

Mitutoyo

Mitutoyo Quality

Measuring Microscopes MF/MF-U Series

Optical Measuring



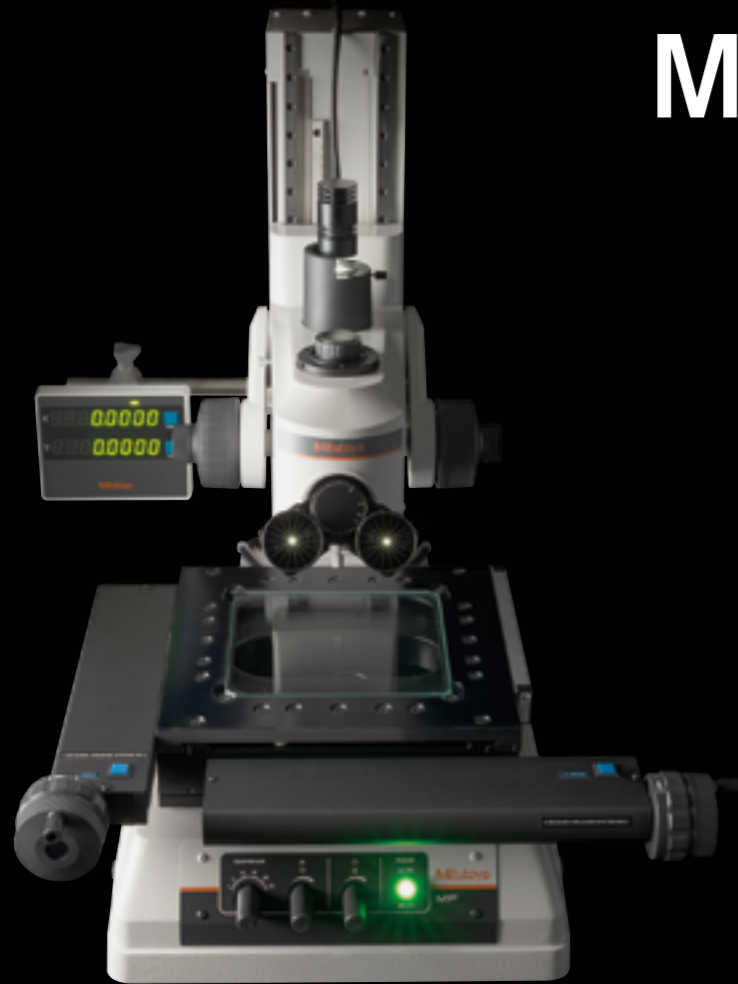
Catalog No. E14003(8)

Standard model, easy-to-use
measuring microscope equipped with
a long working distance
ML objective lens

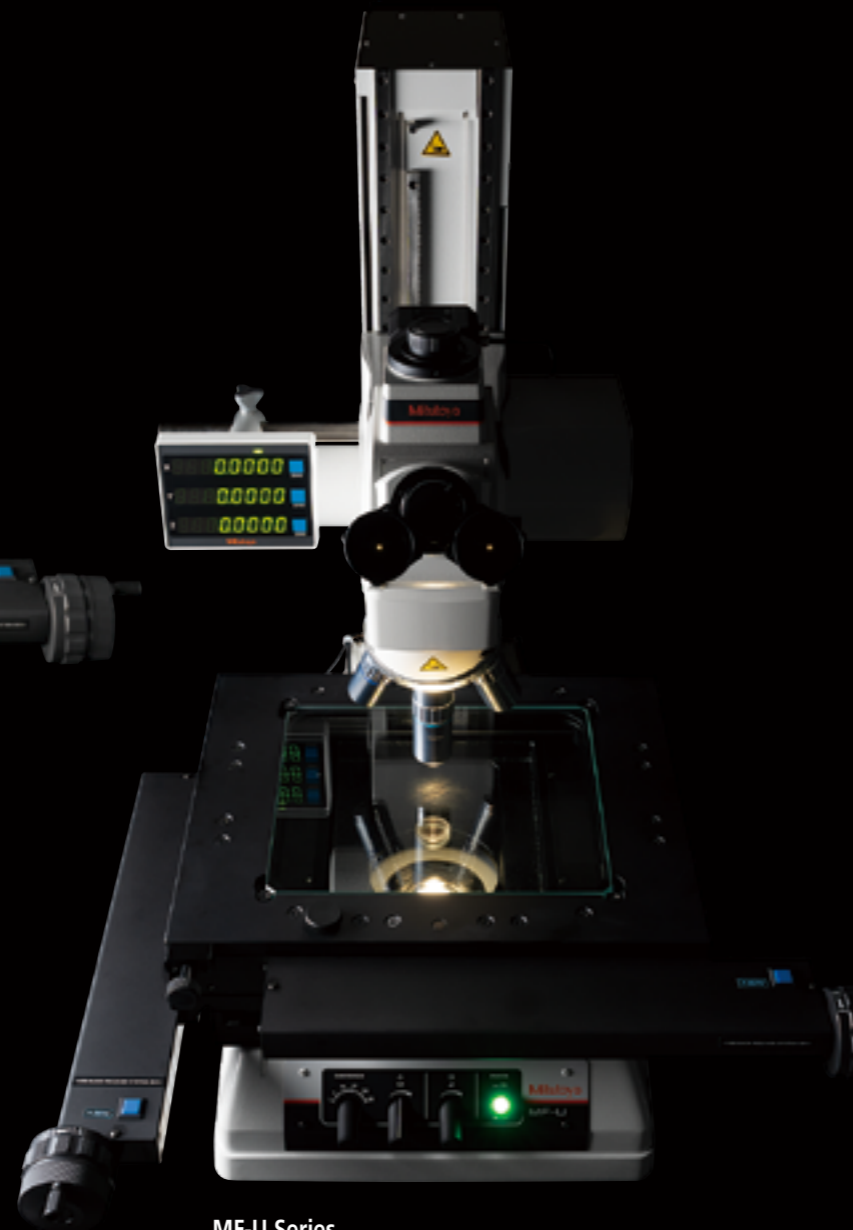
MF Series

A model that enables both high-resolution
observation and highly accurate measurement
through combination of a metallurgical microscope
and a measuring microscope into a single unit

MF-U Series



MF Series



MF-U Series

Ultra-wide View Field and High Magnification Observation

Field Number: 24

This measuring microscope series has achieved an industry-leading wide field of view of $\varnothing 24$ mm (when using 1X objective).

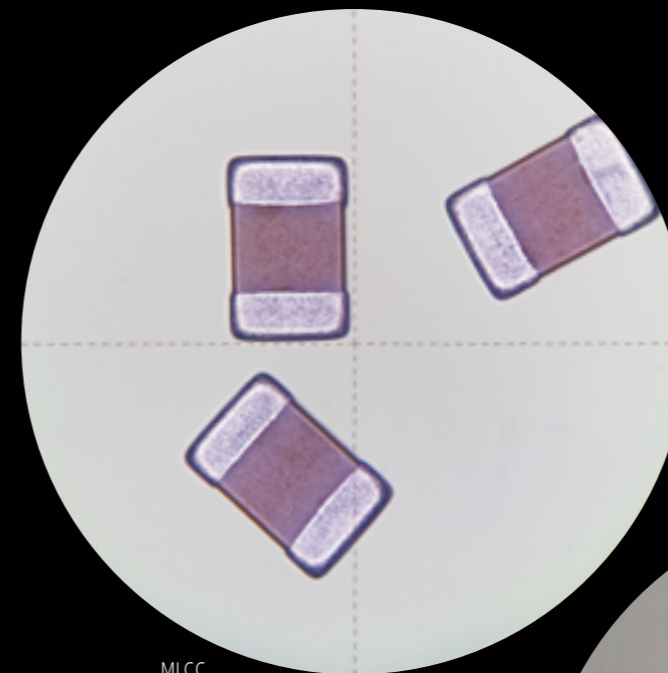
A Camera Port on All Models

All models are equipped with a C-mount port as standard to which a compatible camera is attachable.

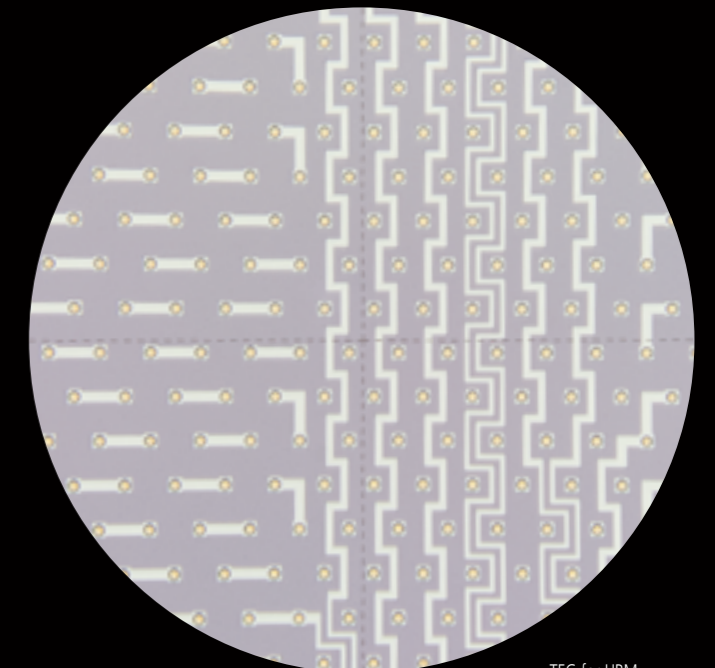
The port allows a vision measurement system or an observation-specific digital camera to be mounted.

Lineup of a Wide Range of Objectives

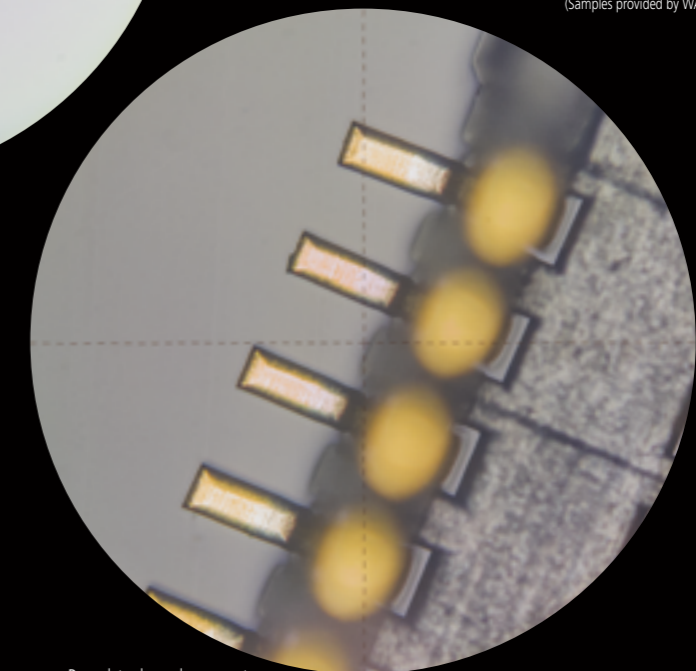
The objectives available provide a choice of ultra-low magnification, for excellent flare suppression, to high magnification that approaches the resolution limit possible with optical wavelengths, allowing the customer to select an optimal magnification depending on the intended use.



MLCC



TEG for HBM
(Samples provided by WALTIS Co., Ltd. and ASKindex.)



Board-to-board connector

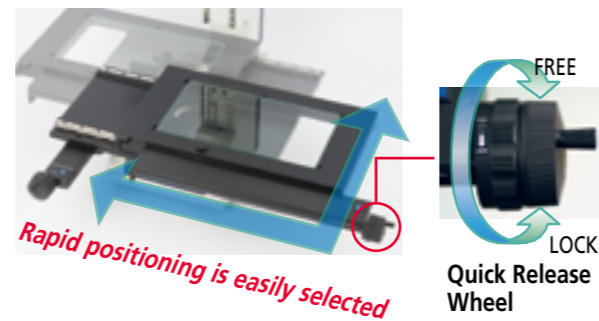
PERFORMANCE

Excellent Observability and Operability

Intuitive Operation

Quick Release Mechanism

The manual stage provides intuitive positioning and can be easily moved rapidly between measuring positions on a workpiece by using the quick release function on each axis. Just free a Quick Release Wheel and move the stage by pushing and pulling. Lock the wheel to continue measurement with fine feed. Very effective for traversing between widely separated positions.

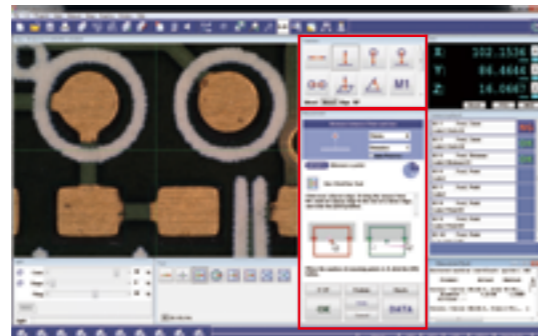


Vision Unit

The vision unit allows anyone to perform simplified measurement of an edge with just one click.

Also, using the vision unit eliminates the need for burdensome parallel alignment of a workpiece and data point detection with cross hairs, thus allowing quick inspection of dimensions.

Vision unit: Option (Refer to page 14 to 16 for details)

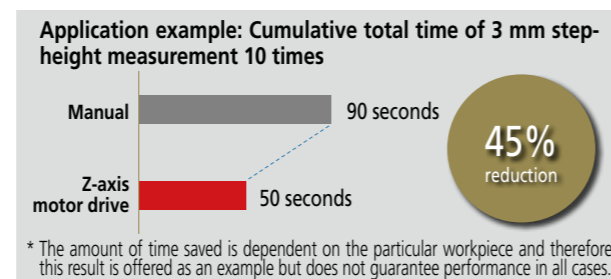


Attainment of Reduction in Measurement Time

Ultra-high Speed AF Function

The ultra-high speed AF function has been installed to allow focusing on a surface to be measured at a speed of about one second.

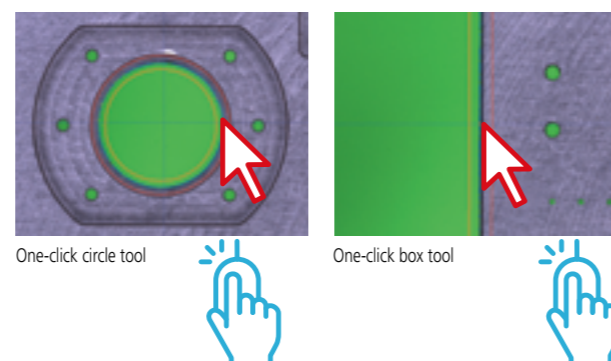
Freedom from burdensome focus adjustment even on a workpiece with many asperities allows the operator to perform stress-free measurement, drastically reducing operator's fatigue.



One-click Tool

The concurrent use of the vision unit as a vision measurement system allows simplified measurement of an edge by merely one click. Moreover, since many data points can be obtained at a time with just one click, this will drastically speed up measurement and reduce data spread compared with the conventional method of "measuring data points one by one with cross hairs".

* Vision unit: Option



Accuracy and Variation

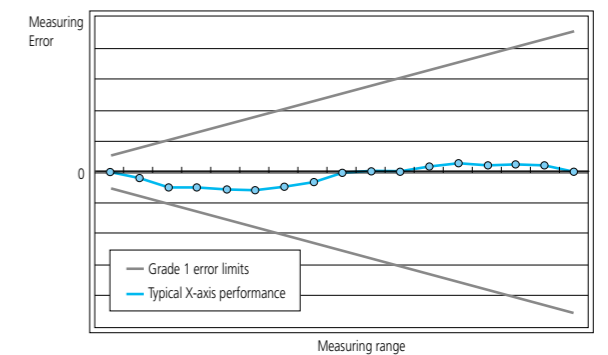
Performance and Stage Size

XY Axis: $(2.2+0.02L) \mu\text{m}$

All models have achieved best-in-class accuracy performance. Since the accuracy of the whole system is ensured by conformity to the inspection method of JIS B 7153, any model enables high-accuracy measurement.

Any measuring microscope that achieves this accuracy performance (close to JIS Class 0) will be a great asset to the customer's quality control improvement program.

Example



Reference) Measuring accuracy of each axis of a JIS B 7153 measuring microscope (at 20 °C)
 Grade 0: $(2+0.01L) \mu\text{m}$ or less
 Grade 1: $(4+0.02L) \mu\text{m}$ or less L: measured length (mm)

A Wide Choice of Stage Size

Precisely because measuring microscopes in this series are widely used in widely different industries, Mitutoyo offers a choice of stage size from 100x100 mm to maximum-in-class 400x200 mm. The customer can choose the optimal size for the application with accuracy performance guaranteed.



LINE-UP

MF Series – User-friendly Standard Model –

Reduction in Magnification Error due to Variation in Point of Focus

Telecentric Optical System

In addition to the highly accurate measurement achieved by creating accurate magnification, this series adopts a telecentric optical system for magnifications below 10x to reduce measurement errors caused by focus deviation.

(Refer to page 8 for details)

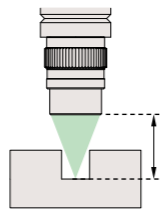


Safe Operation

Ultra-long Working Distance

An ultra-long working distance is ensured in the entire lineup of a wide variety of objectives between 1X and 100X. This practically eliminates any risk of collision with a workpiece even when surface asperities are present.

(Refer to page 8 for details)



Easy Change of Magnification

Sliding Nosepiece

The MF series usually allows only a single objective to be mounted which needs to be replaced for every magnification change. The sliding nosepiece allows up to two objectives to be mounted. In the case of measurement that needs frequent magnification change, this nosepiece design drastically improves workability.

(Refer to page 8 for details)



Manual (2- or 3-axis)



Z-axis Motor Drive



MF-A1010D

MF-U Series – Universal Model Dealing with Diverse Observation Methods –

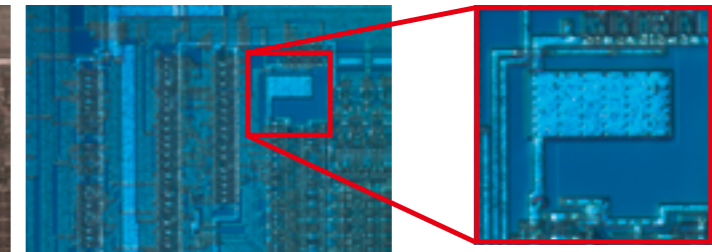
Clear Observation Image

Apochromat Lenses

This series provides a clear observation image with excellent color quality, ultra-long working distance for high operability and apochromatic design that eliminates chromatic aberration.



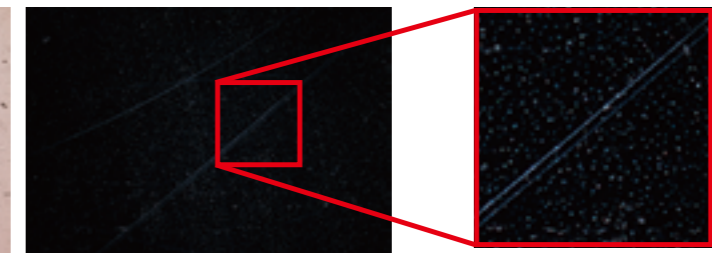
Ordinary observation (bright-field)



Differential interference: Allows observation of microscopic asperities hard to detect with ordinary bright-field observation.



Ordinary observation (bright-field)



Dark-field: Allows highlighted observation of microscopic abnormalities such as flaws and contamination by using diffused light.

Detection of Microscopic Flaws and Asperities

Diverse Observation Methods

A choice of observation method such as dark-field observation, simple polarized observation and differential interference observation in addition to bright-field observation of magnified images are selectable depending on the intended use.

Manual (2- or 3-axis)



Z-axis Motor Drive



MF-UJ2017D

View of icons	
	Standard-equipped function
	Selectable as an option
	Not supported

Camera Port Camera port for mounting a digital camera (standard equipment on all models)

Zero-setting Handy zero-set switch that minimizes the operator's hand motion

F5 Objective Possible to mount an objective that enables various observation methods. (Only for the MF-U series)

Z-axis Motor Z-axis motor drive for fast Z-axis focusing

Remote Remote control box that enables handy operation

Counter Low-profile digital display possible to install on the left or right side and adjust tilt angle to suit the operator

Quick Release Quick-release mechanism that allows rapid stage positioning (Only for manual XY stage models)

Tilting Tilting optical tube that can adjust the eyepoint to suit the operator's physique (Standard-equipped in the MF-U series)

Vision AF Vision auto focus function that speeds up measurement by reducing the operator's focusing error

Power Turret Motor-powered turret enables faster operation when several objectives are required for measurement

OPTIONS

Objectives

ML Objectives for MF Series



Compatible observation method: Bright-field observation
 Advantage: At low magnifications (10x or less) where the height position is difficult to reproduce due to the wide focus range (deep depth of focus), a telecentric optical system is used to reduce magnification error so that the observation magnification does not change depending on the height position.
 In addition, ML objective lenses use Mitutoyo's own proprietary standards that exceed JIS standards and are refined to provide more accurate magnification, making them ideal for comparison measurements using reticles.

Model No.	Code No.	Magnification	Numerical Aperture (NA)	View field with eyepiece (mm)*1	View field with CCD camera (mm)*2	Resolving Power (μm)	Working distance (mm)	Depth of Focus ±D.F. (μm)
ML 1X	375-036-2	1X	0.03	ø24	12.8x9.6	9.2	61.0	306
ML 3X	375-037-1	3X	0.09	ø8	4.27x3.2	3.06	77.0	34
ML 5X	375-034-1	5X	0.13	ø4.8	2.56x1.92	2.12	61.0	16.3
ML 10X	375-039	10X	0.21	ø2.4	1.28x0.96	1.31	51.0	6.2
ML 20X	375-051	20X	0.42	ø1.2	0.64x0.48	0.65	20.0	1.6
ML 50X	375-052	50X	0.55	ø0.48	0.26x0.19	0.5	13.0	0.9
ML 100X	375-053	100X	0.70	ø0.24	0.13x0.10	0.4	6.0	0.6

*1: View field with eyepiece is a view field when using eyepiece 10x (Standard accessory).
 *2: View field with CCD camera is a view field when using Mitutoyo Vision Unit (P14 to P15).

Sliding Nosepiece (This is a factory option and cannot be retrofitted.)

Two ML objectives can be mounted, allowing stress-free change of magnification.
 Two types are available according to the switching specifications.

Parfocal Type (Code No. 176-370-1)

Since the focus of the two lenses, a reference lens (ML 3X) and the specified lens*, are both pre-adjusted, focusing after switching the lens is unnecessary.

Note: The parfocal condition is not achieved with any lenses other than the specified combination.

Magnification Type (Code No. 176-370-2)

The magnification of two lenses is guaranteed in a combination of a reference lens (ML 3X) and pre-specified lens*.

Recommended when using the guide-equipped reticle or comparison-measurement reticle.

Note: Blurring may occur when switching the lens.

* Select a lens from the ML objective lenses other than ML 3X.



FS Objectives for the MF-U Series



M Plan Apo Objectives

Compatible observation method: Bright-field observation, simple polarized observation, differential interference observation

Advantage: Uses a Plan Apochromat lens that corrects curvature aberration and chromatic aberration.

G Plan Apo Objectives

Compatible observation method: Observation through a cover glass

Advantage: Correction design is performed so as to obtain optimal observation images when observing through the glass.
 (Corrected on the basis of BK7 and a cover glass thickness of 3.5 mm. Custom order of other glass material and thickness is also available.)

Model No.	Code No.	Magnification	Numerical Aperture (NA)	View field with eyepiece (mm)	View field with CCD camera (mm)*	Resolving Power (μm)	Working distance (mm)	Depth of Focus ±D.F. (μm)
M Plan Apo 1X	378-800-12	1X	0.025	ø24	12.80x9.60	11	11.0	440
M Plan Apo 2X	378-801-12	2X	0.055	ø12	6.40x4.80	5	34.0	91
M Plan Apo 5X	378-802-6	5X	0.14	ø4.8	2.56x1.92	2	34.0	14
M Plan Apo 7.5X	378-807-3	7.5X	0.21	ø3.2	1.71x1.28	1.3	35.0	6.2
M Plan Apo 10X	378-803-3	10X	0.28	ø2.4	1.28x0.96	1	34.0	3.5
M Plan Apo 20X	378-804-3	20X	0.42	ø1.2	0.64x0.48	0.7	20.0	1.6
M Plan Apo 50X	378-805-3	50X	0.55	ø0.48	0.26x0.19	0.5	13.0	0.9
M Plan Apo 100X	378-806-3	100X	0.70	ø0.24	0.13x0.10	0.4	6.0	0.6
M Plan Apo SL 20X	378-803-3	20X	0.28	ø1.2	0.64x0.48	1	30.5	3.5
M Plan Apo SL 50X	378-811-15	50X	0.42	ø0.48	0.26x0.19	0.7	20.5	1.6
M Plan Apo SL 100X	378-813-3	100X	0.55	ø0.24	0.13x0.10	0.5	13.0	0.9
M Plan Apo HR 50X	378-814-4	50X	0.75	ø0.48	0.26x0.19	0.4	5.2	0.49
M Plan Apo HR 100X	378-815-4	100X	0.90	ø0.24	0.13x0.10	0.3	1.3	0.34
G Plan Apo 20X (t3.5)	378-847	20X	0.28	ø1.2	0.64x0.48	1	Air conversion 29.42	3.5
G Plan Apo 50X (t3.5)	378-848-3	50X	0.50	ø0.48	0.26x0.19	0.6	Air conversion 13.89	1.1

* View field with CCD camera is a view field when using Mitutoyo Vision Unit (P14 to P15).
 Note: SL: Super long working distance model
 HR: High Resolution model



BD Plan Apo Objectives

Compatible observation method: Bright-field observation, dark-field observation, simple polarized observation, differential interference observation

Advantage: Dark-field observation is also supported while maintaining the performance of the M Plan Apo objective series.

Model No.	Code No.	Magnification	Numerical Aperture (NA)	View field with eyepiece (mm)	View field with CCD camera (mm)*	Resolving Power (μm)	Working distance (mm)	Depth of Focus ±D.F. (μm)
BD Plan Apo 2X	378-831-12	2X	0.055	ø12	6.40x4.80	5	34.0	91
BD Plan Apo 5X	378-832-7	5X	0.14	ø4.8	2.56x1.92	2	34.0	14
BD Plan Apo 7.5X	378-830-7	7.5X	0.21	ø3.2	1.71x1.28	1.3	34.0	6.2
BD Plan Apo 10X	378-833-7	10X	0.28	ø2.4	1.28x0.96	1	34.0	3.5
BD Plan Apo 20X	378-834-7	20X	0.42	ø1.2	0.64x0.48	0.7	20.0	1.6
BD Plan Apo 50X	378-835-7	50X	0.55	ø0.48	0.26x0.19	0.5	13.0	0.9
BD Plan Apo 100X	378-836-7	100X	0.70	ø0.24	0.13x0.10	0.4	6.0	0.6

* View field with CCD camera is a view field when using Mitutoyo Vision Unit (P14 to P15).

Turret



Supported observation	Bright field (M Plan Apo/G Plan Apo)	
Code No.	378-018	378-216-10
Driving method	Manual	Power
Number of ways	4	5
Aligning/Parfocal mechanism	Aligning/Parfocal	Aligning

Supported observation	Bright and dark field (BD Plan Apo)	
Code No.	176-211	176-212-10
Driving method	Manual	Power
Number of ways	4	4
Aligning/Parfocal mechanism	—	—

* When using the turret without parfocal mechanism and objectives, it is recommended to concurrently use "Parfocal Adjustment SIMM Set" (for bright-field observation: Code No. 378-089, for dark-field observation: Code No. 378-090).

Polarization Unit

Code No.: 378-092

Used when performing simple polarized observation.
 It is also recommended to use this unit for increasing image contrast during use of a low-magnification lens.



Differential Interference Unit

Code No.: 378-080 (5X, 10X), 378-079 (20X), 378-078 (50X, SL20X), 378-076 (100X, SL80X, SL50X)

Used when performing differential interference observation.
 This unit is used in combination with the polarization unit.



OPTIONS

Eyepieces/Optical Tubes

Optical Tubes

Selectable Eyepiece Unit for MF series (One of the four options must be selected)

Monocular Tube
Code No.176-392



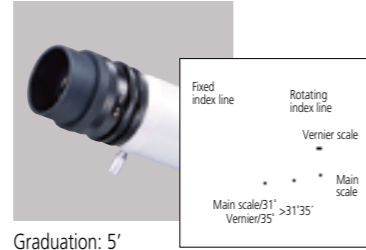
Simple, low-priced monocular tube.
* WF10X/24 eyepiece (1 pc.) equipped.

Binocular Tube
Code No.176-394



Binocular tube reduces eye fatigue.
* WF10X/24 eyepiece (2 pcs.) equipped.

Protractor Eyepiece
Code No.375-043



Graduation: 5'
Measuring range: 360°
The angle reading scale is built in, allowing angle measurement by simply rotating an index line between the features to be measured.
* Exclusive-use eyepiece is equipped (10X, Field number: 21)

Digital Protractor Eyepiece
Code No.176-313-10

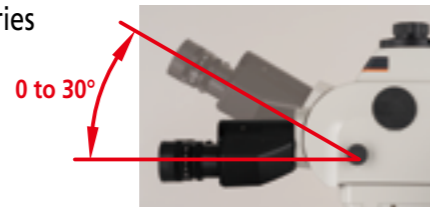


Magnification 10X, Field number 22
Resolution: 0.01°/1' Switchable
Measuring range: 0-369.99°
An angle is measured by simply rotating the cross hairs. Eliminates misreading errors that can occur with the scale type.
* Exclusive-use eyepiece is equipped (10X, Field number: 22)

High-performance optical tube* for MF-U series (MF-U Dedicated Standard Option)

Adjustable eyepiece angle enables the eye point to be adjusted according to operator physique, reducing eye strain and enabling comfortable observation.

* WF10X/24 eyepiece (2 pcs.) equipped.



Eyepieces

In addition to the standard accessory 10x lens, a selection of high magnification 20x type lenses is also available.



Eyepieces

	WF10X/24	WF20X/12
Code No. (1 piece)	378-866-5	378-858-5
Code No. (2 pieces)	378-866	378-858
Magnification	10X	20X
Field number	24	12

Focus Detector Unit

Projecting an LED-generated chart pattern on the target enables easy and high-accuracy focusing, effectively reducing human and repetition errors in height measurement. The concentric circle pattern and slit pattern can be switched. The color of the pattern is selectable from green and red to suit workpiece surface characteristics.



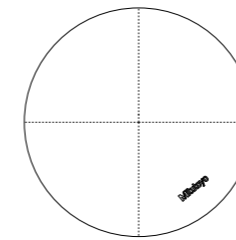
Focus Detector Unit Focus Pilot

Model No.	FP-05	FP-05U
Code No.	375-057-11 (Green) 375-058-11 (Red)	375-067-11 (Green) 375-068-11 (Red)
Light source	Green LED or Red LED	Green LED or Red LED
	<ul style="list-style-type: none"> Concentric circle pattern 	<ul style="list-style-type: none"> Slit pattern
Focusing reproducibility	Approximately 1.5 μm (when using a 20X lens) Note: In-company measured reference value of a sample	
Applicable model	MF	MF-U

The focal point is the position where the top and bottom of the pattern are aligned.
Pattern selection and brightness adjustment are enabled according to the surface status of a workpiece.
Observation with a wide field of view on a video monitor is available using 0.5X optical system (with a CCD camera mounted separately).

Reticles

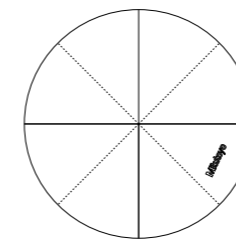
Chain line type



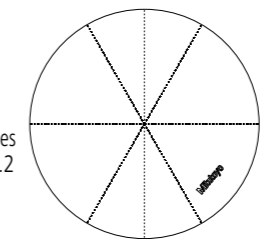
No.12AAG838 (MF)
No.12AAG878 (MF-U)
90° chain lines
Chain line pitch: 0.2 to 0.2
Line width: 7 μm

No.12AAG836 (MF)
No.12AAG877 (MF-U)
90° chain lines
Chain line pitch: 0.2 to 0.2
Line width: 5 μm

No.12AAG873 (MF)
No.12AAG876 (MF-U)
90° chain lines
Chain line pitch: 0.2 to 0.2
Line width: 3 μm

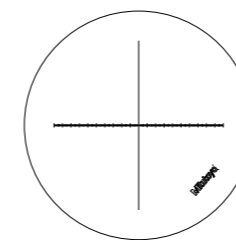


No.12AAG839 (MF)
No.12AAG879 (MF-U)
90° solid lines, 45° chain lines
Chain line pitch: 0.2 to 0.2
Line width: 5 μm

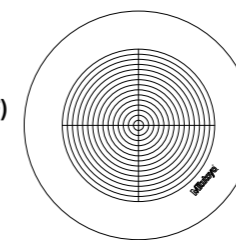


No.12AAG840 (MF)
No.12AAG880 (MF-U)
90° chain lines, 60° chain lines
Chain line pitch: 0.2 to 0.2
Line width: 5 μm

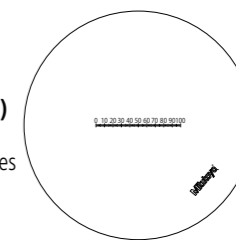
Graduation line type (Objectives for MF series. Use these reticles with an eyepiece that has 10X magnification.)



No.12AAG842 (MF)
Cross haired graduation lines
0.1/20 mm
Line width: 7 μm

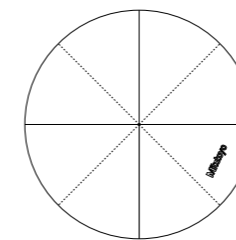


No.12AAG843 (MF)
Concentric circles with graduation lines
ø1.2 to ø18
Line width: 7 μm

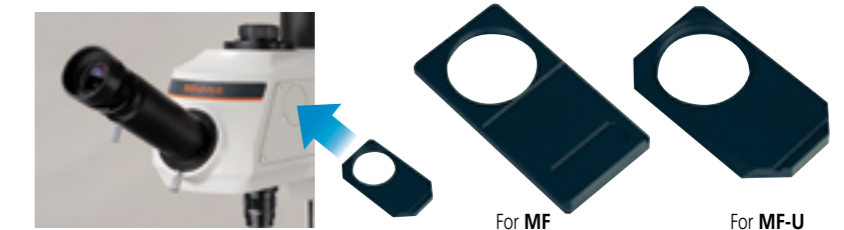


No.12AAG844 (MF)
Graduation lines
0.1/10 mm
Line width: 10 μm

Reticle for digital protractor eyepiece (included as standard)



90° solid lines, 45° chain lines
Chain line pitch: 0.2 to 0.2
Line width: 5 μm



Each reticle includes an insertion unit. Since the insertion unit is specific to the model, select applicable reticles for your microscope.

OPTIONS

Internal Light Source

LED Illumination Unit

The LED illumination unit has a longer operating life than a halogen bulb. This reduces running costs and saves the trouble of replacing the bulb. Also, a quick response to light control allows stress-free search for the illumination condition best suited to a workpiece.

For **MF** series: Transmitted/Reflected illumination Set **Code No. 176-449**
 For **MF-U** series: Transmitted/Reflected illumination Set **Code No. 176-450**



Code No. 176-449

Halogen Illumination Unit

Select this illumination unit when measuring a low-reflectivity workpiece rather than the standard LED illumination unit.

For **MF** series: Transmitted/Reflected illumination Set **Code No. 176-451**
 For **MF-U** series: Transmitted **Code No. 176-452**
 Reflected 150 W (High brightness) **Code No. 176-316**



Code No. 176-451

Code No. 176-316

* When utilizing halogen illumination with the **MF-U** series, using an external control cable (**12AAD128** for 100 W, **12AAG888** for 150 W) will enable light intensity adjustment on the front panel and QSPAK side.

Spare Lighting

Select high-brightness or long-life lighting according to your application.

Applicable model	Applicable model	Illumination method	High-brightness type	Long-life type
MF	176-451	Transmitted/reflected	513667	12BAB345
MF-U	176-452	Transmitted	513667	12BAB345
	176-316	Reflected (150 W)	12BAJ075	12BAJ076

Illumination Filter

Select the optimal filter depending on the intended use.

GIF filter: Emphasises contrast in the image.

LB filter: Converts the warm-colored halogen light to a more natural color.

ND filter: Reduces illumination intensity without changing the observation condition (color temperature) in spite of the fact that halogen light becomes redder when darkened by decreasing the voltage.

ND2: Light intensity 1/2 (transmission factor 50 %) ND8: Light intensity 1/8 (transmission factor 12.5 %)

Light source	Applicable model	Code No.	Illumination method	GIF	LB80	ND2
LED illumination	MF	176-449	Transmitted/reflected	12AAA645	—	—
	MF-U	176-450				
Halogen illumination	MF	176-451	Transmitted/reflected	12AAA645	12AAA646	12AAA643
	MF-U	176-452	Transmitted			



External Light Source

LED Ring Light

For **MF** series : **Code No. 176-367-2** (Standard)
 : **Code No. 176-371** (Specific to Sliding Nosepiece)
 For **MF-U** series : Please contact with your local Mitutoyo Sales Office.

This illumination unit provides a high image contrast for observation of deep-color resins, PCBs and small-diameter cylinders, thus providing optimal performance for vision measurement. Even if the brightness of illumination is changed, no color will change.

* The ring light illumination is compatible with ML objectives of 10X or less. If an objective with a magnification of more than 10X is used, there is a risk of difficulties in observation due to insufficient light intensity.



Mounted on **MF** series

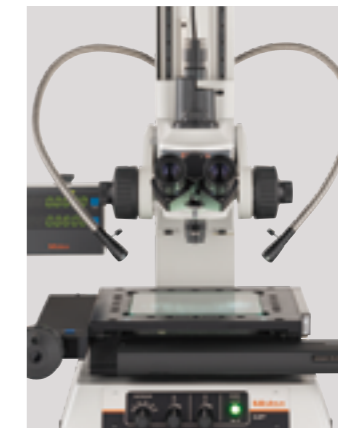


Mounted on **MF-U** series

Dual Swan-neck Light Pipe

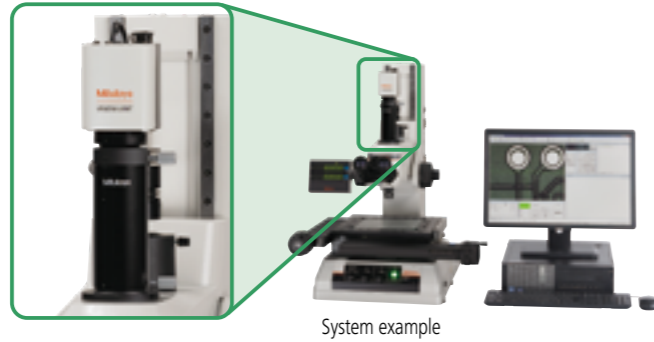
For **MF** and **MF-U** series: **Code No. 176-387**

This illumination unit highlights the features of a workpiece surface by applying oblique light to it, forming shadows which aid viewing. High-brightness spot lighting is also available by the concurrent use of the standard-supplied condenser lens.



OPTIONS

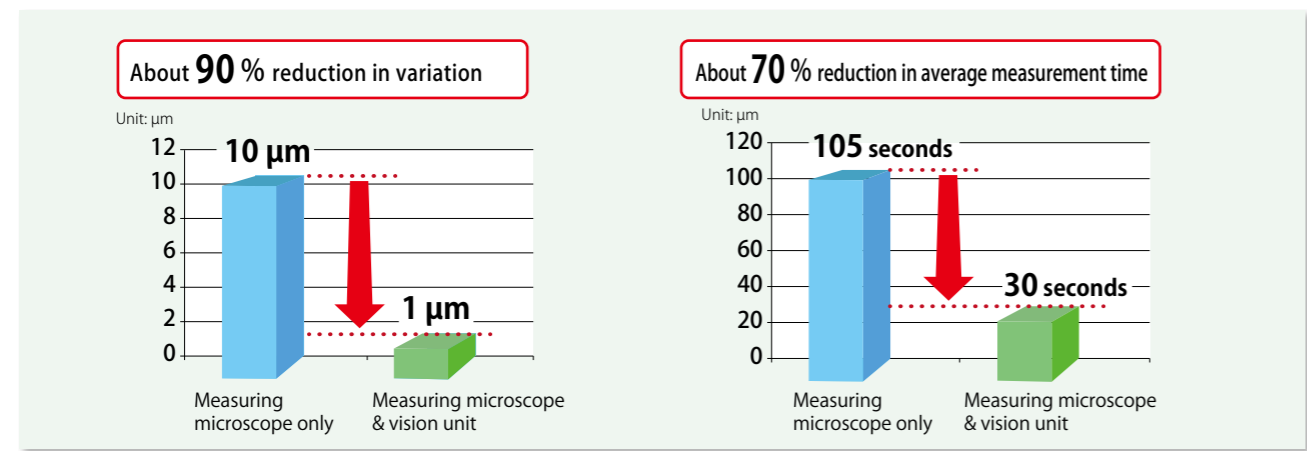
Vision Unit



System example

Reduction of Variation/Improvement in Efficiency

The vision unit allows anyone to perform simplified measurement of an edge with just one click. Also, using the vision unit eliminates the need for burdensome workpiece orientating and data point detection with cross hairs, thus allowing quick inspection of dimensions.



Specifications

Vision unit 10D

Order No.	359-763	
Image sensor	1/2 inch color CMOS 3.0 megapixel	
Image detection camera	External dimensions and mass (camera only)	56 (W) × 54 (D) × 78 (H) mm·0.4 kg
	Optical system magnification	0.5x (0.5x TV adapter included as a standard accessory)
PC system	Windows 11 64bit	
Monitor magnification	Approx. 19x (When using 3x objective lens: Approx. 57x / Imaging area: 4.49 x 3.36 mm)	
Measurement accuracy of each axis* (measurement environment: 20°C)	Depends on the accuracy of the measuring microscope.	
Resolution	0.1 μm	
Maximum power supply capacity	Maximum 312 W (including monitor)	

* Measurement accuracy is the difference between the actual measured value in image measurement and the true value.

Calibration Chart

This chart is used for pixel size-correction of the CMOS camera and optical axis offset correction of the turret.

* The function may be limited depending on the lens. For detailed information, contact a Mitutoyo sales office.

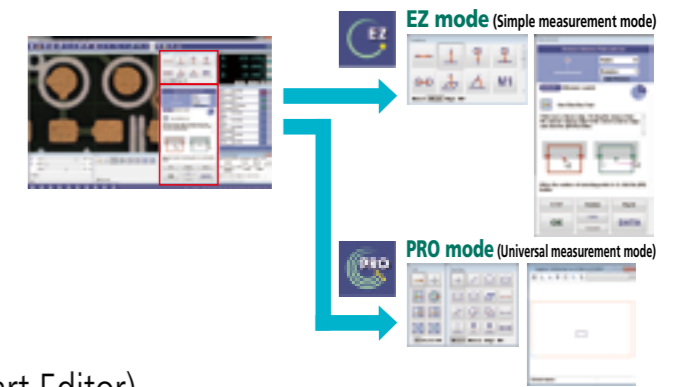


Code No. 02ATN695

QSPAK - Vision Unit Dedicated Software -

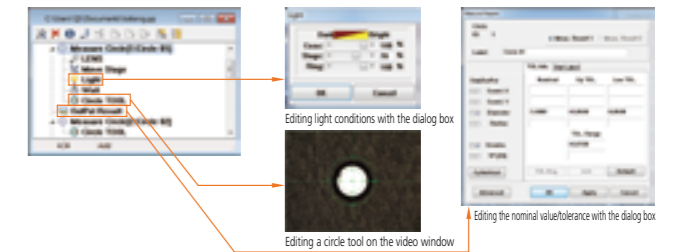
Simple/Universal Mode Switching (EZ/PRO)

In the EZ mode for Simple & Operation guidance display, this software allows even a beginner to perform measurement without any confusion using the easy-to-understand measurement icons and guidance function. Also, it supports the needs of more advanced measurement by the ability to switch to the PRO mode where the full functions of QSPAK are supported.



Simple Edit of Measurement Program (Smart Editor)

This function simply enables program correction/edit by only selecting an item you want to edit from among existing programs.

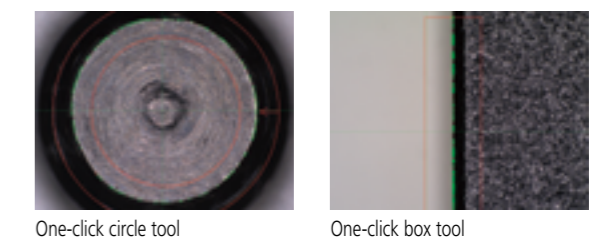


Edge Detection Functions

- Outlier Removal Function** Removes outliers such as burrs and chips.
- Dual-area Contrast Tool** Automatically adjusts the light intensity of two areas to the optimum.
- Auto Trace Tool** Automatically detects contour data while predicting the next one.
To perform contour analysis and contour tolerancing, use 2-dimensional analysis software (FORMTRACEPAK-AP).

Simplified Multi-point Measurement (One-click Tool)

A mere click on an edge allows correct measurement, avoiding the variation inherent in conventional multi-point measurement. The function to remove outliers such as burrs and chips can be used concurrently.



Graphics Function

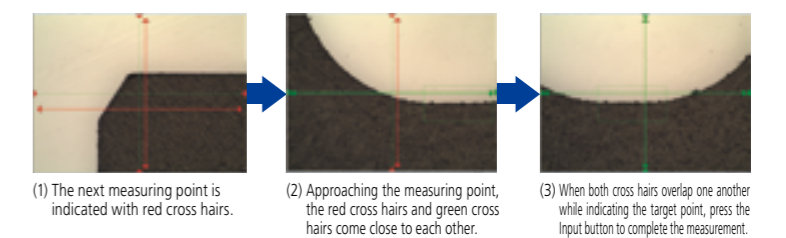
This function automatically displays the current position, coordinate system, measurement feature and measurement result on the graphics window to prevent an omission or error of measurement from occurring. It also enables you to grasp which portion of the whole workpiece is observed by importing 2-dimensional CAD data*.

* Optional software (For details refer to Page 16.)



Navigation Function (Quick Navigation)

Once a measurement program is created, anyone can measure a workpiece just as well as skilled personnel by merely following the navigation instructions at the next measuring point.



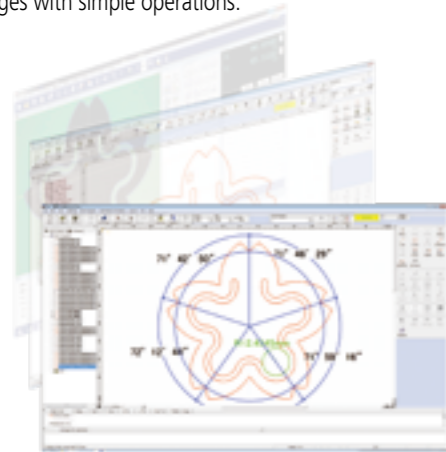
OPTIONS

Optional Software

FORMTRACEPAK-AP - 2-dimensional Analysis Software -

FORMTRACEPAK-AP allows contour analysis and comparative verification with the nominal value, making use of the point group data acquired with the auto trace tool.

Form analysis can be performed seamlessly from measured images with simple operations.



Example of form analysis

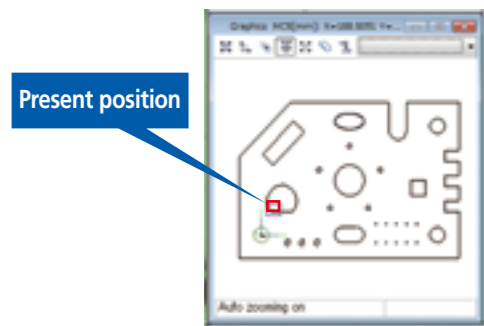
Contour tolerancing against the nominal value is also enabled. For example, the software allows over-pin diameter measurement by defining virtual circles with a given diameter around a gear.



Example of gear contour matching, and an over-pin diameter analysis

QS-CAD I/F - Effective use of CAD model -

2-D CAD model data (DXF-, or IGES-formatted) can be imported to QIPAK. Conversely, QIPAK measurement results can be converted into 2-D CAD model data. The design value for each measurement item is automatically entered. Since the graphics window makes the present position easy to identify, the operator can quickly move the stage a given point in the 2-D CAD model.

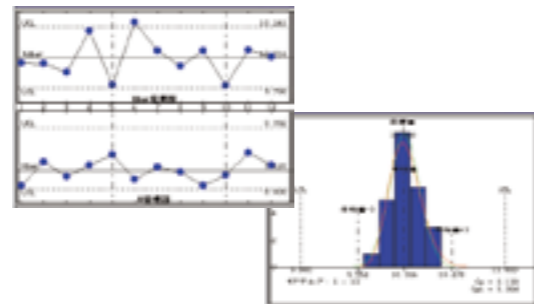


MeasurLink - Early detection of process irregularities -

Statistical data can be displayed in real-time, making early detection of process irregularities possible. Early identification of an out-of-control situation enables rapid remedial action to be taken when necessary.

Examples of remedial action

Mold repair or cycle-timing change
Cutting tool adjustment or replacement.



Data Processing

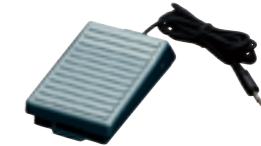
Data Processing Applications

QM-DATA200 - 2-dimensional Data Processing Unit -



Code No.: **264-160-11 (mm)**
264-160-13 (mm/inch)
Application: QM-Data200 allows various data processing operations and creation of measurement programs without needing any other data processing unit.
Resolution: 0.1 μ m
Program function: Creation, execution and editing of measurement procedures
Statistical processing: Measurement items, number of data, maximum value, minimum value, mean value, standard deviation, range, histogram and statistics by measurement function (statistics by command)
Display: TFTLCD (with LED backlight)
Tilting mechanism: Installed
Option: ESC/P printer cable: **No.12AAA804** (2 m)
24-pin color/monochrome compatible

Foot Switch



Code No.: **12AAJ088**
Application: Foot switch for data transfer
A measurement result can be transferred to the data processing unit by stepping on the switch while holding the feed wheels.

Others

C-mount Adapter

This adapter is used to mount a C-mount compatible digital camera on the microscope main unit.



Code No. 970441

0.5X TV Adapter (including C-mount)

This adapter is used to mount a C-mount compatible digital CCD camera on the microscope main unit, thereby making an observation area on the monitor close to the real field of view through the objective.

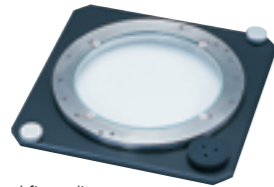


Code No. 375-054

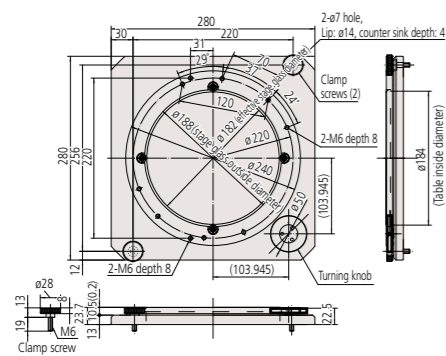
OPTIONS

Others

Rotary Table with Fine Wheel (A)



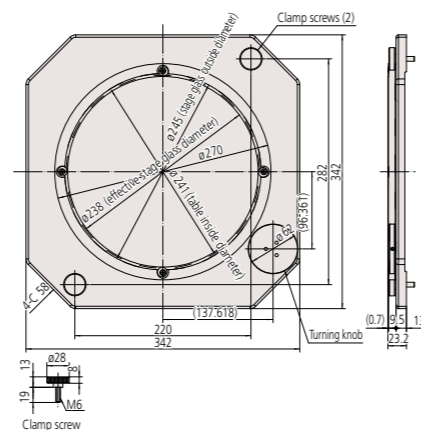
Code No.: **176-305**
 Application: Workpiece orientating/positional fine-adjustment
 External dimension: 280 (W)×280 (D)×23.7 (H) mm
 Tabletop: ø240 mm, 360° rotation, no angle scale
 Mass: 5.5 kg
 Effective glass diameter (mm): ø182
 Applicable model: Size 1010, 2010 (MF/MF-U series)
 * Option: **172-604** Swivel Center Support
176-107 Holder with Clamp
172-378 V-block with Clamp



Rotary Table with Fine Wheel (B)

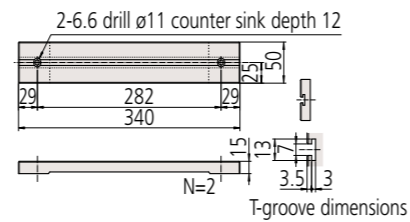
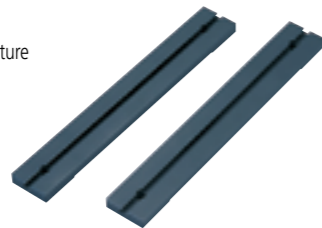


Code No.: **176-306**
 Application: Workpiece orientating/positional fine-adjustment
 External dimension: 342 (W)×342 (D)×23.2 (H) mm
 Tabletop: ø270 mm, 360° rotation, no angle scale
 Mass: 6.5 kg
 Effective glass diameter (mm): ø238
 Applicable model: Size 2017, 3017, 4020 (MF/MF-U series)
 * The V-block with Clamp, Swivel Center Support and Holder with Clamp can NOT be mounted on the table.

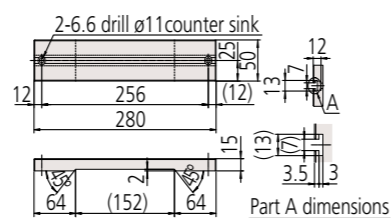


Stage Adapter

Code No.: Stage Adapter: **176-304**
 Stage Adapter B: **176-310**
 Application: Used when setting the workpiece fixture on the stage.
 External dimensions for one piece:
 50 (W)×340 (D)×15 (H) mm
 *Note) Adapter B is 280 (D)
 Mass: Stage Adapter: 1.5 kg
 Stage Adapter B: 1.2 kg



176-304 Stage Adapter



176-310 Stage Adapter

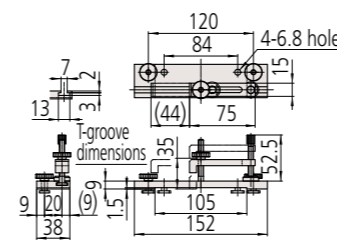
		Stage size		
		1010	2010	2017 3017 4020
176-304	Stage Adapter	—	Not applicable	Applicable
176-310	Stage Adapter B	—	Applicable	Not applicable

Note: Not required for model 1010.

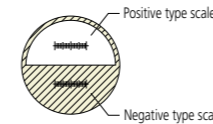
Holder with Clamp



Code No.: **176-107**
 Application: Used to clamp a thin workpiece such as a PCB or pressed part.
 Maximum clamp length: 35 mm
 External dimensions: 62 (H)×152 (W)×38 (D) mm
 Mass: 0.4 kg
 * Note: Size 2010 is used with stage adapter B. Sizes 2017, 3017, and 4020 are usable with stage adapter



Stage Micrometer

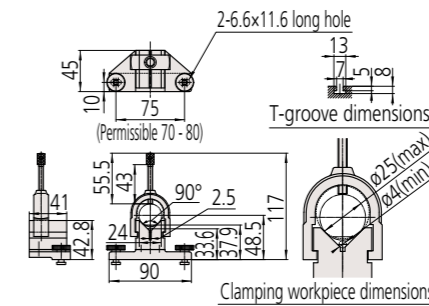


Code No.: **375-056**
 Scale length: 1 mm
 Application: For verifying magnification of objective lens
 Minimum graduation: 0.01 mm
 Scale accuracy (20 °C): 1+L (µm) L: length between any two lines (mm)
 External dimensions: 76 (W)×26 (D) mm
 Mass: 16 g
 * Note: After purchasing the product, we perform calibration.
 For details, contact your nearest Mitutoyo Sales Office.

V-block with Clamp



Code No.: **172-378**
 Maximum clamping diameter: ø25 mm
 Height from the mounting surface to the center: 38-48 mm
 Application: Used to mount a cylindrical-form workpiece.
 External dimensions: 117 (H)×90 (W)×45 (D) mm
 Mass: 0.8 kg
 * Note: Size 2010 is used with stage adapter B. Sizes 2017, 3017, and 4020 are usable with stage adapter



Mounting Stand (for Microscope)

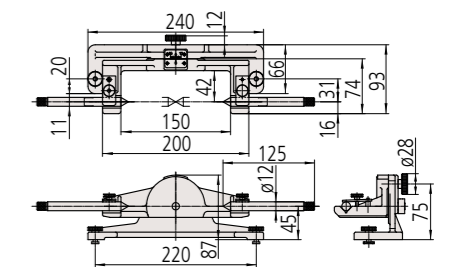


Code No.: **176-309**
 Application: Microscope main unit mounting stand
 Maximum loading: 300 kg
 External dimensions: 1200 (W)×900 (D)×650 (H) mm
 Mass: Approximately 50 kg
 Applicable model: **MF/MF-U**
 * Note: When specifying a microscope with the Vision Unit, we recommend selecting the large mounting stand **No. 02ATE760**, which has external dimensions of 1,800 (W)×900 (D)×740 (H) mm.

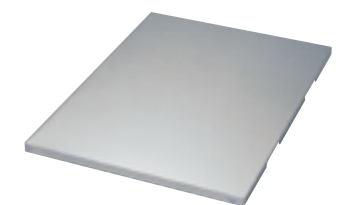
Swivel Center Support



Code No.: **172-604**
 ±10° for swivel position
 Maximum angle index: 1°
 Application: Used to mount a center-machined workpiece for measurement of screw pitch diameter, depth, etc.
 Maximum horizontal clamping size: ø80×140 mm
 Maximum clamping size when inclined 10°: ø65×140 mm
 Mass: 2.5 kg
 * Note: Size 2010 is used with stage adapter B. Sizes 2017, 3017, and 4020 are usable with stage adapter



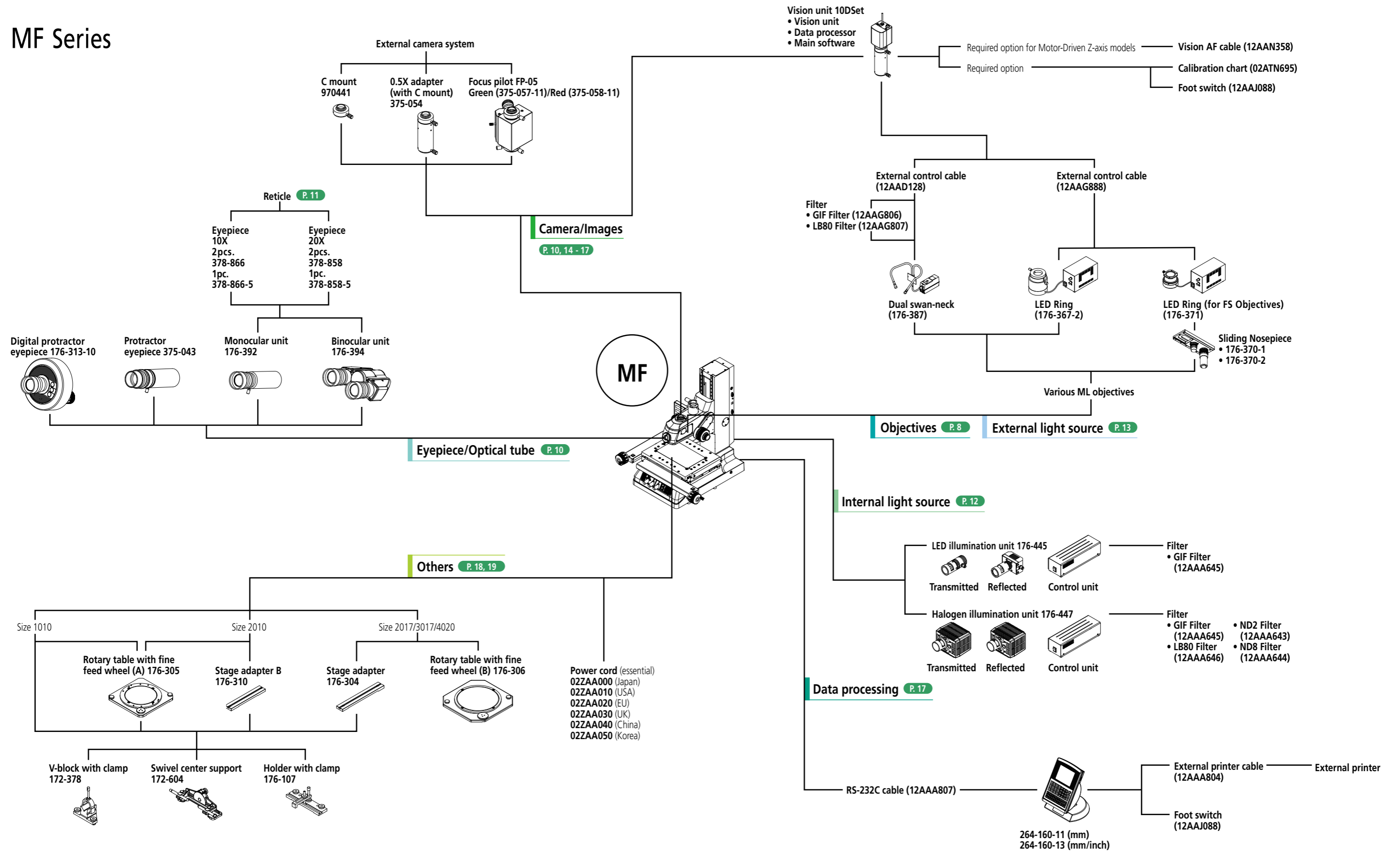
Vibration Damping Stand



Code No.: **176-308**
 Application: Microscope vibration isolation table
 Supporting method: Spring pad
 Maximum loading: 200 kg
 External dimensions: 750 (W)×550 (D)×36 (H) mm
 Mass: 36 kg
 Applicable model: **MF/MF-U**

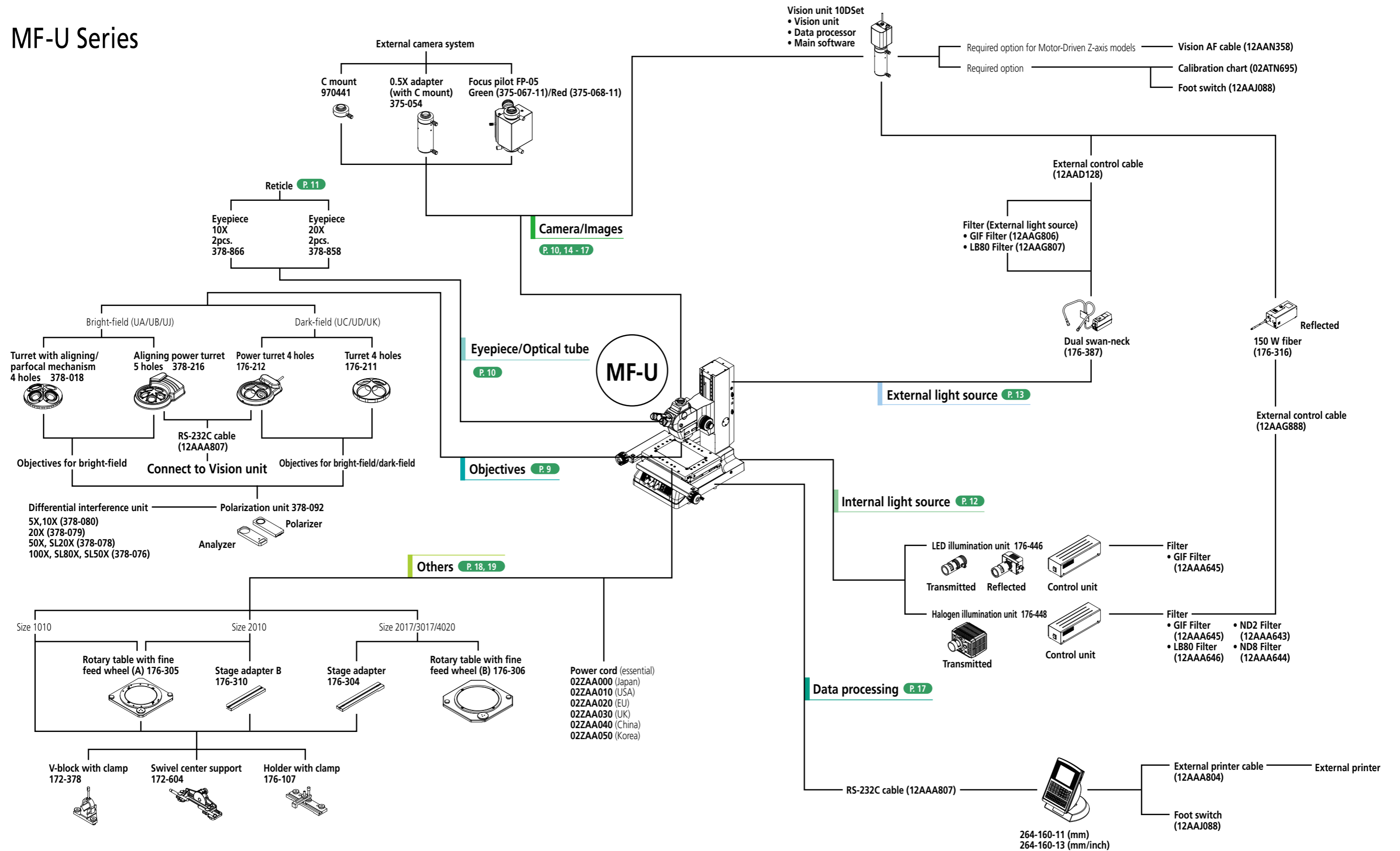
SYSTEM DIAGRAM

MF Series



SYSTEM DIAGRAM

MF-U Series



SPECIFICATIONS

MF Series

Manual Models

Main unit		1010	2010	2017	3017	4020
Without Z-axis scale		MF-A1010D	MF-A2010D	MF-A2017D	MF-A3017D	MF-A4020D
		176-961*	176-962*	176-963*	176-964*	176-965*
With Z-axis scale		MF-B1010D	MF-B2010D	MF-B2017D	MF-B3017D	MF-B4020D
		176-966*	176-967*	176-968*	176-969*	176-970*
Measuring accuracy*1 (20 °C, when not loaded)		(2.2+0.02L) μm L: measuring length (mm)				
Minimum reading		High accuracy digital scale is mounted 1/0.5/0.1 μm switchable				
Observation	Optical tube	Monocular or binocular TV camera port for all models (observation/TV camera = 50/50)*4 is provided as standard Reticle (broken cross-hair, line width: 5 μm) is provided as standard Various reticles are optional.				
	Incline angle	Angle of column: 25°				
	Observation image	Erect image				
	Observation method	Bright-field observation				
Eyepiece		10X (eyepiece field number: 24) is provided as standard 15X, 20X, Angle eyepieces 10X, Digital angle eyepieces 10X are optional.				
Objective		3X (working distance: 77 mm) is provided as standard 1X, 5X, 20X, 50X, 100X, a pair of sliding nosepieces*5 are optional.				
Stage	Measuring range	100x100 mm	200x100 mm	200x170 mm	300x170 mm	400x200 mm
	Max. table loading	10 kg		20 kg		15 kg
	Feed mechanism	Manual and Quick-release mechanism (zero-set switch is incorporated)				
	Swiveling angle	—		±5°		±3°
Internal light source*2	LED Illumination Unit	White LED (transmitted/vertical reflected), no step modulated light				
	Halogen Illumination Unit	12 V, 50 W halogen (transmitted/vertical reflected), no step modulated light				
External light source		Ring light and dual swan-neck light pipe are optional.				
Z axis	Feed mechanism	Coaxial coarse and fine feed, handles on both sides (coarse: 30 mm/rotation, fine: 0.2 mm/rotation)				
	Max. workpiece height	150 mm		220 mm		
Dimensions (WxDxH)	Main unit	562x730x667 mm	624x745x667 mm	642x892x782 mm	692x892x782 mm	756x892x782 mm
	Control unit	—				
	Control unit for illumination unit	114x360x96 mm				
Output		RS-232C output, USB output for Vision Unit				
Mass		Approx. 70 kg	Approx. 75 kg	Approx. 150 kg	Approx. 160 kg	Approx. 165 kg
Max. power consumption*3		LED: 45 W Halogen: 160 W AC power input connector: 100 to 240 V				

Motor-Driven Z-axis Models Specifications other than the listed below are common to the manual models.

Main unit		1010	2010	2017	3017	4020
With Z-axis scale				MF-J2017D	MF-J3017D	MF-J4020D
				176-891*	176-892*	176-893*
Z axis	Feed mechanism	Motor drive (Maximum measuring speed: 20 mm/s), lower limit setting (for collision avoidance with a workpiece)				
	Max. workpiece height	220 mm				
Dimensions (WxDxH)	Main unit	642x892x782 mm				
	Control unit	355x364x106.5 mm				
	Control unit for illumination unit	114x360x96 mm				
Output		RS-232C output, USB output for Vision Unit				
Mass		Approx. 160 kg	Approx. 170 kg	Approx. 175 kg	Approx. 175 kg	Approx. 175 kg
Max. power consumption*3		LED: 275 W Halogen: 390 W AC power input connector: 100 to 240 V				

* Add "-11" for mm models and "-13" for mm/inch models to the end of the code number.

*1 Required optional accessory

*2 Inspected in conformance with JIS B 7153

*3 When the main unit and the required optional light source are used (For motor-driven z-axis model, the contour unit is included.)

*4 C mount is required separately

*5 A pair of Sliding Nosepieces are factory-installed option.

MF-U Series

Manual Models

Main unit		1010	2010	2017	3017	4020
BF (Bright-field)	With Z-axis scale	MF-UB1010D	MF-UB2010D	MF-UB2017D	MF-UB3017D	MF-UB4020D
		176-976*	176-977*	176-978*	176-979*	176-980*
BD (Bright/Dark-field)	With Z-axis scale	MF-UD1010D	MF-UD2010D	MF-UD2017D	MF-UD3017D	MF-UD4020D
		176-986*	176-987*	176-988*	176-989*	176-990*
Measuring accuracy*1 (20 °C, when not loaded)		(2.2+0.02L) μm L: measuring length (mm)				
Minimum reading		High accuracy digital scale is mounted 1/0.5/0.1 μm switchable				
Observation	Optical tube	Tilting optical tube is provided as standard TV camera port for all models (observation/TV camera = 50/50)*4 is provided as standard Reticle (broken cross-hair, line width: 5 μm) is provided as standard Various reticles are optional.				
	Incline angle	Angle of column: 0-30°				
	Observation image	Erect image				
	Observation method*2	Bright-field observation/Dark-field observation (Only for MF-UC and MF-UD types) Simple polarization and differential interference are optional.				
Eyepiece		10X (eyepiece field number: 24) is provided as standard 15X, 20X are optional.				
Turret*2		Manual or motor drive				
Objective*2	Bright-field (BF)	M Plan Apo, G Plan Apo series				
	Bright/Dark-field (BD)	BD Plan Apo series				
Stage	Measuring range	100x100 mm	200x100 mm	200x170 mm	300x170 mm	400x200 mm
	Max. table loading	10 kg		20 kg		15 kg
	Feed mechanism	Manual and Quick-release mechanism (zero-set switch is incorporated)				
	Swiveling angle	—		±5°		±3°
Internal light source*2	LED Illumination Unit	White LED (transmitted/vertical reflected), no step modulated light				
	Halogen Illumination Unit	12 V, 50 W halogen (transmitted), no step modulated light 12 V, 100 W (vertical reflected), no step modulated light*5 15 V, 150 W (vertical reflected), no step modulated light are optional.*5				
External light source		Dual swan-neck light pipe are optional.				
Z axis	Feed mechanism	Manual handles on both sides (coarse: 30 mm/rotation, fine: 0.2 mm/rotation)				
	Max. workpiece height	150 mm		220 mm		
Dimensions (WxDxH)	Main unit	562x730x667 mm	624x745x667 mm	642x892x782 mm	692x892x782 mm	756x892x782 mm
	Control unit	—				
	Control unit for illumination unit	114x360x96 mm				
Output		RS-232C output, USB output for Vision Unit				
Mass		Approx. 70 kg	Approx. 75 kg	Approx. 150 kg	Approx. 160 kg	Approx. 165 kg
Max. power consumption*3		LED: 55 W Halogen: 190 W (vertical reflected 12 V, 100 W) and 240 W (vertical reflected 15 V, 150 W) AC power input connector: 100 to 240 V				

Motor-Driven Z-axis Models Specifications other than the listed below are common to the manual models.

Main unit		1010	2010	2017	3017	4020
BF (Bright-field)	With Z-axis scale			MF-UJ2017D	MF-UJ3017D	MF-UJ4020D
				176-894*	176-895*	176-896*
BD (Bright/Dark-field)	With Z-axis scale			MF-UK2017D	MF-UK3017D	MF-UK4020D
				176-897*	176-898*	176-899*
Z axis	Feed mechanism	Motor drive (Maximum measuring speed: 20 mm/s), lower limit setting (for collision avoidance with a workpiece)				
	Max. workpiece height	220 mm				
Dimensions (WxDxH)	Main unit	642x892x782 mm				
	Control unit	355x364x106.5 mm				
	Control unit for illumination unit	114x360x96 mm				
Output		RS-232C output, USB output for Vision Unit				
Mass		Approx. 160 kg	Approx. 170 kg	Approx. 175 kg	Approx. 175 kg	Approx. 175 kg
Max. power consumption*3		LED: 285 W Halogen: 420 W (vertical reflected 12 V, 100 W) and 470 W (vertical reflected 15 V, 150 W) AC power input connector: 100 to 240 V				

* Add "-11" for mm models and "-13" for mm/inch models to the end of each code number.

*1 Inspected in conformance with JIS B 7153

*2 Required optional accessory

*3 When the main unit and the required optional light source are used (For motor-driven z-axis model, the contour unit is included.)

*4 C mount is required separately

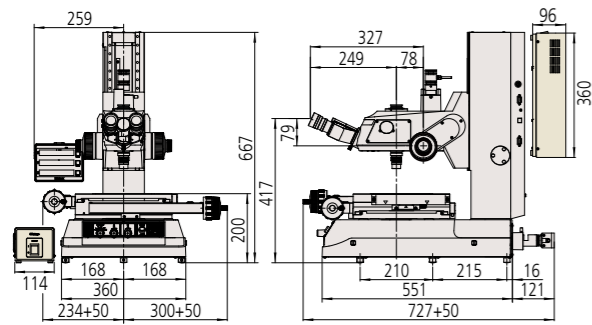
DIMENSIONS

MF Series

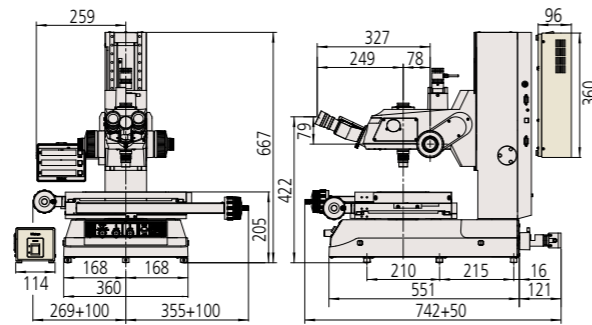
Manual Models * Common dimensions for MF-A and MF-B models.

Unit: mm

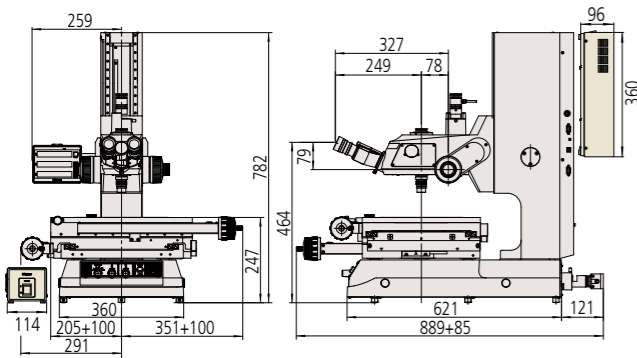
MF-B1010D



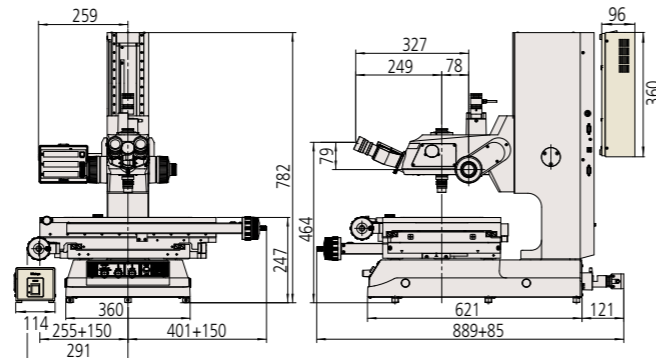
MF-B2010D



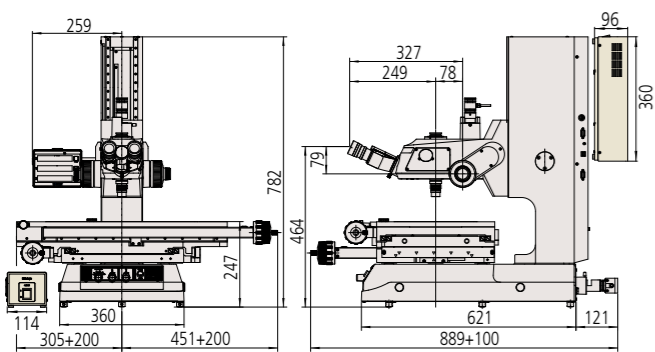
MF-B2017D



MF-B3017D



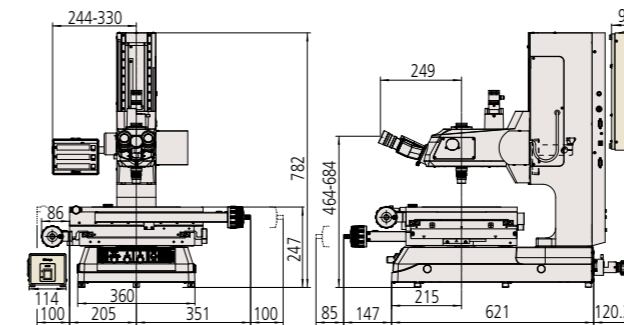
MF-B4020D



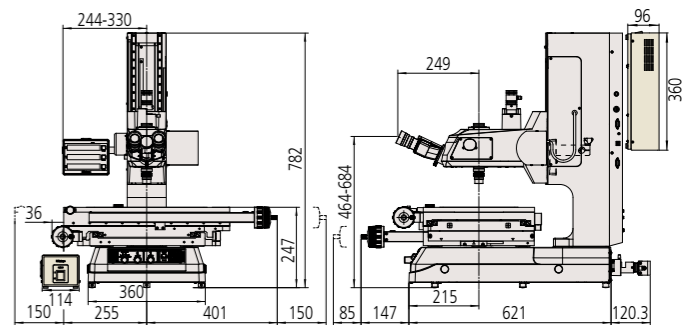
Motor-Driven Z-axis Models

Unit: mm

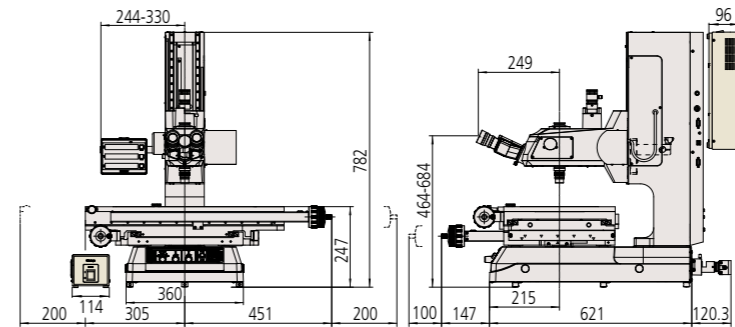
MF-J2017D



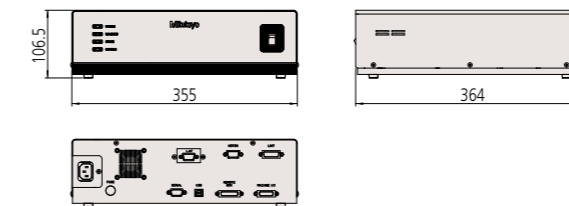
MF-J3017D



MF-J4020D



Control unit



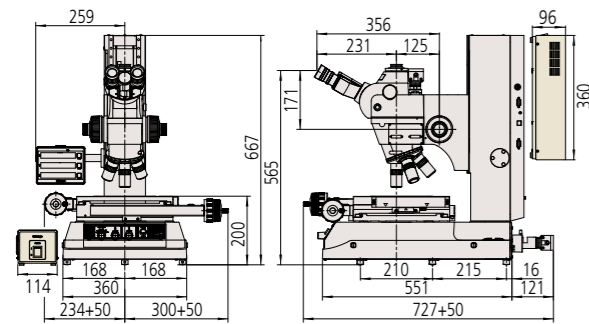
DIMENSIONS

MF-U Series

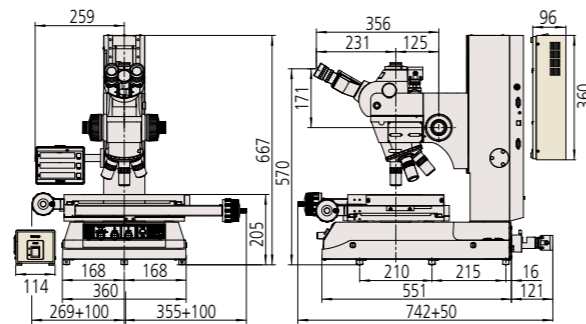
Manual Models * Common dimensions for MF-UA, MF-UB, MF-UC, and MF-UD models.

Unit: mm

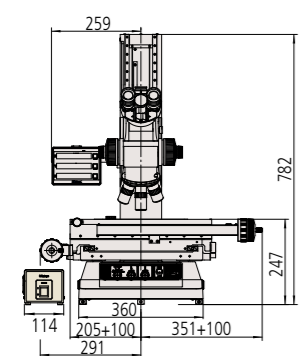
MF-UB1010D



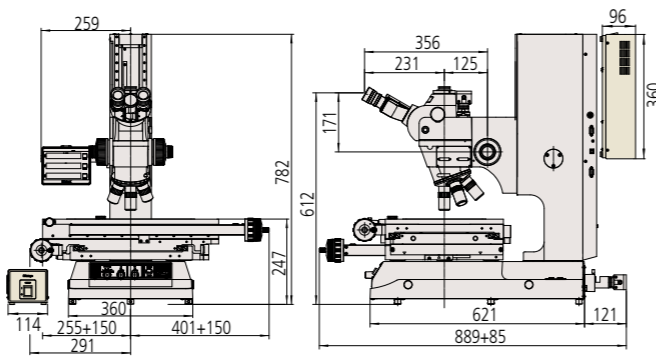
MF-UB2010D



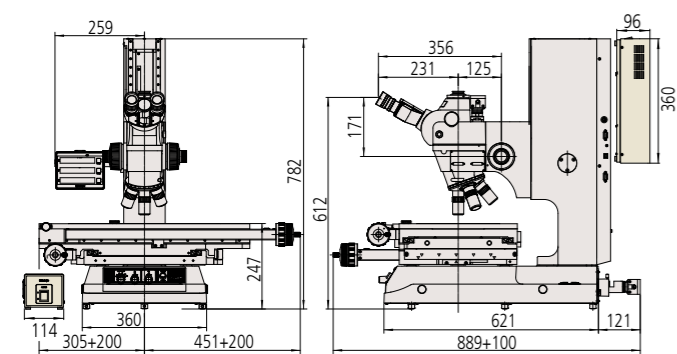
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MF-UB3017D



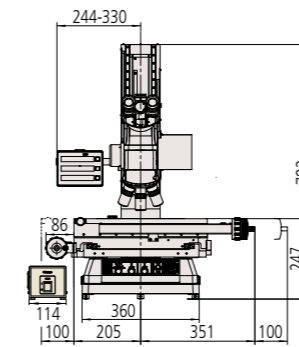
MF-UB4020D



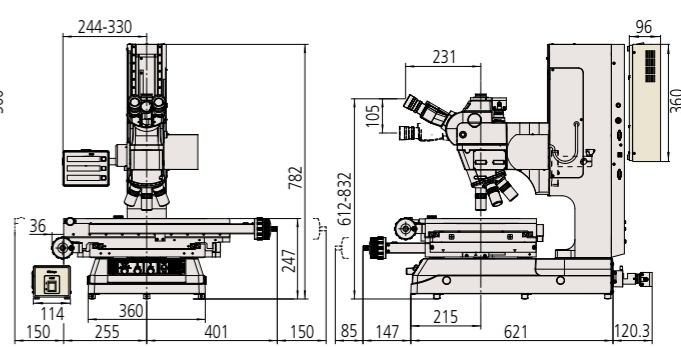
Motor-Driven Z-axis Models * Common dimensions for MF-UJ and MF-UK models.

Unit: mm

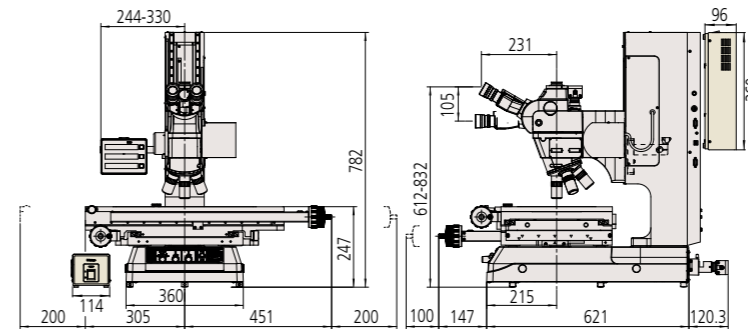
MF-UJ2017D



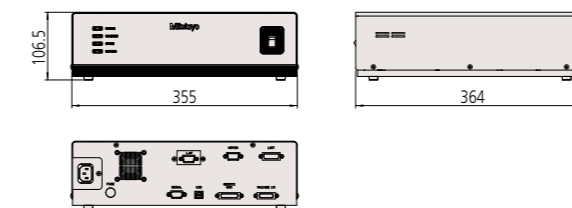
MF-UJ3017D



MF-UJ4020D



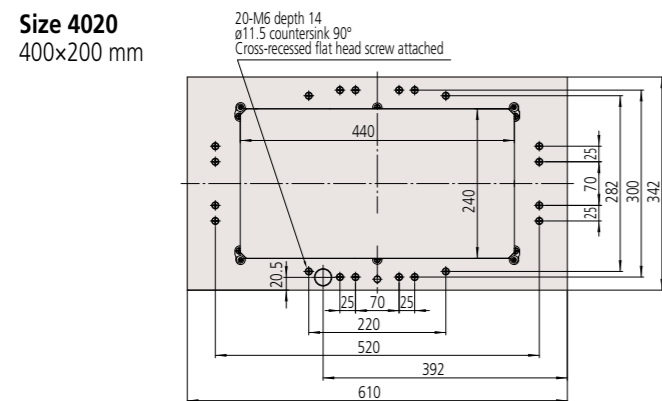
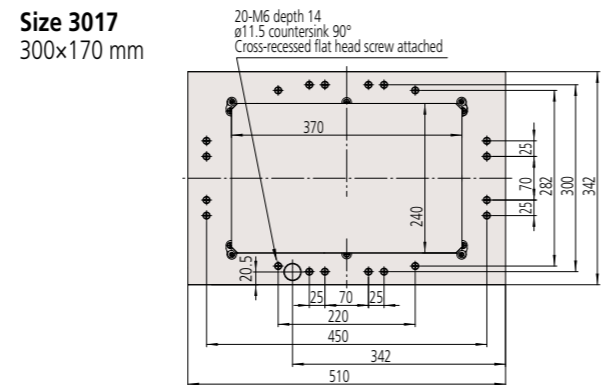
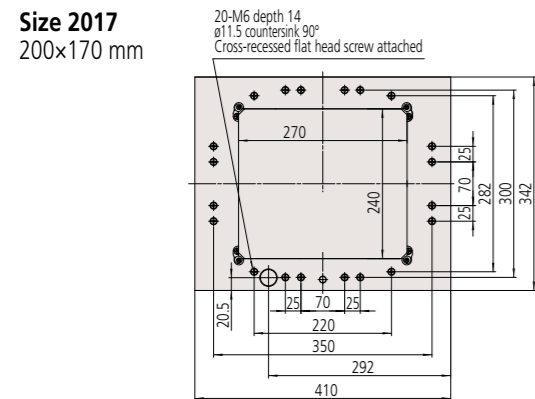
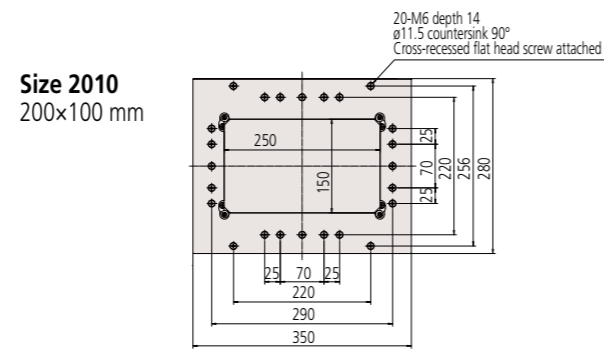
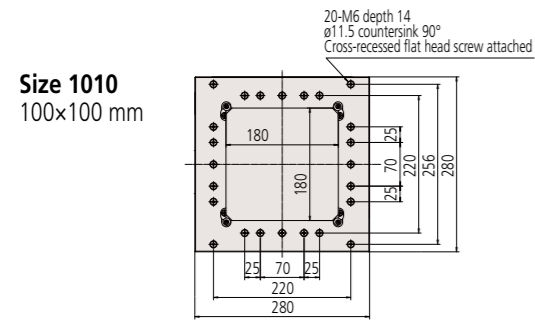
Control unit



DIMENSIONS

Stage Top View * Common dimensions for all models.

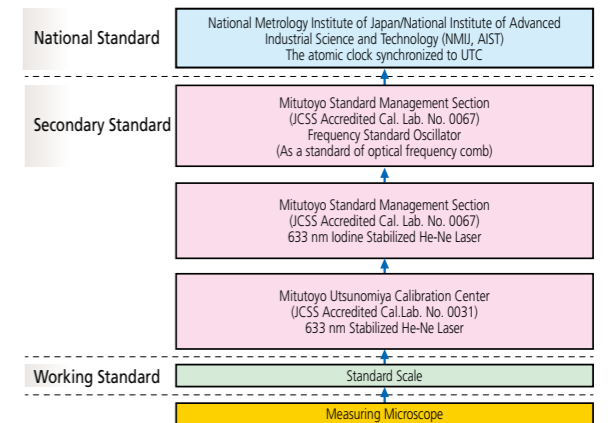
Unit: mm



Extraordinary Reliability

Traceability to National Standards

Mitutoyo ensures and maintains traceability of various types of precision measuring instruments by holding standards of length and other physical quantities that are directly traceable to the national standards for use in calibrating the working standards used for the calibration of measuring instrument products supplied to industry. Furthermore, Mitutoyo offers a temperature calibration service which is indispensable for high-accuracy length measurement.



Outline of the traceability chain for a Mitutoyo microscope.

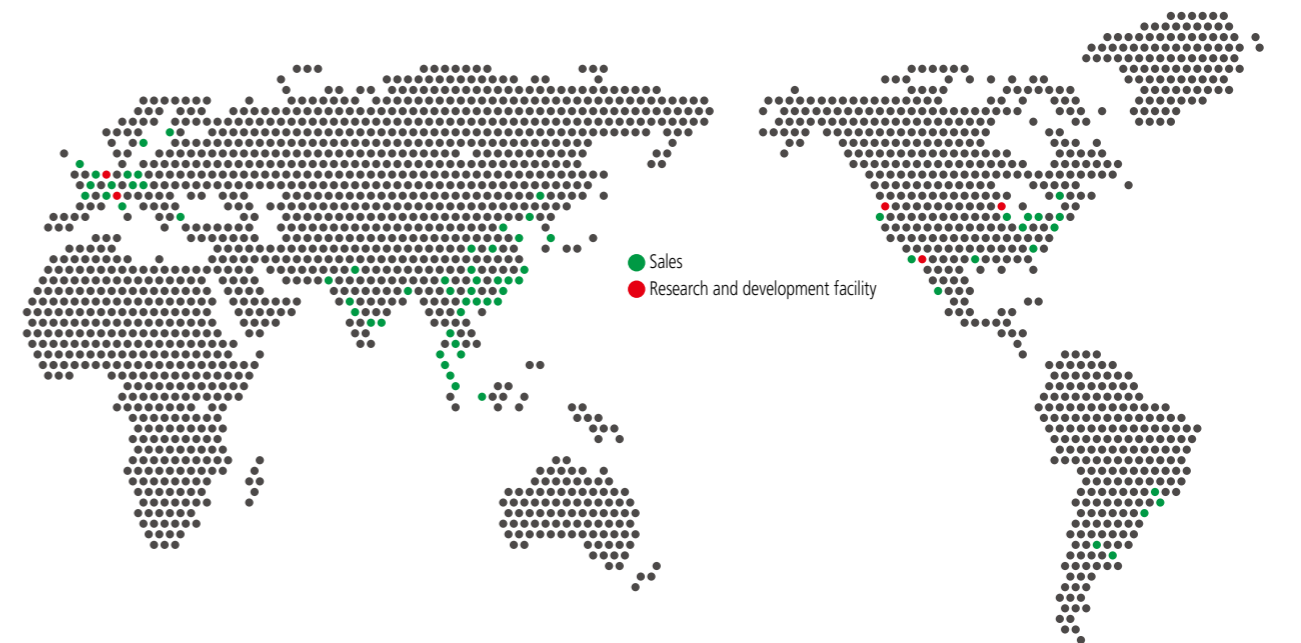
Reliable support system

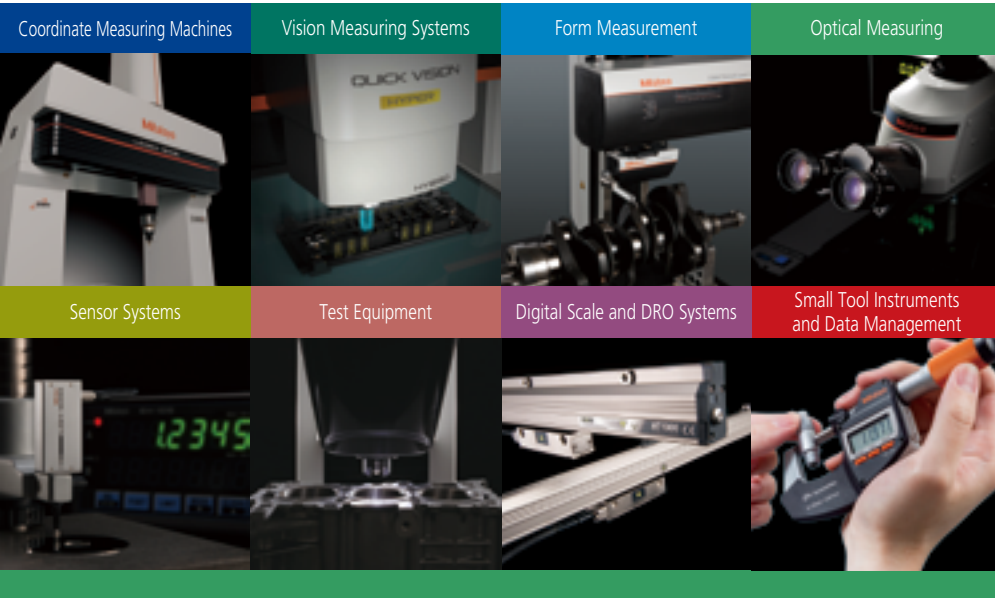
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Whatever your challenges are, Mitutoyo supports you from start to finish.

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