# Measuring Microscopes
# Hyper MF/MF-U

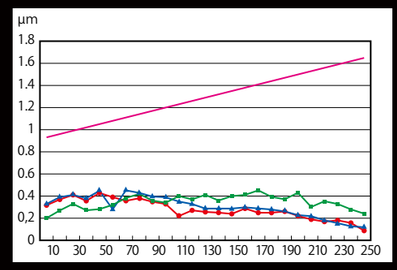
CATALOG No. E14012(2)


**Measuring Microscopes So Accurate They Defy Common Sense**

Mitutoyo


## High Measuring Accuracy*

Measuring accuracy in the X and Y axes at full stroke surpasses class 0 of the JIS Standard for measuring microscopes (B7153-1995). This makes these microscopes ideal for high accuracy measurement of precision molds or cutting tools that require the best resolution, or for inspecting sub-miniature semiconductor/electronic parts such as wafers and integrated circuits.




* As of July, 2006

## Concept

Inspecting complex microstructures of ever-decreasing size demands ever-higher accuracy from measuring microscopes used to satisfy the manufacturing and quality control principle of Observation plus Measurement. Mitutoyo is committed to providing microscopes that meet this requirement as well as exceeding users' expectations in terms of sophisticated functionality and ergonomic features that allow fatigue-free use over extended periods of time.

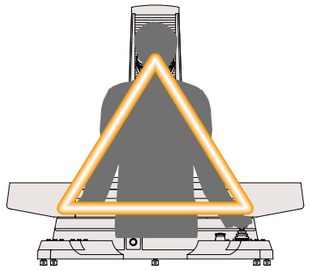
Mitutoyo

## Core Technology

Over many years Mitutoyo has made significant contributions to the technologies that are key to the core technology of manufacturing industry: measurement. The experience and expertise gained is reflected in the design and manufacture of each individual component of these microscopes and can be seen most clearly in their sublime integration of optics, mechanics, and electronics.

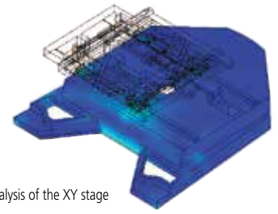
## Ergonomic Design

The microscope main unit has been designed with the emphasis on user friendliness and ease of operation. Mitutoyo has executed the mechanical design to allow easy operation. Even after extended use, its fatigue-fighting design still provides a comfortable work-experience for the operator.



## Large, Highly Accurate XY Stage

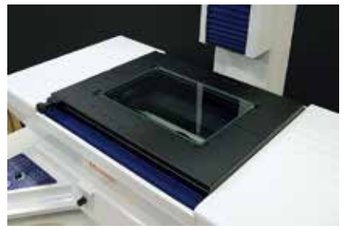
Mitutoyo uses a type of linear guideway on the large XY stage that is highly regarded for excellent straightness and stability. This is one key element in the strategy to maximize geometrical accuracy - another is FEM analysis. Our designers used FEM techniques extensively during the design phase to ensure stage stability was optimal in any measurement situation. Thus, the foundations for achieving the highest measuring accuracy were laid.



FEM analysis of the XY stage

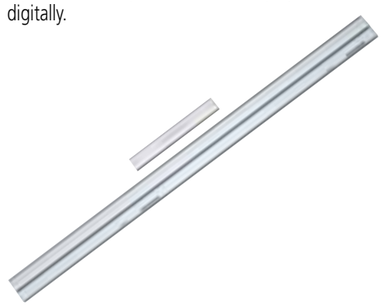
## More about the XY Stage

The XY stage is a massive, highly stable design created using mechanical techniques developed over Mitutoyo's long years of experience in manufacturing precision measuring microscopes. Maximum stage loading is 30 kg and a range of useful fixtures is available that includes a wafer holder and swivel-center support.



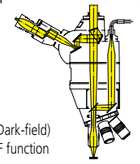
## Highly Accurate Digital Scales

These microscopes are equipped with highly accurate digital glass scales on all three axes. Mitutoyo produces glass scales in an underground laboratory where the temperature and humidity are constant throughout the year. The XY (stage) and Z (optical tube) displacements are displayed digitally.




## FS Optical System

The FS optical system is respected more than ever before for its ability to enable measurement, observation and analysis with a leading-edge combination of long working distance and high NA. This optical system ensures high operability when measuring deep holes, steps, etc., or when setting up workpieces for measurement.



BD (Bright/Dark-field) with the LAF function

## Tilting Optical Tube*

To reduce fatigue due to extended use, it is important that the operator use a microscope in an unforced posture. The eyepiece unit allows stepless adjustment of tilt angle so that, no matter what their physique, operators can always adjust the viewing position for comfortable working during any measuring task.

* Available for model MF-U only.

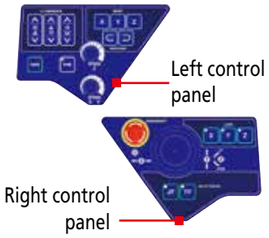
## LAF Optical Tube*

The LAF (Laser AF) optical tube can be selected as an option. The LAF system achieves high repeatability when measuring minute steps, etc., enabling difficult measurements with minimum fatigue.

* Available for model MF-U only

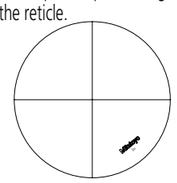
## Front Operation

Controls are arranged to fall within easy reach of the operator on two control panels at the front of the microscope. This allows the operator to concentrate on measurement without having to look away from the eyepieces. Membrane technology makes the switches very durable.




## Cross-hair Reticle

How accurately the reticle can be aligned with a workpiece feature is a very important feature in a measuring microscope. Taking ocular resolution into account, the thin-line reticle has been standardized on a broken, 90˚ cross hair with a line width of 5 µm*. This allows precise positioning of the reticle.



* Cross-hair reticles of 3 µm and 7 µm line width are also available.

## Fiber-optic Cold Light Illumination

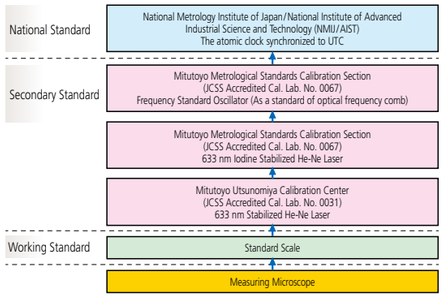
A fiber-optic cold light illuminator and an IR absorption filter greatly reduce thermal effects on the instrument and workpiece that would otherwise have an adverse effect on measuring accuracy. Telecentric illumination is used for reflected light observation and Koehler illumination for viewing contours. Both systems use an aperture diaphragm for even, glare-free illumination with good image contrast.

## System Extensibility

A video port is standard on the optical tube, thereby allowing a digital camera unit and various vision analysis units to be added to a system.


## For Safe Use — Traceability to National Standards —

To establish and maintain the traceability of measuring tools and instruments, Mitutoyo uses length standards traceable to the national standards in Japan to calibrate the standard used to calibrate measuring tools and instruments.




Note: The chart on the above shows an outline of traceability for the measuring microscope.

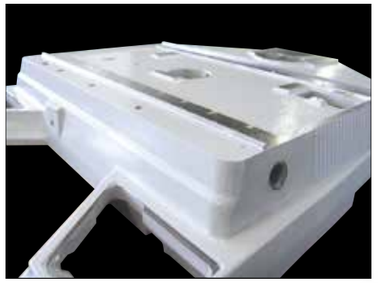
# Main Specifications

MF/MF-U

## Highest-in-Class Measuring Accuracy

Mitutoyo has achieved a measuring accuracy of (0.9 + 3L/1000) µm (L: Measured length in mm) in both X and Y axes. This performance surpasses Class 0* of JIS B7153:1995, Measuring Microscopes, and allows support of ultra-precise inspection and measurement of the smallest visible features to those extending across the full measuring range of these microscopes.

* Class 0: (2 + 0.01L) µm or less, L: Measured length (mm)



MF/MF-U

## Large, Highly Accurate XY Stage Handles Wide-field, Heavy-weight Workpieces

The pressures for diversification and up sizing of workpieces are increasing in various industrial fields, such as semiconductors, electronics, precision automotive parts and tools. These microscopes not only have the accuracy for the smallest workpiece but also have the power to handle larger components such as lead frames, precision cutting tools and molds.


Both center supports are equipped.

MF/MF-U

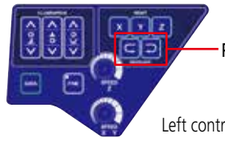
## Three-axis Motor-driven Joystick Ensures High Operability from High Speed to Ultra-Low speed

The X, Y, and Z axes are driven and controlled with one joystick that serves as the nerve center of front operation. Speed control is possible from high-speed traverse of the stage to ultra low-speed, minute positioning of a workpiece. Also, the lock mechanism is provided for each X, Y, and Z axis to support high-accuracy pitch measurement by single-axis displacement. The primary target is assumed to concentrate the operator on a workpiece.


MF-U

## Remote-controlled Objective Magnification Change

The power turret in the optical tube is controlled with membrane switches on the left front panel. LEDs indicating each lens position on the upper part of the optical tube are linked to rotation of the turret so that the operator can see the current magnification at a glance.


Power Turret Drive Switches

Left control panel

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# Main Unit Specifications

Hyper MF

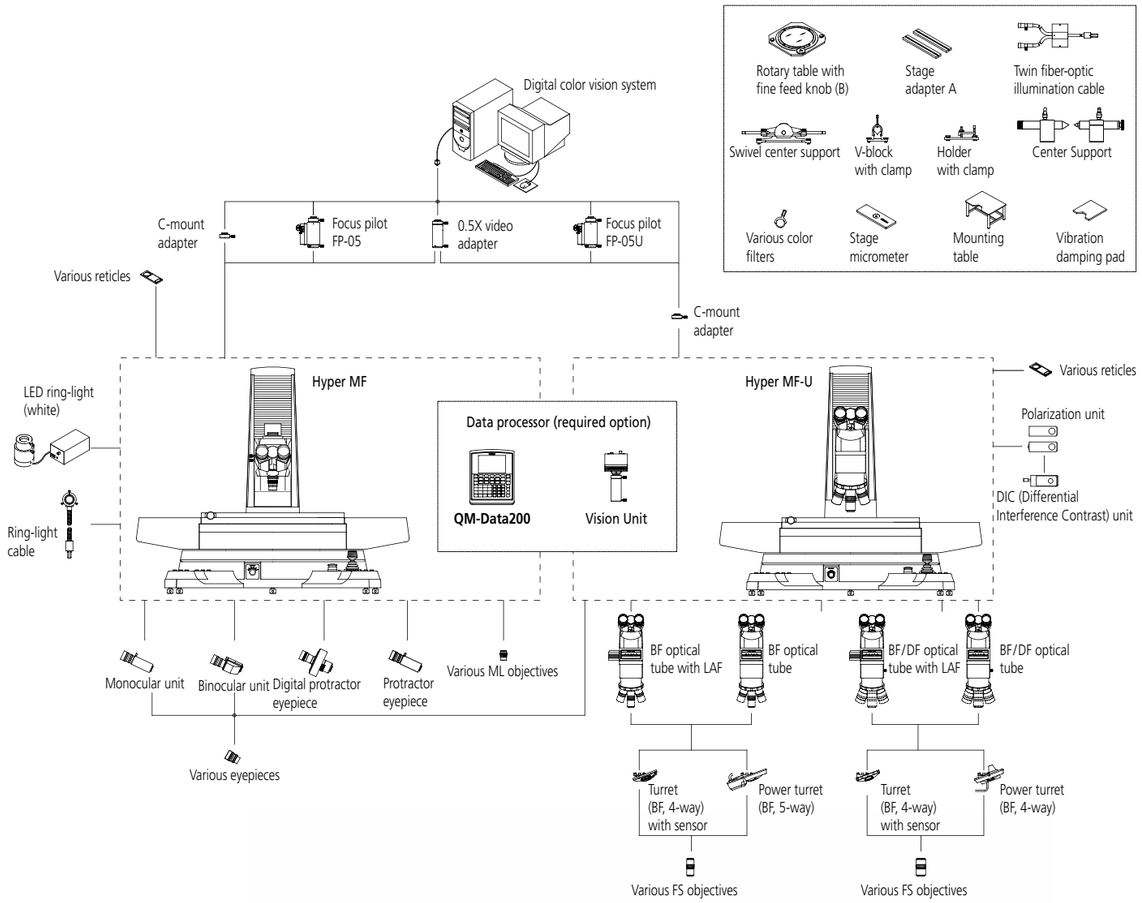
Hyper MF-U
An optical tube, turret, and objective lens are optional.

| Model No. | | Hyper MF-B2515B | Hyper MF-UB2515B | Hyper MF-UD2515B | Hyper MF-UE2515B | Hyper MF-UF2515B |
|---|---|---|---|---|---|---|
| Order No. | | 176-430*1 | 176-431*1 | 176-432*1 | 176-433*1 | 176-434*1 |
| Optical tube | | Finite correction optical system — | Infinity-correction optical system BF (Bright-field) | Infinity-correction optical system BD (Bright/Dark-field) | Infinity-correction optical system BF (Bright-field) with the LAF function | Infinity-correction optical system BD (Bright/Dark-field) with the LAF function |
| | Standard reticle (Built-in) | 90° broken-cross line (line width 5 µm) | | | | |
| | Pupil distance adjustment | Siedentoph type Adjustment range: 51 to 76 mm | | | | |
| | Optical path switching ratio | Observation/TVphotomicrography=50/50 | | | | |
| | Vertical tilt angle | 25° | Tilting | | | |
| | TV port | Provided as standard | | | | |
| Observation image | | Erect image | | | | |
| Eyepiece | Magnification | 10X, 15X, 20X | | | | |
| Objective lens (optional) | | Selectable from the monocular unit (equipped with an eyepiece) or binocular tube (equipped with two eyepieces) | Equipped with two 10X eyepieces | | | |
| | ML series objective lens | 1X, 3X, 5X, 10X, 20X, 50X, 100X | — | | | |
| | BF (Bright-field) | — | M Plan Apo, M plan Apo SL, G plan Apo | | | |
| | BD (Bright/Dark-field) | — | BD Plan Apo | | | |
| Turret (optional) | BF (Bright-field) | — | (Equipped with a four-hole manual sensor/motorized five-hole sensor*2) | | | |
| | BD (Bright/Dark-field) | — | (Equipped with a four-hole manual sensor/motorized four-hole sensor*3) | | | |
| Focusing section | Maximum height of workpiece | 150 mm | | | | |
| | Measuring accuracy | (1.5 + 0.01L) µm L: Measuring length (mm) | | | | |
| | Drive method | Motorized control with the use of a joystick | | | | |
| Illumination unit | Transmitted illumination device | Telecentric system, Built-in aperture diaphragm, Halogen bulb (12 V, 50 W), 100-step light intensity control, Fiber optics cable cold light illumination | | | | |
| | Reflected illumination unit | Koehler illumination, Variable aperture diaphragm mechanism, Halogen bulb (12 V, 100 W), 100-step light intensity control, Fiber optics cable cold light illumination | | | | |
| Workstage | Measuring range (X×Y) | 250 mm×150 mm | | | | |
| | Measuring accuracy*4 (When no load is put on the X- or Y-axis) | (0.9 + 0.003L) µm L: Measuring length (mm) | | | | |
| | Dimensions of the top plane | 460 mm×350 mm | | | | |
| | Usable dimensions of the stage glass | 300 mm×200 mm | | | | |
| | Swiveling angle | ±3° | | | | |
| | Maximum loading mass | 30 kg | | | | |
| | Drive method | Motorized control with the use of a joystick | | | | |
| Detector | | High precision digital scale (Patented) | | | | |
| Digital display | Resolution | 0.01 µm | | | | |
| | Axes to be displayed | X, Y, Z | | | | |
| | Data processing unit | QM-Data200 or Vision Unit | | | | |
| Operation section | Joystick lock | Available | | | | |
| | Fine pitch | Available | | | | |
| | Data output | Available | | | | |
| | Digital display reset | Available | | | | |
| | Illumination light intensity control: | Available | | | | |
| | LAF (just focus) | — | — | | Available | |
| | LAF (tracking focus) | — | — | | Available | |
| | Turret remote control | — | Available (when installing a power turret) | | | |
| External dimensions | Microscope main unit | 880 mm×913 mm×730 mm | 880 mm×913 mm×770 mm | | | |
| | Power unit | 160 mm×476 mm×381 mm | | | | |
| Mass | Microscope main unit | Approx. 250 kg | Approx. 255 kg | | | |
| | Power unit | 14 kg | | | | |
| Power supply | | 100 - 240 V AC, 50/60 Hz Maximum power consumption: 700 W | | | | |

*1 To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.
*2 and *3 are the factory-installed options.
*4 Measurement accuracy complies with JIS B7153.

When replacing the bulb, please request a halogen bulb for transmitted illumination (12 V, 50 W) (**02APA527**) or for Reflected illumination (12 V, 100 W) (**517181**). A high-intensity model (12 V, 100 W) (**12BAD602**) is also available.

# System Configuration




## Eyepieces

### Monocular unit MF

**176-392**

With one eyepiece 10X/24

### Binocular Unit MF

**176-393**

With two eyepiece 10X/24

### Eyepieces MF/MF-U

| Part name | WF10X/24 | WF20X/12 |
|---|---|---|
| No. (1-piece pack) | **378-866-5** | **378-858-5** |
| No. (2-piece pack) | **378-866** | **378-858** |
| Magnification | 10X | 20X |
| Field number | 24 | 12 |

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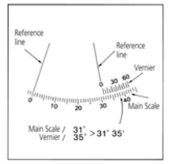
# Lens and Illumination

### Protractor eyepiece MF




**375-043**

Measures angle between workpiece edges by successive alignment with two crosshairs whose separation is adjustable and calibrated through 360˚

- Magnification: 10X
- Field number: 21
- Resolution: 5′
- Measuring range: 360°

### Digital protractor eyepiece MF

**176-313**

Measures angle between workpiece edges by successive alignment with reticle cross hairs whose rotation is digitally calibrated. Switching or resetting the resolutions is controlled with the standard accessory counter. Data output to an RS-232C equipped PC is possible.

•Magnification: 10X •Field number: 18 •Reticle: 90˚ solid line, 45˚ broken line •Angular resolution: 0.00˚ or 1˚ •Power supply: 9 VAC, 600 mA •Maximum power consumption: 4 W •Maximum angle value: ±369.99˚ or ±369.59′

## Objective

### ML Objective MF

| Model name | ML1X | ML3X | ML5X | ML10X | ML20X | ML50X | ML100X |
|---|---|---|---|---|---|---|---|
| Order No. | **375-036-2** | **375-037-1** | **375-034-1** | **375-039** | **375-051** | **375-052** | **375-053** |
| Magnification | 1X | 3X | 5X | 10X | 20X | 50X | 100X |
| Numerical aperture N.A. | 0.03 | 0.09 | 0.13 | 0.21 | 0.42 | 0.55 | 0.7 |
| Working distance WD | 61 mm | 77 mm | 61 mm | 51 mm | 20 mm | 13 mm | 6 mm |
| Focal depth | 306 µm | 34 µm | 16.3 µm | 6.2 µm | 1.6 µm | 0.9 µm | 0.6 µm |

### FS Objective Bright-field (BF) MF-U

| Model name | MplanApo1X | MplanApo2X | MplanApo5X | MplanApo7.5X | MplanApo10X | MplanApo20X | MplanApo50X | MplanApoHR50X | MplanApo100X | MplanApoHR100X |
|---|---|---|---|---|---|---|---|---|---|---|
| Order No. | **378-800-12** | **378-801-12** | **378-802-6** | **378-807-3** | **378-803-3** | **378-804-3** | **378-805-3** | **378-814-4** | **378-806-3** | **378-815-4** |
| Magnification | 1X | 2X | 5X | 7.5X | 10X | 20X | 50X | 50X | 100X | 100X |
| Numerical aperture N.A. | 0.025 | 0.055 | 0.14 | 0.21 | 0.28 | 0.42 | 0.55 | 0.75 | 0.7 | 0.9 |
| Working distance WD | 11 mm | 34 mm | 34 mm | 35 mm | 34 mm | 20 mm | 13 mm | 5.2 mm | 6 mm | 1.3 mm |
| Focal depth | 200 µm | 100 µm | 40 µm | 26.7 µm | 20 µm | 10 µm | 4 µm | 4 µm | 2 µm | 2 µm |

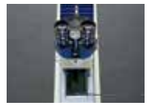
| Model name | MplanApoSL20X | MplanApoSL50X | MplanApoSL100X | GplanApo20X (t3.5) | GplanApo50X (t3.5) |
|---|---|---|---|---|---|
| Order No. | **378-810-3** | **378-811-15** | **378-813-3** | **378-847** | **378-848-3** |
| Magnification | 20X | 50X | 100X | 20X | 50X |
| Numerical aperture N.A. | 0.28 | 0.42 | 0.55 | 0.28 | 0.5 |
| Working distance WD | 30.5 mm | 20.5 mm | 13 mm | Air conversion 29.42 mm | Air conversion 13.89 mm |
| Focal depth | 10 µm | 4 µm | 2 µm | 10 µm | 4 µm |

### FS Objective Bright/Dark-field (BD) MF-U

| Model name | BDplanApo2X | BDplanApo5X | BDplanApo7.5X | BDplanApo10X | BDplanApo20X | BDplanApo50X | BDplanApo100X |
|---|---|---|---|---|---|---|---|
| Order No. | **378-831-12** | **378-832-7** | **378-830-7** | **378-833-7** | **378-834-7** | **378-835-7** | **378-836-7** |
| Magnification | 2X | 5X | 7.5X | 10X | 20X | 50X | 100X |
| Numerical aperture N.A. | 0.055 | 0.14 | 0.21 | 0.28 | 0.42 | 0.55 | 0.7 |
| Working distance WD | 34 mm | 34 mm | 34 mm | 33.5 mm | 20 mm | 13 mm | 6 mm |
| Focal depth | 100 µm | 40 µm | 26.7 µm | 20 µm | 10 µm | 4 µm | 2 µm |

## External light source

### LED ring-light MF



**176-367-2** (white LED)

Position is adjustable so as to be appropriate for the light equalizing function and working distance.
12 V 7.7 W, outside diameter: 70 mm

Note: 10X lens or less is applicable.

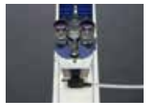
### LED ring-light (for FS Objectives) MF-U

Consult your local Mitutoyo office for the Order No. (white LED)

Position is adjustable so as to be appropriate for the light equalizing function and working distance.
12 V 7.7 W, outside diameter: 70 mm

Note: 10X lens or less is applicable.

### Fiber-optics ring-light MF



**176-417**

This uses the surface illumination light source in microscope main unit. The light equalizing function and condenser lens are included.
12 V 100 W

Note: 10X lens or less is applicable.

### Twin fiber-optics illuminator MF/MF-U

**176-416**

This uses the surface illumination light source in microscope main unit. The light equalizing function and condenser lens are included.
12 V 100 W

# Data Processing System - 2D Calculating System -

## Features

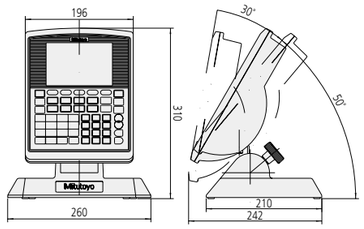
> Powerful 2D measurement capabilities with graphic display functions that make the most of the large LCD screen
> Graphical help on the screen guides the operator during measurement sequences.
> Measurement results are displayed automatically
> Measurement procedures (Part Programs) can be learnt by the system and easily repeated with position navigation help on screen
> Frequently-used combination measurements (e.g. circle-to-circle) are single-key operations
> The Automatic Identification (AI) function recognizes the feature type automatically, making preselection unnecessary
> Macros to initiate learned measuring sequences can be created at a keystroke
> Custom menus to suit specific requirements can be created
> Tolerance comparisons and various statistical evaluation options are possible for every measurement result.
> Measurement results can be output to MS Excel®* in table form (CSV)
> Measurement results and Measurement procedure can be stored on the USB-Memory stick available
> A free-standing table version with tilting device is available

* MS-Excel® is a registered trademark of Microsoft Corporation.

## Specifications

| Order No. | **264-159** |
|---|---|
| Display languages | Japanese, English, German, French, Italian, Spanish, Portuguese, Czech, Chinese (simplified/traditional), Korean, Turkish, Swedish, Polish, Ditch, and Hungarian |
| Measurement value unit | Length: mm, angle: Switchable between decimal degree and sexagesimal notation |
| Resolution | 0.01 µm |
| Programming function | Creating, performing, and editing of the measurement procedures |
| Statistical processing | Number of data, maximum value, minimum value, mean value, standard deviation, range, histogram<br>Statistics classified by each measurement function (Statistics classified by each command) |
| Number of elements in memory | Maximum 1000 elements |
| Element call | Point, line, circle, distance, ellipse, square hole, slotted hole, point and angle of intersection |
| Element key-in | Point element line element, circle element |
| Display unit | Color graphic LCD (equipped with a backlight) |
| Measurement result file output | RS-232C output (CSV format, MUX-10 format) |
| Power supply | 100 to 240 VAC |
| Maximum power consumption | 17 W (excluding optional accessories) |
| External dimensions | Approx. 260×242×310 mm (including the stand) |
| Mass | Approx. 2.9 kg |

## Dimensions

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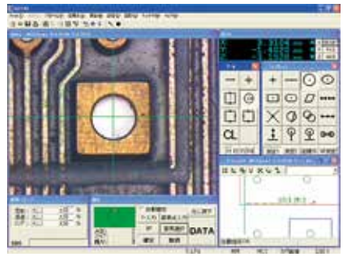
# Vision Measuring - Vision Unit -

## Features

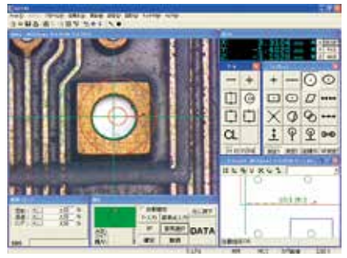
> Automatic edge detection tool and measurement macro icons enable single-key measurement
> Graphics and measurement navigation function support ease of use
> Image capturing/saving function
> Tolerancing calculation results and statistical processing for each item
> Measurement results can be exported to MS-Excel®* in CSV format (allows unique inspection sheets to be created on the same PC)
> Supports total measurement on a single screen.
> Automatic light equalizing function faithfully reproduces illumination conditions

* MS-Excel® is a registered trademark of Microsoft Corporation.

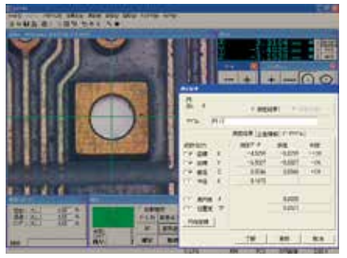
## Measuring a Workpiece Feature



1) Display the feature to be measured on the monitor, adjust the illumination and focus with the microscope main unit, and then select the feature and the edge detection tool.



2) Click in the vicinity of the feature with the mouse to automatically detect its edge and perform the measurement/calculation.



3) The measurement results for the feature selected are displayed on the monitor.

## Specifications

| Model | | Vision Unit |
|---|---|---|
| Image detection camera | Image sensor | 1/2 inch color CMOS, 3 megapixels |
| | External dimensions/Mass (camera only) | 56 (W) ×54 (D) ×78 (H) mm/0.4 kg |
| | Optical system magnification | 0.5X (using the 0.5X TV adapter) |
| PC | OS | Microsoft Windows 10 |
| | Monitor | 22 inch |
| | Software (optional) | QSPAK VUE |
| | Maximum power consumption | Max. 372 W (including monitor) |
| | Monitor Magnification | Approximately 19X (3X objective lens is used: approx. 57X/Imaging range: 4.49×3.36 mm) |
| | Resolution | 0.01 µm (When using Hyper MF/MF-U) |
| | Measuring accuracy for each axis at 20 ℃*1 | Depends on the accuracy specification of the Mitutoyo measuring microscope to which the unit is fitted |
| | Repeatability at 20 ℃*2 | Depends on the accuracy specification of the Mitutoyo measuring microscope to which the unit is fitted.<br>For reference: Repeatability within the Field of View (When using a sample workpiece based on the Mitutoyo standards)<br>When using ML Series 3X objective lens (3σ): less than ±2.5 µm<br>When using ML Series 10X objective lens (3σ): less than ±1.0 µm |

*1 This measuring accuracy means a difference between an actual measurement value in vision measurement and a true value.
*2 Repeatability on one screen means the variation in measurement values when different positions within the same screen are measured repeatedly.
Note: QSPAK VUE and a data processor are required separately.



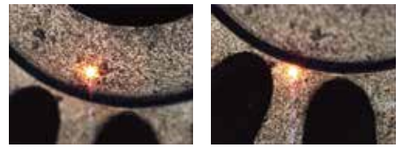


# Laser Auto Focus

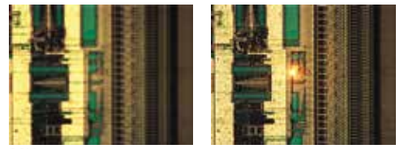
## LAF Optional Tube

The laser auto focus function provides high accuracy and high repeatability and brings significant advantage to the inspection of minute steps, multi-layer board detail, etc. A powerful function that helps avoid operator error and ensures high productivity.

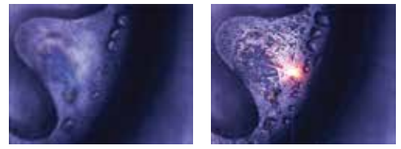
LAF is available both in BF and BD optical tubes.



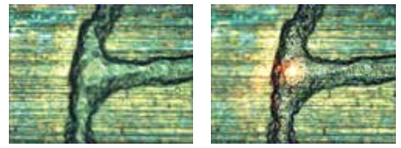
ultra-precision small-sized gear 10X



Wafer 20X



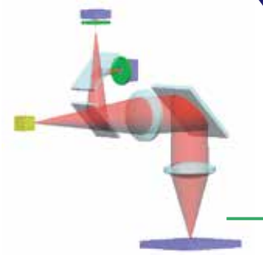
Metal slope 20X



Metal marking 20X

## Selectable LAF Functions

Providing a choice of the Just Focus (JF) mode that functions quickly at the current point of interest and the Tracking Focus (TF) mode that tracks the focusing position to retain sharp focus as the stage moves has improved measurement efficiency.

Visible Semiconductor Laser 690 nm

## LAF Effective in the Smallest Area

An LAF spot diameter of ø1 µm or less is achieved using an objective with a magnification of 50X or more. This performance supports a wide range of measurement tasks.

| Objective | Spot diameter*1 | Repeatability*2 (2σ) |
|---|---|---|
| MplanApo 5X | 6 µm | 1.2 µm |
| MplanApo 10X | 3 µm | 0.6 µm |
| MplanApo 20X | 1.5 µm | 0.6 µm |
| MplanApo 50X | 0.8 µm | 0.6 µm |
| MplanApo 100X | 0.6 µm | 0.6 µm |

*1 The spot diameters are a logical value determined by calculation.
*2 Repeatability is in an inspection using a sample workpiece based on the Mitutoyo standards.

**The AF function delivers highly repeatable focusing on areas with different surface textures and slopes.**

## Laser Beam Class

The LAF (factory-fit option) function uses a low-power laser that corresponds to Class 2 (visible light) of JIS C6802/1997, Safety of Laser Products.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# Main Optional Accessories

## Turret

**176-410**: Manual (BF, 4-way)
**176-411**: Motor (BF, 5-way)
**176-412**: Manual (BF/BD, 4-way)
**176-413**: Motor (BF/BD, 4-way)

## Polarization Unit

**378-092**
Bright-field (BF)
Bright and dark-field (BD)

## DIC Unit

**378-080**: For 5X, 10X
**378-079**: For 20X
**378-078**: For 50X, SL20X
**378-076**: For 100X, SL80X, SL50X

## Illumination Filter

**12AAA643**: **ND2**
**12AAA644**: **ND8**
**12AAA645**: **GIF**
**12AAA646**: **LB80**

## V Block with Clamp

**172-378**
Maximum clamp diameter: ø25 mm
Mass: 0.8 kg

Note: Stage Adapter A is used together.

## Swivel Center Support

**172-197**
A tilt angle of ±10° can be supported.
Minimum reading of angle: 1°
Maximum support size: ø80×140 mm in horizontal orientation, ø65×140 mm at a tilt angle of 10°
Mass: 2.5 kg

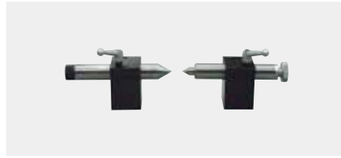
Note: Stage Adapter A is required.

## Holder with Clamp

**176-107**
Maximum workpiece thickness: 35 mm
Mass: 0.4 kg

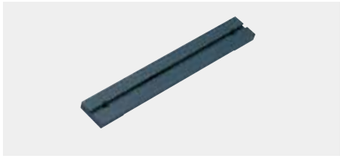
Note: Stage Adapter A is used together.

## Center Support



**176-415**
Maximum support length: 250 mm
Maximum support diameter: ø150 mm
Maximum diameter allowing external apex observation: ø140 mm
Effective stroke of the center-clamping mechanism: 22 mm
Mass: 13 kg

## Stage Adapter A

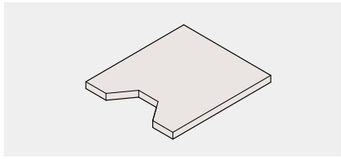


**176-304**
Pieces pack
Mass: 1.5 kg

## Rotary table with fine feed knob (B)

**176-306**
Effective glass diameter: ø240 mm
Rotary table rotation angle: Approx. 51.5°
(per full turn of the fine feed knob)
Mass: 6.5 kg

## Vibration Damping Pad



**176-419**
Max. loading: 300 kg
Spring pad type
Float unit material: SUS304
W×D×H=800×900×48 mm
Mass: 58 kg

## Machine Stand

**176-418**
Max. loading: 400 kg
W×D×H=1100×900×650 mm
Mass: 45 kg

# Measuring Microscope Line-up

Demand for measuring microscopes that can perform observational tasks as well as measurement is increasing rapidly in various sectors of industry such as semiconductors, electronic parts, precision auto parts and tools. The following summarizes Mitutoyo's line-up of measuring microscopes actively participating in many industries. Mitutoyo intends to widen the appeal of measuring microscopes that can determine miniscule part dimensions on a workpiece and make them serve as the Basic Machine for non-contact measurement.

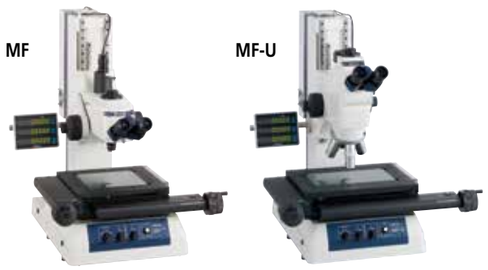
## High-accuracy Measuring Microscopes

### Hyper MF / MF-U


| Series name | Hyper MF | Hyper MF-U |
|---|---|---|
| Optical tube | Standard (Finite correction) | Metallurgical microscope (Infinity-correction) |
| Measuring range (X/Y/Z) | 250/150/150 mm | |
| Control system/ reading unit | 3-axis motor-driven with Joystick/digital scale | |
| Resolution | 0.01 µm | |
| Data processing unit | QM-DATA200/vision unit | |
| Video port | Standard equipment | |

## Measuring Microscopes

### MF / MF-U




| Series name | MF | MF-U |
|---|---|---|
| Optical tube | Standard (Finite correction) | Metallurgical microscope (Infinity-correction) |
| Measuring range (X/Y/Z) | 100/100/150, 200/100/150, 200/170/220, 300/170/220, 400/200/220 mm | |
| Control system/ reading unit | 3-axis motor-driven with Joystick/digital scale | |
| Resolution | 0.1/0.5/1 µm | |
| Data processing unit | QM-DATA200/vision unit | |
| Video port | Standard equipment | |

## Toolmaker's Microscope

### TM


| Series name | TM |
|---|---|
| Optical tube | Standard (Finite correction) |
| Measuring range (X/Y/Z) | 50/50/115, 100/50/107 mm |
| Control system/ reading unit | Manual/micrometer head |
| Resolution | 1 µm (MHD head) |
| Data processing unit | QM-DATA200 |
| Video port | None |

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# MEMO

214 21102(2)e-(DI)PR-(JP4), Printed in Japan

- Coordinate Measuring Machines
- Vision Measuring Systems
- Form Measurement
- Optical Measuring
- Sensor Systems
- Test Equipment
- Digital Scale and DRO Systems
- Small Tool Instruments and Data Management

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