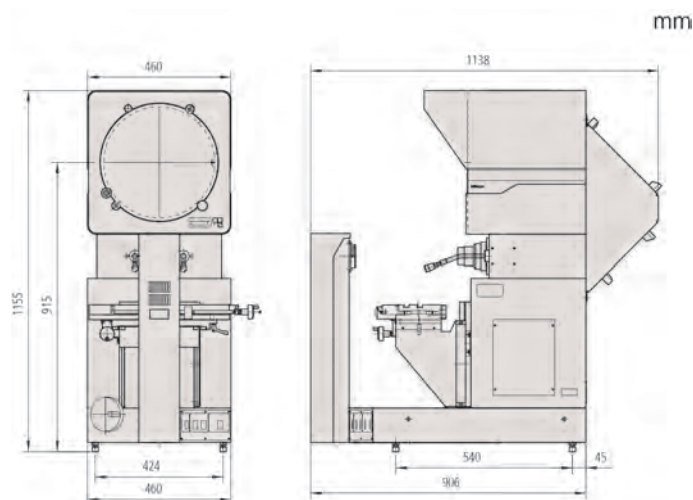


172-868D

Model	PH-3515F
No.	172-868D
Price [€]	14317,00
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	$\pm 10^\circ$
Max stage loading [kg]	45

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	Price €
172-145	Projection lens 5X with condenser	2600,00
172-173	Projection lens 20X with condenser	652,00
172-165	Projection lens 50X with condenser	997,00
172-166	Projection lens 100X with condenser	1963,00
172-423	Vertical surface illumination unit	752,00
172-116	Standard scale 50 mm	170,00
172-118	Reading scale 200 mm	281,00
172-161	Reading scale 300 mm	340,00
172-286	Green filter	222,00
172-142	Centre support	976,00
172-143	Centre support riser	509,00
172-144	Rotary vice (Max. workpiece ø60 mm)	923,00
172-234	V-block with clamp (Max. workpiece ø50 mm)	568,00
172-132	Vertical holder	382,00
12AAM027	Overlay chart set (12 sheets) (No. 12AAM587 to 12AAM598)	855,00
12AAF182	Digital counter stand	91,00
011534	Cleaner for optics	19,00
174-173D	KA-Counter 2 Axis	530,00
332-151	Optoeye-200	1473,00
12AAE671	Detector mounting plate for ø250 to ø350 mm	40,00
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.

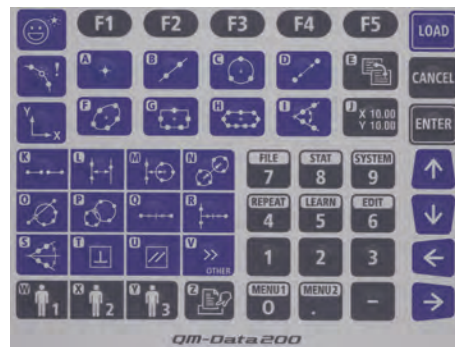


Stand-mount type



Arm-mount type

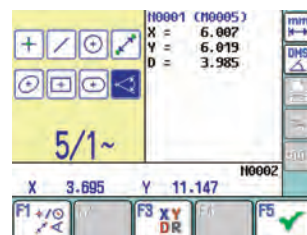
No.	Mass [kg]	Description
264-155D	2,9	Stand-mount type
264-156D	2,8	Arm-mount type
264-159D	2,9	Stand-mount type for Hyper MF / MF-U



Intuitive panel design



Clear function icons



Coloured LCD display with backlight



Guided measurements

Specifications

Resolution [μm]	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	Mitutoyo's AI Function : 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. Customized Operation : 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	Price €
12AAD033	Thermal printer (with connection cable)	752,00
908353-1	Printer paper for thermal printer	11,00
I-1525612	Cable for printer (2 m)	52,00
937179T	Footswitch	42,00
12AAA807D	RS-232C cable (2m)	56,00
011119	Signal cable RS-232C D-SUB 25 to D-SUB 9 (2m)	85,00

Edge Detection Sensor OPTOEYE 200

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).

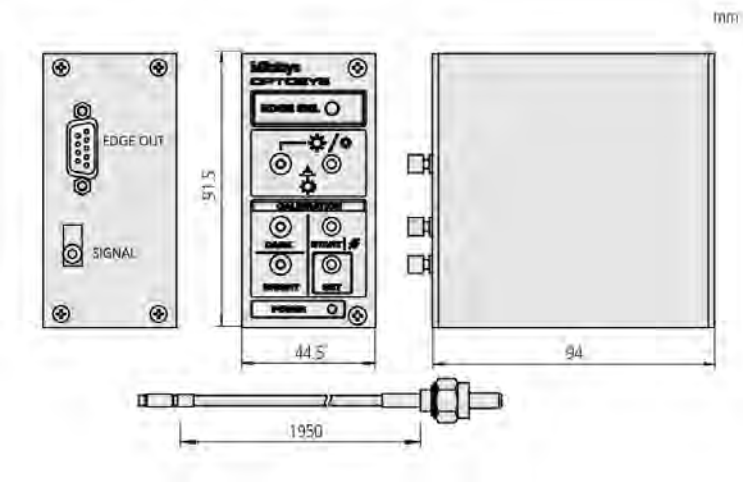
Specifications	
Image detection	Directivity : All directions
Min. diameter	2 mm on the screen
Min. width	1 mm on the screen
Applicable illumination	Type : Surface/Contour illumination Range : 30 to 2000 Lux on the screen Bright-Dark field difference : 20 Lux
Function	Automatic detection of feature edges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

Optional accessories		
No.	Description	Price €
12AAE671	Detector mounting plate for ø250 to ø350 mm	40,00
12AAE672	Optoeye mounting plate for ø500 to ø600 mm screen	56,00



332-151

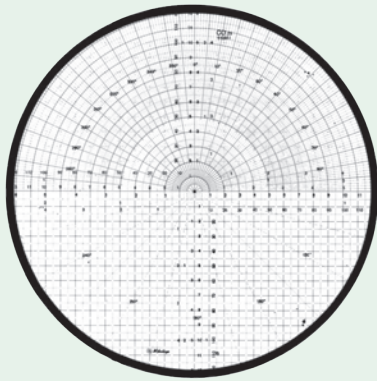
No.	Description	Price [€]
332-151	Edge detection sensor OPTOEYE 200	1473,00



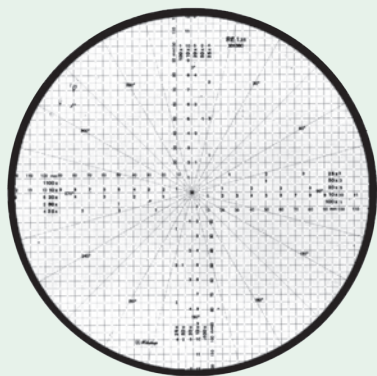
Accessories for Measuring Projectors

Additional Specifications

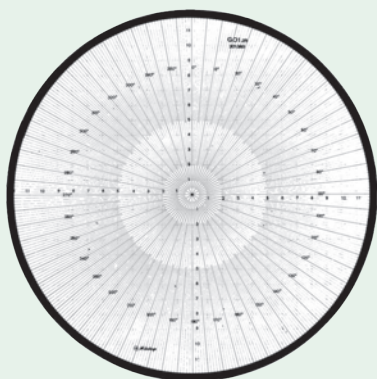
Grid divisions	10X : 0,1 mm
	20X : 0,05 mm
	50X : 0,02 mm
	100X : 0,01 mm



Combination chart



Grid/protractor chart



Radius/protractor chart

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]	Price [€]
512651	250	430,00
512652	300	499,00
512653	340	594,00
512654	500	933,00
512655	600	1221,00

Grid/protractor chart

Angle : 15° increments

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

No.	Diameter [mm]	Price [€]
201380	250	430,00
201386	300	499,00
201392	340	594,00
512621	500	933,00
511843	600	1167,00

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]	Price [€]
201383	250	430,00
201389	300	499,00
201395	340	594,00
512624	500	933,00
511846	600	1167,00

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.

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- 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]	Price [€]
201385	250	430,00
201391	300	499,00
201397	340	594,00
512626	500	933,00
511848	600	1167,00

ISO Metric threads

No.	Diameter [mm]	Price [€]
201384	250	430,00
201390	300	499,00
201396	340	594,00
512625	500	933,00
511847	600	1167,00

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]	Price [€]
201381	250	430,00
201387	300	499,00
201393	340	594,00
512622	500	933,00
511844	600	1167,00

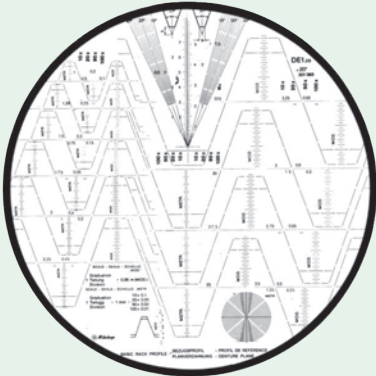
Radius chart

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

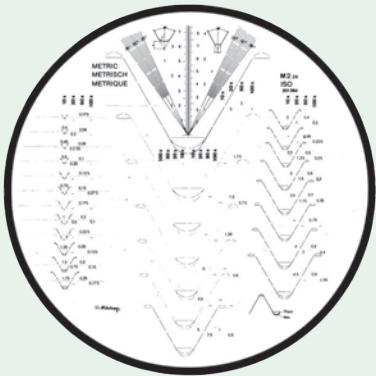
No.	Diameter [mm]	Price [€]
201382	250	430,00
201388	300	499,00
201394	340	594,00
512623	500	933,00
511845	600	1167,00

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

Accessories for Measuring Projectors

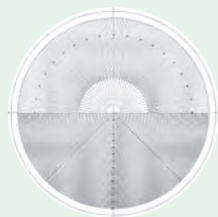
Group 2 - Makes inspection of projected images an easy process.

Optional accessories

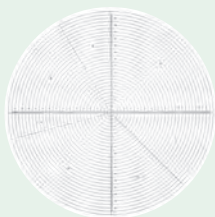
No.	Description	Price €
12AAM027	Overlay chart set (12 sheets) (No. 12AAM587 to 12AAM598)	855,00

Metric

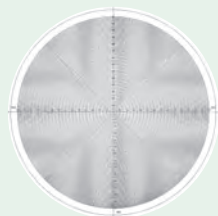
Description	ø 300 mm	
	No.	Price [€]
Concentric circles 1 mm pitch	12AAM589	78,00
Concentric circles at 1 mm pitch with radial index 1° increments	12AAM596	92,00
Crossed lines with 0,5 mm pitch	12AAM592	81,00
Crossed lines with 1 mm graduation and concentric circles 5 mm pitch	12AAM588	78,00
Grid chart (10 x 10 mm)	12AAM591	81,00
Grid chart (1 mm pitch)	12AAM593	78,00
Horizontal for 20X, vertical for 50X with 1 mm graduations	12AAM590	78,00
Horizontal lines 1 mm pitch	12AAM595	78,00
Metric threads 0,075 - 0,225 mm, 100X involute gear teeth : 20° MOD 0,2-1, 14,5° MOD 0,2-1	12AAM598	78,00
Metric threads 0,2-2 mm, unified threads 28-12 TPI 20X Whitworth threads 20-10 TPI 20X	12AAM597	81,00
Radial index 1° increments	12AAM594	78,00
Radial index 1° increments (upper) concentric circle 1 mm pitch (lower)	12AAM587	81,00



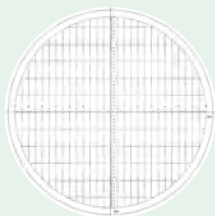
12AAM587



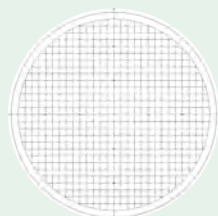
12AAM588



12AAM589



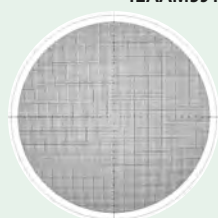
12AAM590



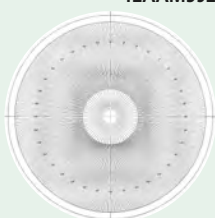
12AAM591



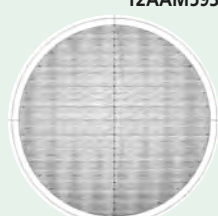
12AAM592



12AAM593



12AAM594



12AAM595



12AAM596



12AAM597



12AAM598

Accessories for Measuring Projectors

Workpiece Fixtures

For Profile Projectors and Measuring Microscopes

Centre Support

No.	Max. workpiece height [mm]	Mass [kg]	Price [€]
172-142	120	3,3	976,00

Centre Support Riser

No.	Max. workpiece height [mm]	Mass [kg]	Price [€]
172-143	240	3,3	509,00

Holder with Clamp

No.	Max. workpiece height [mm]	Mass [kg]	Price [€]
176-107	35	0,42	266,00

Rotary Tables

No.	Effective glass dia. [mm]	Angular resolution °	Fine feed	Mass [kg]	Price [€]
176-106	66	6		1,7	796,00
172-198	96	1	Available	2,4	976,00
172-196	100	1		2,5	955,00
176-305	182		Available	5,5	1857,00
176-306	238		Available	6,5	2408,00

Rotary Vice

No.	Rotary range	Width of jaws [mm]	Angle graduations °	Max. workpiece height [mm]	Mass [kg]	Price [€]
172-144	360°	40	5	60	2,8	923,00

Swivel Centre Support

No.	Max workpiece dia. [mm]	Swivel range	Max. workpiece length [mm]	Mass [kg]	Price [€]
176-105	70 (45) when swiveled 10°	±10°	140	2,4	950,00
172-197	80 (65) when swiveled 10°	±10°	140	2,5	824,00

V-Block with Clamp

No.	Max workpiece dia. [mm]	Width of block [mm]	Mass [kg]	Price [€]
172-378	25	41	0,8	313,00
172-234	50	60	1,24	568,00

Vertical Holder

No.	Mass [kg]	Price [€]
172-132	1,3	382,00



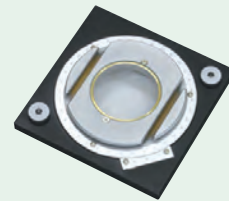
172-142



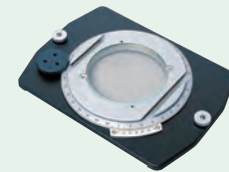
172-143



176-107



176-106



172-198



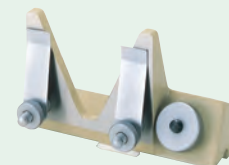
172-144



172-197



172-234 - 172-378



172-132

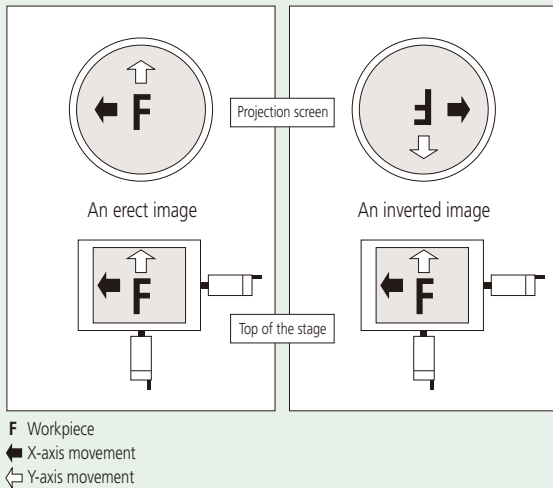
Quick Guide to Precision Measuring Instruments



Profile Projectors

Erect Image and Inverted Image

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



Magnification Accuracy

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

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

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

$\Delta M(\%)$: Magnification accuracy expressed as a percentage of the nominal lens magnification

L : Length of the projected image of the reference object measured on the screen

ℓ : Length of the reference object

M : Magnification of the projection lens

Type of Illumination

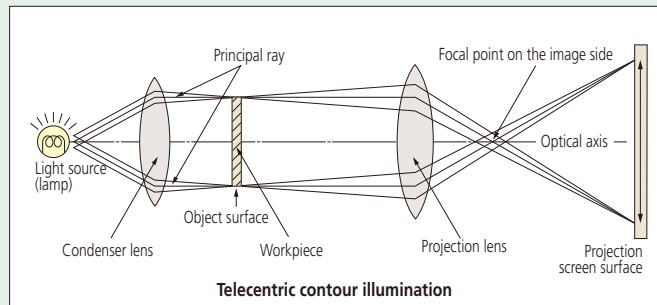
- **Contour illumination:** An illumination method to observe a workpiece by transmitted light and is used mainly for measuring the magnified contour image of a workpiece.
- **Coaxial surface illumination:** An illumination method whereby a workpiece is illuminated by light transmitted coaxially to the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

(An oblique mirror is needed. Models in the PJ-H30 series are supplied with an oblique mirror.)

Telecentric Optical System

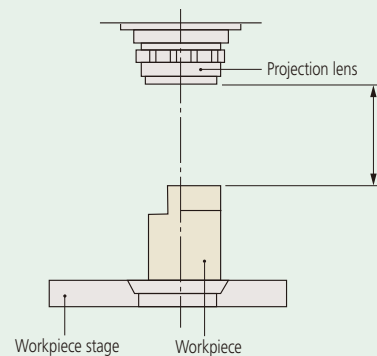
An optical system based on the principle that the principal ray is aligned parallel to the optical axis by placing a lens stop on the focal point on the image side. Its functional feature is that the image will not vary in size though the image blurs as the object is shifted along the optical axis.

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



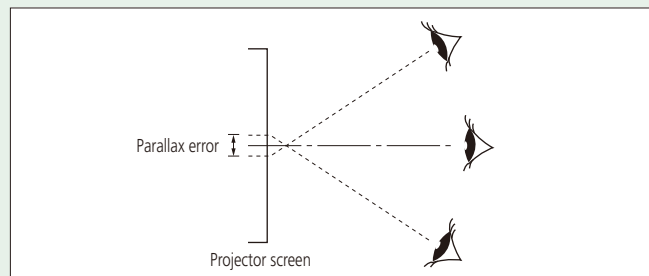
Working distance

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



Parallax error

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



Field of view diameter

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

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

Example: If a 5X magnification lens is used for a projector with a screen of $\phi 500\text{mm}$:

$$\text{Field of view diameter is given by } \frac{500\text{mm}}{5} = 100\text{mm}$$