

Measuring Microscopes Hyper MF / MF-U

CATALOG No. E14012



Measuring Microscopes So Accurate They Defy
Common Sense

Mitutoyo

World's Highest Measuring Accuracy



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.



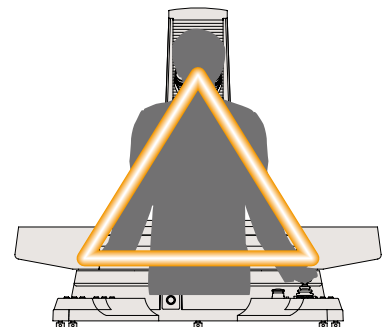
Core Technology

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

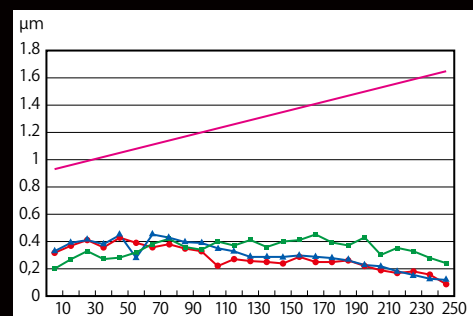
The microscope main unit has been designed with the emphasis on user friendliness and ease of operation. Mitutoyo has executed the mechanical design to allow easy operation. Even after extended use, its fatigue-fighting design still provides a comfortable work-experience for the operator.





World's Highest Measuring Accuracy*

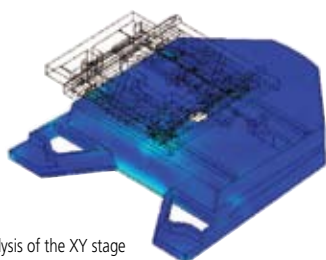
Measuring accuracy in the X- and Y-axes at full stroke surpasses class 0 of the JIS Standard for measuring microscopes (B7153-1995). This makes these microscopes ideal for high accuracy measurement of precision molds or cutting tools that require the best resolution, or for inspecting sub-miniature semiconductor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



*As of July, 2006

Large, Highly Accurate XY Stage

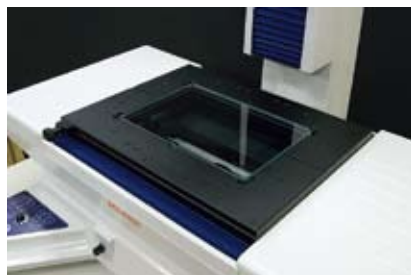
Mitutoyo uses a type of linear guideway on the large XY stage that is highly regarded for excellent straightness and stability. This is one key element in the strategy to maximize geometrical accuracy - another is FEM analysis. Our designers used FEM techniques extensively during the design phase to 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

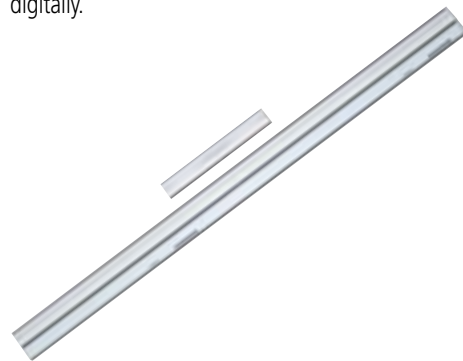
More about the XY Stage

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 30kgf (66lbf) 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.

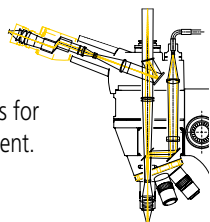


Excellent Operability and Solid Reliability



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.



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*

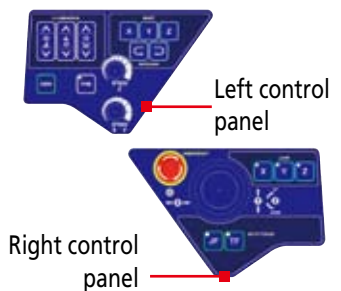
The LAF (Laser AF) optical tube can be selected as an option. The LAF system achieves high repeatability when measuring minute steps, etc., enabling difficult measurements with minimum fatigue.

* 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.

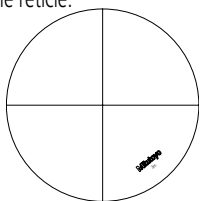


Measuring with Hyper MF - an Emotional Experience



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 5µm*. This allows precise positioning of the reticle.



* Cross-hair reticles of 3µm and 7µm 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.



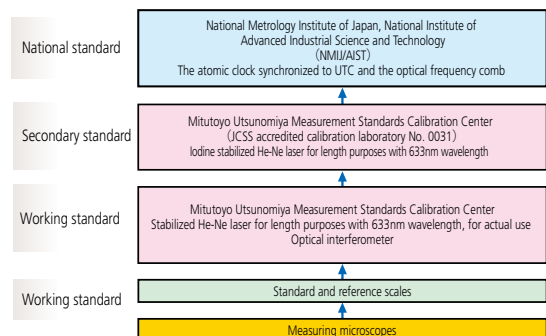
System Extensibility

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.



Main Specifications

MF/MF-U

Highest-in-Class Measuring Accuracy

Mitutoyo has achieved a measuring accuracy of $\pm (0.9+3L/1000)\mu\text{m}$ (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.

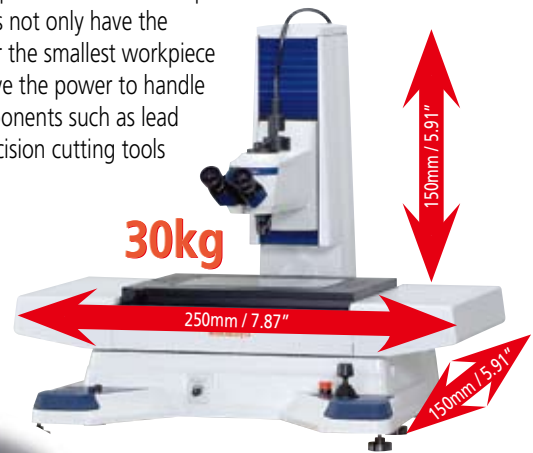
* Class 0: $(2+0.01L)\mu\text{m}$ or less, L: Measured length (mm)



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

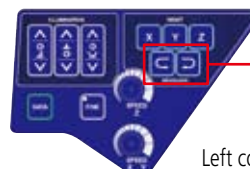
The X, Y, and Z axes are driven and controlled with one joystick that serves as the nerve center of front operation. Speed control is possible from high-speed traverse of the stage to ultra low-speed, minute positioning of a workpiece. Also, the lock mechanism is provided for each X, Y, and Z axis to 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

Mitutoyo

Laser Auto Focus

LAF Optional Tube

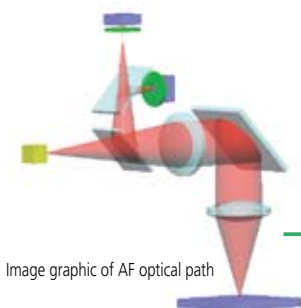
The laser auto focus function provides high accuracy and high repeatability and brings significant advantage to the inspection of minute steps, multi-layer board detail, etc. A powerful function that helps avoid operator error and ensures high productivity.



LAF is available both in BF and BD optical tubes.

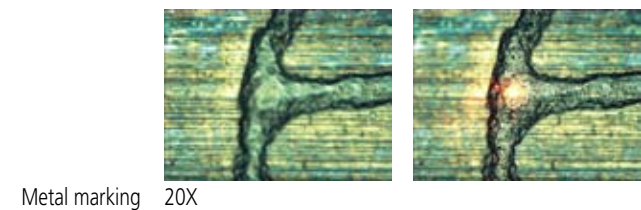
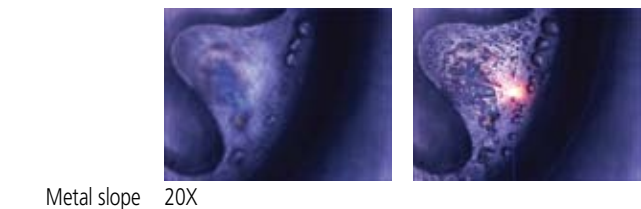
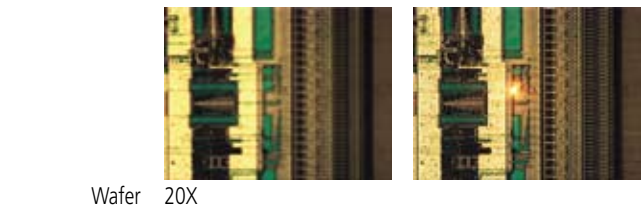
Selectable LAF Functions

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 690nm

Image graphic of AF optical path



LAF Effective in the Smallest Area

An LAF spot diameter of $\phi 1\mu\text{m}$ or less is achieved using an objective with a magnification of 50X or more. This performance supports a wide range of measurement tasks.

The spot diameters are a logical value determined by calculation.

| Objective | Spot diameter |
|---------------|-------------------------------------|
| MplanApo 2X | $6\mu\text{m} / 630\mu\text{inch}$ |
| MplanApo 5X | $6\mu\text{m} / 240\mu\text{inch}$ |
| MplanApo 10X | $3\mu\text{m} / 120\mu\text{inch}$ |
| MplanApo 20X | $1.5\mu\text{m} / 60\mu\text{inch}$ |
| MplanApo 50X | $0.8\mu\text{m} / 3\mu\text{inch}$ |
| MplanApo 100X | $0.6\mu\text{m} / 2\mu\text{inch}$ |

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.



Main Unit Specifications

Hyper MF



Hyper MF-U

An optical tube, turret, and objective lens are optional.



| Model No. | HyperMF-B2515B | HyperMF-UB2515B | HyperMF-UD2515B | HyperMF-UE2515B | HyperMF-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 5µm) | | | | |
| Pupil distance adjustment | Siedentoph type Adjustment range: 51 to 76mm / 2.01" to 2.99" | | | | |
| Optical path switching ratio | Observation/TVphotomicrography = 50/50 | | | | |
| Vertical tilt angle | 25° | | | | Tilting |
| TV port | Provided as standard | | | | |
| Observation image | Erect image | | | | |
| Eyeiece 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, BD Plan Apo SL | | |
| Turret (optional) | — | | (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 150mm / 5.91" | | | | |
| 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 (12V, 50W), 100-step light intensity control, Fiber optics cable cold light illumination | | | | |
| Reflected illumination unit | Koehler illumination, Variable aperture diaphragm mechanism, Halogen bulb (12V, 100W), 100-step light intensity control, Fiber optics cable cold light illumination | | | | |
| Workstage | Measuring range (X×Y) 250mm×150mm / 9.84"×5.91" | | | | |
| Measuring accuracy** (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 | 460mm×350mm / 18.11"×13.78" | | | | |
| Usable dimensions of the stage glass | 300mm×200mm / 11.81"×7.87" | | | | |
| Swiveling angle | ±3° | | | | |
| Maximum loading mass | 30kgf / 66lbf | | | | |
| Drive method | Motorized control with the use of a joystick | | | | |
| Detector | High precision digital scale (Patented) | | | | |
| Digital display | Resolution 0.01µm / .0004µinch | | | | |
| 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 motorized turret) | | |
| External dimensions | Microscope main unit | 880mm×913mm×730mm / 34.65"×35.94"×28.74" | | 880mm×913mm×770mm / 34.65"×35.94"×30.31" | |
| Power unit | 160mm×476mm×381mm / 6.30"×18.74"×15" | | | | |
| Mass | Microscope main unit | Approx. 250kg / 551.2lb | | Approx. 255kg / 562.2lb | |
| Power unit | 14kg / 30.86lb | | | | |
| Power supply | 100 - 240V AC, 50/60 Hz Maximum power consumption: 700W | | | | |

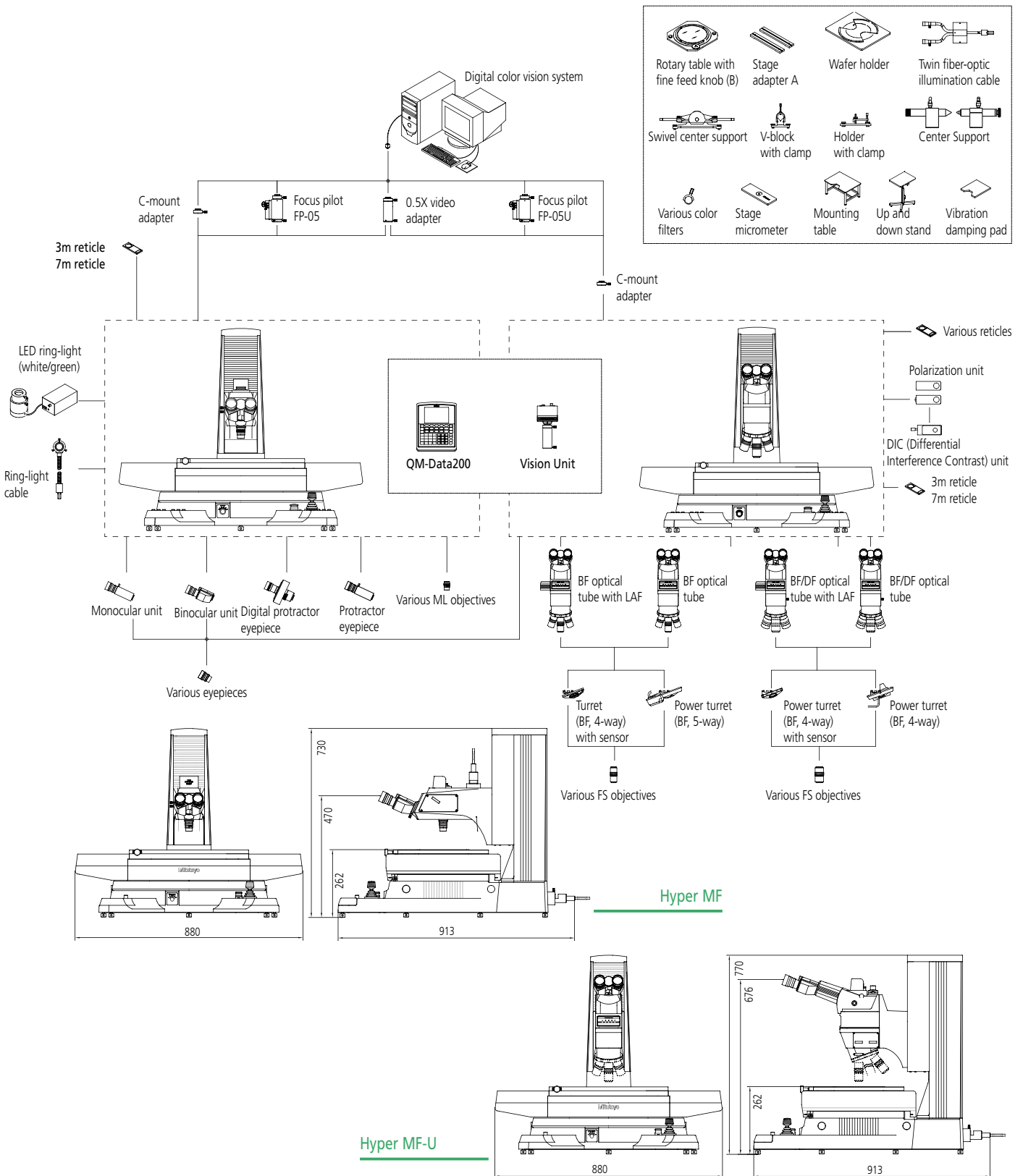
*1: To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.

*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 (12V, 50W) (No.02APA527) or for Reflected illumination (12V, 100W) (No.517181). A high-intensity model (12V, 100W) (No.12BAD602) is also available.

System Configuration



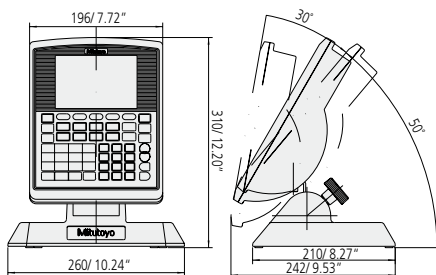
Data Processing System - 2D Calculating System -



Specifications

| | |
|--------------------------------|--|
| Order No. | 264-159 |
| Display languages | Japanese, English, German, French, Italian, Spanish, Portuguese, Czech, Traditional Chinese, Simplified Chinese, Korean, Turkish, Swedish, Polish, Ditch, and Hungarian |
| Measurement value unit | Length: mm, angle: Switchable between decimal degree and sexagesimal notation |
| Resolution | 0.01µm |
| 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 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 240VAC, 50/60Hz (AC adapter used) |
| Maximum power consumption | 17W (excluding optional accessories) |
| External dimensions | Approx. 260x242x310mm (including the stand) / 10.24"x9.53"x12.20" |
| Mass | Approx. 2.9kg / 6.39lbs |

Dimensions



Mitutoyo

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 as an optional accessory
 - > A free-standing table version with tilting device is available
 - > The next measurement can be started even while the last is printing out
- * MS-Excel® is a registered trademark of Microsoft Corporation.

USB-Memory Stick

No. 12AAH034

- Used for saving / reading files of part programs, user macros, measurement results, etc.



USB-FDD Unit

No. 12AAH035

- Used for saving / reading files of part programs, user macros, measurement results, etc.



Printer

No. 12AAD032

- Used to print measurement results.



[Optional accessories]

No. 908353

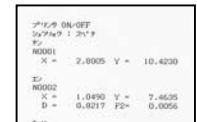
Printer paper (5 rolls)

* An external printer (color/monochrome) compatible with ESC/P is also available.

Printer control code system: ESC/P, compatible with MS-DOS.

Pin-out: 24 pins

ESC/P printer cable (No.12AAA804): 2m - - Option



Receipt printer print example

| | |
|-----------------------------|--|
| Print method | Serial-matrix thermosensitive method |
| Number of print digits | 40 digits |
| Print speed | Maximum 52.5cps (normal character) |
| External dimensions (WxDxH) | 160x170x65.5mm (printer main unit) / 6.30"x5.59"x2.58" |
| Standard accessories | Printer cable, printer paper (1 roll), AC adapter (for 100V) |

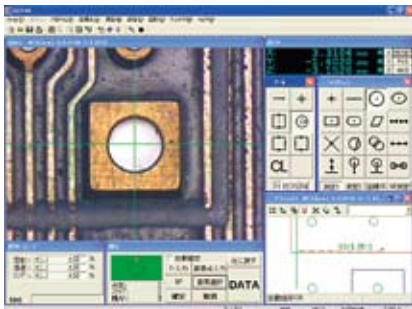


Features

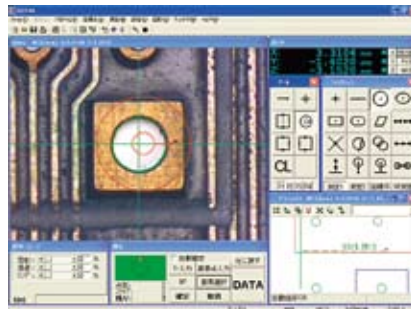
- > Automatic edge detection tool and measurement macro icons enable single-key measurement
- > Graphics and measurement navigation function support ease of use
- > Image capturing / saving function
- > Tolerancing calculation results and statistical processing for each item
- > Measurement results can 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.

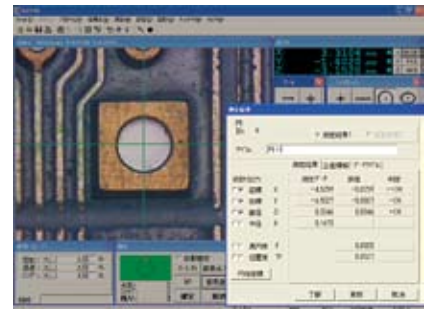
Measuring a Workpiece Feature



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

| | Vision Unit |
|---|--|
| Magnification of the optical system | When installed on the microscope 0.5X (using the 0.5X TV adapter) |
| Image detection | High-sensitivity 1/2" color CMOS camera 3 million pixels |
| Resolution | 0.1μm |
| Measuring accuracy for each axis (Measurement environment: 20°C) | Depends on the accuracy specification of the Mitutoyo measuring microscope to which the unit is fitted. |
| Accuracy (Measurement environment: 20°C) | Depends on the accuracy of Mitutoyo measuring microscopes. For reference: When using an ML series 3X objective lens (In an inspection using a sample workpiece based on the Mitutoyo standards) Measurement accuracy in the screen: Less than ±2.5μm Repetitive accuracy in the screen (±2σ): Less than ±1μm |
| Software (option) | QSPAK Vision Unit Edition |

Note: QSPAK and a data processor are required separately.



Lens and Illumination

Eyepieces

Monocular unit MF



No. 176-302

With one eyepiece 10X / 24

Binocular Unit MF



No. 176-393

With two eyepiece 10X / 24

Eyepiece MF/MF-U



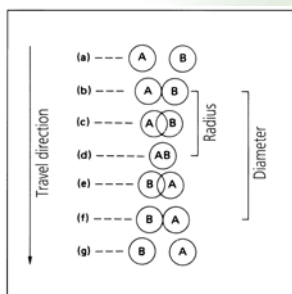
| Part name | WF10X / 24 | WF15X / 16 | WF20X / 12 |
|--------------------|------------------|------------------|------------------|
| No. (1-piece pack) | 378-856-5 | 378-857-5 | 378-858-5 |
| No. (2-piece pack) | 378-856 | 378-857 | 378-858 |
| Magnification | 10X | 15X | 20X |
| Field number | 24 | 16 | 12 |

Double-image eyepiece MF



No. 375-044

Aids accurate measurement of hole-to-hole distances, hole diameters and sections using the double image generate when the feature under inspection is not aligned with the optical axis of the microscope.



- Magnification: 10X
- Field number: 22

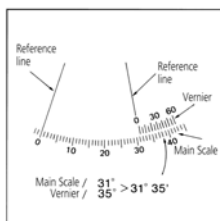
Protractor eyepiece MF



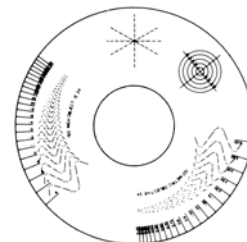
No. 375-043

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

- Field number: 21
- Resolution: 5'



Rotary template eyepiece MF



No. 176-357

Uses a template to superimpose screw thread forms (metric UST, Uni-field Screw Thread), concentric circles, and crosshairs on the workpiece image for quick and efficient measurement by comparison.

- Magnification: 10X
- Field number: 21

| | |
|--|--|
| ISO metric screw pitch (for 3X objective) | 0.25, 0.3, 0.4, 0.45, 0.5, 0.6, 0.7, 0.75, 0.8, 0.9, 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4 |
| ISO unified screw thread / inch (for 3X objective) | 80, 75, 64, 56, 48, 44, 40, 36, 32, 28, 24, 20, 18, 16, 147, 13, 12, 11, 10, 9, 8, 7, 6 |
| Concentric circles with cross hairs (for 3X objective) | ø1, ø2, ø3, ø4, ø5 |
| Dotted-line cross scale | 60°, 90° |

Digital protractor eyepiece MF

No. 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: 9VAC, 600mA
- Maximum power consumption: 4W
- Maximum angle value: ±369.99° or ±369.59°



Mitutoyo

Objective

ML Objective

MF

| Model name | ML1X | ML3X | ML5X | ML10X | ML20X | ML50X | ML100X |
|-------------------------|--------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Order No. | 375-036-1 | 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 | 61mm / 2.40" | 77mm / 3.03" | 61mm / 2.40" | 51mm / 2.32" | 20mm / .79" | 13mm / .51" | 6mm / .24" |
| Focal depth | 306µm / 12.05µinch | 34µm / 1.33µinch | 23µm / .91µinch | 6.2µm / .24µinch | 1.6µm / .06µinch | 0.9µm / .94µinch | 0.6µm / .02µinch |

FS Objective Bright field (BF)

MF-U

| Model name | MplanApo 1X | MplanApo 2X | MplanApo 5X | MplanApo10X | MplanApo 20X | MplanApo 50X | MplanApoHR50X | MplanApo 100X | MplanApoHR100X |
|-------------------------|--------------------|------------------|------------------|------------------|------------------|------------------|-------------------|------------------|-------------------|
| Order No. | 378-800-3 | 378-801-6 | 378-802-6 | 378-803-3 | 378-804-3 | 378-805-3 | 378-814-4 | 378-806-3 | 375-815-4 |
| Magnification | 1X | 2X | 5X | 10X | 20X | 50X | 50X | 100X | 100X |
| Numerical aperture N.A. | 0.025 | 0.055 | 0.14 | 0.28 | 0.42 | 0.55 | 0.75 | 0.7 | 0.9 |
| Working distance WD | 11mm / .43" | 34mm / 1.33" | 34mm / 1.33" | 34mm / 1.34" | 20mm / .79" | 13mm / .51" | 5.2mm / .20" | 6mm / .24" | 1.3mm / .05" |
| Focal depth | 440µm / 17.32µinch | 91µm / 3.58µinch | 14µm / .55µinch | 3.5µm / .14µinch | 1.6µm / .06µinch | 0.9µm / .04µinch | 0.48µm / .02µinch | 0.6µm / .02µinch | 0.34µm / .01µinch |

| Model name | MplanApoSL20X | MplanApoSL50X | MplanApoSL80X | MplanApoSL100X | MplanApoSL200X | GplanApo20X(t2.5) | GplanApo50X(t3.5) |
|-------------------------|------------------|------------------|------------------|------------------|------------------|-------------------|-------------------|
| Order No. | 378-810-3 | 378-811-3 | 378-812-3 | 378-813-3 | 378-816-3 | 378-847 | 378-848-3 |
| Magnification | 20X | 50X | 80X | 100X | 200X | 20X | 50X |
| Numerical aperture N.A. | 0.28 | 0.42 | 0.5 | 0.55 | 0.62 | 0.28 | 0.5 |
| Working distance WD | 30.5mm / 1.2" | 20.5mm / .81" | 15mm / .59" | 13mm / .51" | 13mm / .51" | 29.42mm / 1.16" | 13.89mm / .55" |
| Focal depth | 3.5µm / .14µinch | 1.6µm / .09µinch | 1.1µm / .04µinch | 0.9µm / .04µinch | 0.7µm / .03µinch | 3.5µm / .14µinch | 1.1µm / .04µinch |

FS Objective Bright / dark field (BD)

MF-U

| Model name | BDplanApo2X | BDplanApo5X | BDplanApo10X | BDplanApo20X | BDplanApo50X | BDplanApoHR50X | BDplanApo100X | BDplanApoHR100X |
|-------------------------|------------------|------------------|------------------|------------------|------------------|-------------------|------------------|-------------------|
| Order No. | 378-831-7 | 378-832-7 | 378-833-7 | 378-834-7 | 378-835-7 | 378-845-7 | 378-836-7 | 378-846-7 |
| Magnification | 2X | 5X | 10X | 20X | 50X | 50X | 100X | 100X |
| Numerical aperture N.A. | 0.055 | 0.14 | 0.28 | 0.42 | 0.55 | 0.75 | 0.7 | 0.9 |
| Working distance WD | 34mm / 1.34" | 34mm / 1.34" | 33.5mm / 1.32" | 20mm / .79" | 13mm / .51" | 5.2mm / .20" | 6mm / .24" | 1.3mm / .05" |
| Focal depth | 91µm / 3.58µinch | 14µm / .55µinch | 3.5µm / .15µinch | 1.6µm / .96µinch | 0.9µm / .04µinch | 0.48µm / .03µinch | 0.6µm / .02µinch | 0.34µm / .01µinch |

| Model name | BDplanApoSL20X | BDplanApoSL50X | BDplanApoSL80X | BDplanApoSL100X |
|-------------------------|------------------|------------------|------------------|------------------|
| Order No. | 378-840-7 | 378-841-7 | 378-842-7 | 378-843-7 |
| Magnification | 20X | 50X | 80X | 100X |
| Numerical aperture N.A. | 0.28 | 0.42 | 0.5 | 0.55 |
| Working distance WD | 30.5mm / 1.2" | 20mm / .79" | 13mm / .51" | 13mm / .51" |
| Focal depth | 3.5µm / .14µinch | 1.6µm / .09µinch | 1.1µm / .04µinch | 0.9µm / .04µinch |

Twin fiber-optics illuminator

MF/MF-U



No. 176-416

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

12V100W

*10X lens or less is applicable.

Fiber-optics ring-light

MF-U



No. 176-417

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

12V100W

*10X lens or less is applicable.

LED ring-light

MF



No. 176-367-2
(white LED)

Position is adjustable so as to be appropriate for the light equalizing function and working distance. 12V 7.7W, outside diameter:70mm/2.76"

*10X lens or less is applicable.

LED ring-light

MF

(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.

12V7.7W, outside diameter:

70mm/2.76"

*10X lens or less is applicable.

Main Optional Accessories

Polarization Unit



No.378-092
Bright field (BF)
Bright and dark field (BD)

DIC Unit



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

Illumination Filter



No.12AAA643:ND2
No.12AAA644:ND8
No.12AAA645:GIF
No.12AAA646:LB80

Centering, Parfocal Turret



No.378-018
Objectives: Up to 4
Visual field adjustment range:
 $\pm 0.5\text{mm}/.02''$
Parfocal adjustment range:
 $\pm 0.5\text{mm}/.02''$

Power Turret (for BF)



No.176-411
Objectives: Up to 5
Visual field adjustment range:
 $\pm 0.5\text{mm}/.02''$
Positioning accuracy: $2\sigma=3\mu\text{m}/120\mu\text{inch}$
Drive life: 1,000,000 movements

V Block with Clamp



No.172-378
Maximum clamp diameter:
 $\phi 25\text{mm}/.98''$
Mass: 0.8kg/ 1.76lb
* Stage Adapter A is used together.

Swivel Center Support



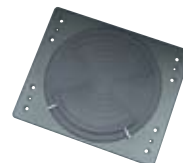
No.172-197
A tilt angle of $\pm 10^\circ$ can be supported.
Minimum reading of angle: 1°
Maximum support size: $\phi 80 \times 140\text{mm}/3.15'' \times 5.51''$ in horizontal orientation
 $\phi 65 \times 140\text{mm}/2.56'' \times 5.52''$ at a tilt angle of 10°
Mass: 2.5kg/ 5.51lb
* Stage Adapter A is required.

Holder with Clamp



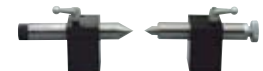
No.176-107
Maximum workpiece thickness:
35mm/ 1.38''
Mass: 0.4kg/ .88lb
* Stage Adapter A is required.

Wafer Holder



No.176-414
Wafer size: 3 to 8 inches
Rotary Holder (**No.378-363**) attached
Mass: 3.2kg/ 7.06lb

Center Support



No.176-415
Maximum support length:
250mm/9.84''
Maximum support diameter:
 $\phi 150\text{mm}/5.91''$
Maximum diameter allowing external apex observation: $\phi 140\text{mm}/5.51''$
Effective stroke of the center-clamping mechanism: 22mm/ .87''
Mass: 13kg/ 28.66lb

Stage Adapter A



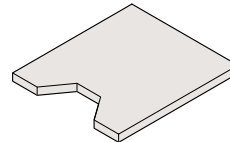
No.176-304
pieces pack Mass: 1.5kg/ 3.31lb

Rotary table with fine feed knob (B)



No.3176-306
Effective glass diameter: $\phi 240\text{mm}/9.45''$
Rotary table rotation angle: Approx. 51.5° (per full turn of the fine feed knob)
Mass: 6.5kg/ 14.33lb

Vibration Damping Pad



No.176-419
Spring pad type
Float unit material: SUS304
WxDxH = $800 \times 900 \times 49\text{mm}/31.50'' \times 35.43'' \times 1.93''$
Mass: 58kg/ 127.9lb

Machine Stand



No.176-418
Max. loading: 400kgf/ 881.8lbf
WxDxH = $1100 \times 900 \times 650\text{mm}/433.07'' \times 35.43'' \times 26.59''$
Mass: 45kg/ 99.21lb

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) | 250·150·150mm | |
| Control system/ reading unit | 3-axis motor-driven with Joystick/digital scale | |
| Resolution | 0.01μm | |
| Data processing unit | QM-DATA200/vision unit | |
| Video port | Standard equipment | |

Measuring Microscopes

MF-B/UB



| 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/ 300·170·220/400·200·220mm | |
| Control system/ reading unit | 3-axis motor-driven with Joystick/digital scale | |
| Resolution | 0.1 / 0.5 / 1μm | |
| 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) | 50·50·115/100·50·107mm |
| Control system/ reading unit | Manual/micrometer head |
| Resolution | 1 (MHD head) |
| Data processing unit | QM-DATA200 |
| Video port | None |



Our products are classified as regulated items under Japanese Foreign Exchange and Foreign Trade Law. Please consult us in advance if you wish to export our products to any other country. If the purchased product is exported, even though it is not a regulated item (Catch-All controls item), the customer service available for that product may be affected. If you have any questions, please consult your local Mitutoyo sales office.

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

Note: All information regarding our products, and in particular the illustrations, drawings, dimensional and performance data contained in this pamphlet, as well as other technical data are to be regarded as approximate average values. We therefore reserve the right to make changes to the corresponding designs, dimensions and weights. The stated standards, similar technical regulations, descriptions and illustrations of the products were valid at the time of printing. Only quotations submitted by ourselves may be regarded as definitive.

Our products are classified as regulated items under Japanese Foreign Exchange and Foreign Trade Law. Please consult us in advance if you wish to export our products to any other country. If the purchased product is exported, even though it is not a regulated item (Catch-All controls item), the customer service available for that product may be affected. If you have any questions, please consult your local Mitutoyo sales office.



Mitutoyo Corporation
20-1, Sakado 1-Chome,
Takatsu-ku, Kawasaki-shi,
Kanagawa 213-8533, Japan
T +81 (0) 44 813-8230
F +81 (0) 44 813-8231
<http://www.mitutoyo.co.jp>

