Measuring Microscopes
MF/MF-U Series

Catalog No. E14003

Meeting performance expectations for measuring microscopes
Microscopes that also serve as measuring instruments

Expectations for Measuring Microscopes
A measuring microscope can be used to perform both measurement and observation, inspecting a variety of objects including semiconductors, electronic and electrical components, automobile precision components, resin moldings, tools, and medical products. For example, this type of microscope can be used to measure an object that is too soft for contact measurement or the diameter of a hole that is too small for a measurement probe to contact. A balance between optical performance, overall accuracy, and ease of use is an important requirement for a measuring microscope. A measuring microscope enables you to observe elements that have either been invisible or difficult to see and measure them. Mitutoyo believes that expectations for measuring microscopes will continue to grow and that user friendliness, high measurement data throughput, and environmental friendliness will be demanded at the same time. To play our part in supporting essential technologies in the industry, we will continue to provide high-quality, high-definition measuring microscopes, while staying true to our commitments and beliefs.
From Design and Development to Support after Delivery

Mitutoyo designs, develops and manufactures all microscope parts – including those for the body, such as the lenses and optical tube – and the highly accurate built-in digital scale. Our in-house design and development processes allow us to, proactively, offer consultation on special requirements and respond to customer requests, such as those for customized fabrication.

Mitutoyo carefully delivers the microscope from the production plant to its desired destination*, and then installs and adjusts it there. The packaging box is recyclable, which enables the customer to eliminate as much waste as possible at the delivery destination. After adjustment, customers can sign a maintenance contract or use our reliable after-sales services according to their needs, which ensures that they can confidently use their Mitutoyo microscope for a long time to come.

*If a dedicated delivery service is used.
In Pursuit of Optical Performance — The Essence of Microscopy —

These microscopes use an optical design inherited from the previous B Series for the optical tube and objective lens to reduce flare within the optical system as much as possible and so enable the clear display of subtle details of inspected objects. With this series, even the surface of black resin can also be clearly observed in high contrast. The MF-U Series is equipped with the proven FS optical system metal microscope head and displays clear images with high color reproducibility in which the three primary colors are corrected. (The plan apochromat specifications are used for the objective lens.). For the C Series, an LED- or halogen-based lighting system can be used. Higher lighting efficiency and sufficient illuminance within the optical system provide an environment for high-magnification measurement and bright-field and dark-field observation in which you can work efficiently without getting tired.

*Specifications according to which aberrations across the image surface and chromatic aberrations in the wave length range of the three primary colors (blue, yellow, and red) are corrected.

In Pursuit of Measuring Accuracy — Close to JIS Grade 0 —

X and Y axes: (2.2+0.02L)µm or less

Reference) Measuring accuracy of each axis of a JIS B 7153 measuring microscope (at 20°C)
Grade 0: (2+0.01L)µm or less
Grade 1: (4+0.02L)µm or less
L: measuring length (mm)

A measuring microscope must have high level optical performance and overall measuring accuracy. The C Series realizes the measuring accuracy stipulated by the above standards for every stage size*. This series is useful for any measurement because it offers both long stroke measurement and high accuracy at the same time.

*Conforms to the JIS B 7153 measurement method for the X and Y axes. The above measuring accuracy graph is an example and does not represent all main unit accuracies.

The digital scale built into the microscope is a photoelectric type transmission linear encoder with a maximum response speed of 50m/min. This highly accurate encoder was developed in an underground laboratory where the world’s best scale accuracy evaluation technique is available. Mitutoyo was the first manufacturer to acquire accreditation for calibrating line standards (standard scales up to 500mm long) in Japan.

For Safe Use — Traceability to International Standards —

To establish and maintain the traceability of customer measuring tools and instruments, Mitutoyo uses length standards that directly lead to the national standards in Japan to calibrate the standard used to calibrate measuring tools and instruments. Mitutoyo also offers temperature calibration services necessary for highly accurate length measurement.

Line standard calibration unit

Underground temperature fluctuation chart

Glass scales

Specified standard

Mitutoyo Utsunomiya Measurement Standards Calibration Center (JCDC accredited calibration laboratory No. 0311)

Regular reference standard

Mitutoyo Utsunomiya Measurement Standards Calibration Center (JCDC accredited calibration laboratory No. 0311)

Inspection and calibration units

Standard and reference scales

Measuring microscopes
Solutions Provided by Measuring Microscopes

Observation and Inspection of Small Areas

By using various types of illumination, the MF Series can more precisely reproduce the colors and shapes of objects that are observed and inspected. The MF-U Series microscopes are high value-added instruments that offer microscope observation functions such as dark-field mode (to observe surface scratches and small steps, which are difficult to see in bright-field mode), simple polarization (to observe coloration or contrast through the polarizer or analyzer using polarization properties), and differential interference (to observe small surface steps and other elements in color contrast using the polarization filter with a differential interference prism), as well as measurement functions.

| Bright-field observation | Dark-field observation | Polarized observation | Differential interference observation |

Easy Image Photography

Anyone can easily photograph microscope images by attaching a digital camera to the microscope. Because a general-purpose C-mount adapter is used, any digital camera model that supports C-mounting can be attached. For example, several people can simultaneously analyze and evaluate the microscope image displayed on the monitor, or generation of an inspection chart attached to the image can be automated.

Microscope-Based High-Resolution Measurement

It is possible to build a manual image measurement system by equipping a measuring microscope with the image measurement option (the Vision Unit). Because the software constantly transmits stage displacements, measurements within the camera imaging range (on the screen) as well as those wider than the screen are supported. In addition, automatic edge detection provides an efficient measurement environment with a high throughput. However, eyepiece resolution might be superior to camera resolution in some cases. For example, the surface of a molded item made of black resin might be clearer to the naked eye than to the camera (monitor observation). Therefore, a measuring microscope that also enables you to see the surface and other elements is said to be a system that has a very high added value. It is recommended to connect the two-dimensional data processing unit QM-Data 200 (a dedicated control unit) to the measuring microscope for such dimensional measurement.
Height Measurement with a High Focus Repeatability

Focus repeatability is important when measuring a vertical step or other element using the microscope. In particular, measurement errors due to the depth of focus of the objective lens are inevitable. The MF and MF-U Series measuring microscopes have a focus pilot, which enhances focus repeatability. The focus pilot is mounted on the TV camera port section in the main unit as an add-on unit* and enables focusing position detection with high accuracy and repeatability. This realizes higher repeatability than a visual check and decreases variation in measured values caused by human error.

Two types of focus patterns are available, either of which can be selected according to the size of the part to be focused on or the surface state, material, or other properties of the inspected object. A clear, bright, high-intensity LED (green or red) is employed as the light source. The focus pattern, for which brightness can be steplessly adjusted, can be checked on the eyepiece or TV monitor. This substantially improves measurement throughput.

* This is a factory installed option for the MF-U Series.
Wide-Field Observation
(Common to MF C, MF-U C, MF D and MF-U D)

The best-in-class eyepiece field number* of 24mm (for WF10X) offers a wide viewing field that helps prevent extended observation or measurement from affecting your eyes or causing fatigue. The WF10X eyepiece, which was designed at the same time as the C Series, has wider diopter adjustment ranges on the left and right sides than older products.

*Width of an inspected object that can be seen across the whole viewing field when a 1X objective lens is used

LED and Halogen Light Options for Transmitted and Reflected Illumination
(Common to MF C, MF-U C, MF D and MF-U D)

An LED or halogen light can be selected for the coaxial illumination in the main unit. While the conventional halogen light can be used for observation and measurement, the LED light can also be selected if you want to reduce the time lost to replace a failed halogen bulb with a new one and need high intensity illumination that quickly responds to brightness adjustment. The LED light has a long working life*1 and will not suddenly fail. In addition, the visibility, brightness and coloration are constant because, unlike fluorescent tubes, the LED light is free from glare and changes in color temperature. This means less eye fatigue after extended observation. Because the LED consumes little power and emits little heat radiation, measurement is economical and produces less heat-induced effects on inspected objects*2. In addition, this light source is impact resistant and does not contain environmental toxins.

High Visibility Digital Display
(Common to MF C and MF-U C)

Because the resolution can be switched to 1µm, 0.5µm, or 0.1µm for the digital display (two or three axes), which is a standard accessory for all models, high-discrimination measurement can be performed. The zero-set, direction changeover, and smoothing functions are also standard. (Zero can be set using the switch near the X or Y handwheel.) Because the general-purpose RS-232C format is adopted for data transfer, data can be output to a standard printer or personal computer. It is also possible to output the display readings to spreadsheet software. The digital display can be installed on the left or right* side of the column.

*Factory installed option.

Highly Rigid Column Base
(Common to MF C, MF-U C, MF D and MF-U D)

The base that supports the column holding the optical tube and the rest of the microscope must be absolutely rigid to enable observation and measurement using any amount of magnification. This series has been repeatedly evaluated from various aspects including a drop test*, transportation test*, and smoothing test and provides steady vision and consistent accuracy over the entire stroke. To enhance rigidity, horizontal ribs have been added within the column. The power supply section is located outside the base to reduce heat effects for higher base rigidity and highly accurate measurement.

*Proprietary Mitutoyo tests executed using appropriate procedures.
Quick Release Mechanism*¹ and Zero-set Switch Incorporated*² (Common to MF C and MF-U C)

The stage movement can be switched between extremely coarse and fine (FREE and LOCK) by using the quick release handles on the X and Y handles. These handles are useful for freeing the stage when the distance to the measurement position is long or you want to quickly return to a reference position.

Because this mechanism uses the twist roller method, switching causes little impact and enables smooth movement. Because the display zero-set switches are located near the handles*², you can focus on the eyepiece during measurement and keep your hand near the handle almost all the time except when adjusting the focus.

*¹: Patent pending (Japan)
*²: The zero-set buttons are located on the X and Y axes, not the Z axis.

Stage Variations Including Long Stroke (Common to MF C and MF-U C)

Inspected objects vary in size. Widely used in every industry, this series provides many measurement stroke variations.

This series offers a stage for long stroke measurement of 400×200×220mm in X, Y and Z. This is useful when measuring printed circuit boards, shafts, knife tools and other objects. Although the standard model has a Z-axis range of 220mm, the Z axis can be extended with a column upgrade. A swivel rotation mechanism* is also provided as standard. This mechanism is useful when fixing an inspected object in parallel with the table movement direction.

*Only for models with a Y-axis range of 170mm or longer

Z-Axis Handles Provided on Both Sides of Standard Model (MF C and MF-U C)

Because the Z axis handles are placed on both sides of the column in standard models, the user can easily use one of them regardless of handedness.

The digital display can also be installed on either side of the column to set up an environment suited to the user’s dominant hand.

Ergonomics have also been taken into consideration, and the handle is located in a position where a user of shorter stature can comfortably turn it.

Tilting Optical Tube of Standard Model (MF-U C and MF-U D)

Comfortable observation is possible because the eye point can be adjusted to a position suitable for the user’s stature.

The angle of the column can be fixed anywhere between 0° and 30°. The reticle in the optical tube can be replaced.

Stage Variations Including Long Stroke

Widely used in every industry, this series provides many measurement stroke variations.

This series offers a stage for long stroke measurement of 400×200×220mm in X, Y and Z. This is useful when measuring printed circuit boards, shafts, knife tools and other objects. Although the standard model has a Z-axis range of 220mm, the Z axis can be extended with a column upgrade.

A swivel rotation mechanism* is also provided as standard. This mechanism is useful when fixing an inspected object in parallel with the table movement direction.

*Only for models with a Y-axis range of 170mm or longer

Sliding Nosepiece (Factory installed option for MF C and MF D)

Usually, only one objective lens can be attached to an MF instrument (limited compensation optical system), and this must be replaced to change the magnification.

Because up to two objective lenses can be attached to the sliding nosepiece, the magnification can be quickly changed when this option is specified.

Note: An external illumination source cannot be attached.
Measuring Microscopes
MF Series (MF C)

Features
- Observation with a clear and flare-less erect image and a wide field of view
- Measuring accuracy that is the highest in its class (conforms to JIS B 7153)
- ML series, high-NA objectives that are specially designed for the MF series (long working distance type)
- Illumination unit (reflected/transmitted) selectable from a high-intensity LED or halogen bulb (required)
- Variable aperture diaphragm (reflected/transmitted) allows observation measurement while suppressing light diffraction
- Variety of standardized stages in sizes up to 400×200mm
- Quick-release mechanism useful for moving the stage quickly when measuring workpieces that are large in size or quantity
- Coarse/fine feed handles equipped as standard on both sides allow precise focus and observation measurement regardless of handedness
- High-magnification eyepiece observation up to 2000X
- Standard measuring microscope that has a wide variety of optional accessories including a Vision Unit and various digital CCD cameras
- Low-noise design

MF-B1010C
* The binocular tube (eyepiece) and illumination unit are optional accessories.

MF-B2010C
* The binocular tube (eyepiece) and illumination unit are optional accessories.
### Specifications

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<thead>
<tr>
<th>Without Z-axis scale</th>
<th>With Z-axis scale</th>
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<td><strong>Model No.</strong></td>
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</tr>
<tr>
<td><strong>Order No.</strong></td>
<td>176-662*</td>
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<tr>
<td><strong>Model No.</strong></td>
<td>MF-A2010C</td>
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<td>MF-A4020C</td>
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<td><strong>Order No.</strong></td>
<td>176-666*</td>
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**Optical tube (eyepiece(s)) required:**
- Monocular or binocular (angle of column: 25°)
- Standard TV camera port for all models, reticle (broken cross-hair, line width: 5µm), optical path switching (observation/TV camera = 50/50)

**Observation image:**
- Bright-field observation

**Observation method:**
- 10X (eyepiece field number: 24), 15X, 20X

**Eye piece (optional):**
- Adjustable diopter

**Objective (optional):**
- Max. workpiece height: 150mm
- ML objective 3X (provided as standard), 1X, 3X, 10X, 20X, 50X, 100X

**Feed mechanism:**
- Coaxial coarse and fine feed, handles on both sides (coarse: 30mm/rotation, fine: 0.2mm/rotation)

**Illumination unit:**
- LED or halogen is required

**Illumination filter:**
- One GIF filter is provided as standard (and mountable for both transmitted and reflected illumination)

**Stage:**
- Measurement range: 100x100mm, 200x100mm, 200x170mm, 300x170mm, 400x200mm
- Tabletop size: 280x280mm, 350x280mm, 410x342mm, 510x342mm, 610x342mm
- Effective stage glass size: 180x180mm, 250x150mm, 270x240mm, 370x240mm, 440x240mm
- Swiveling angle: ±5° (left) ±3° (left)
- Maximum table loading (glass top): 10kg, 20kg, 15kg
- Quick-release mechanism: Provided as standard for the X and Y axes
- Zero-set button: Provided as standard for the X and Y axes (and for the Z axis only for the MF-B type)

**Measurement system:**
- High-accuracy digital scale

**Measuring accuracy:**
- (2.2+0.02L)µm, L: measuring length (mm)

**Digital display:**
- Minimum reading: 10.5/0.1/0.05 µm switchable
- Display axes: X and Y (or X, Y, and Z only for the MF-B type)
- Functions: Zero-setting, direction switching, RS-232C output

**Main unit dimensions (WxDxH):**
- 562x730x667mm
- 624x745x667mm
- 632x892x782mm
- 682x892x782mm
- 757x907x782mm

**Main unit mass:**
- 65.5kg
- 69.5kg
- 130kg
- 138kg
- 144kg

**Control unit dimensions and mass:**
- 1140x330x90x590mm
- 2.0kg

**Maximum power consumption:**
- LED: 65W
- Halogen bulb: 120W

**Replacement halogen bulb:**
- Standard: 513667 (12V/50W)
- Long life: 12BAB345 (12V/50W)

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Note: The following suffixes are added to the order No. (e.g.: 176-662-10) to specify the User Manual's language: -10 for English; -11 for Chinese; no suffix for Japanese.

*1: Patent registered in Japan. *2: Measured in conformance with JIS B 7153
Universal Measuring Microscopes
MF-U Series (MF-U C)

■ Observation with a clear and flare-less erect image and a wide field of view
■ Measuring accuracy that is the highest in its class (and conforms to JIS B 7153)
■ Proven M Plan Apo/BD Plan Apo/G Plan Apo series, high-NA objectives from the FS optical system (long working distance type)
■ Integration of metallurgical and measurement microscope functions provides a high-resolution observation and high-accuracy measurement solution
■ Illumination unit (reflected/transmitted) selectable from a high-intensity LED or halogen bulb (required)
  * Only the halogen light source for transmitted illumination is provided as standard accessory. A separate light source for transmitted illumination must be ordered additionally as optional accessory.
■ Variable aperture diaphragm (reflected/transmitted) allows observation measurement while suppressing light diffraction
■ Variety of standardized stages in sizes up to 400x200mm
■ Quick-release mechanism useful for moving the stage quickly when measuring workpieces that are large in size or quantity
■ Coarse/fine feed handles equipped as standard on both sides allow precise focus and observation measurement regardless of handedness
■ High-magnification eyepiece observation up to 4000X (when using M Plan Apo SL200X)
■ Standard measuring microscope that has a wide variety of optional accessories including a Vision Unit and various digital CCD cameras
■ Low-noise design

MF-UB1010C
* The turret, objectives and illumination unit are optional accessories.

MF-UB2010C
* The turret, objectives and illumination unit are optional accessories.

Features

Mitutoyo
### Specifications

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<tr>
<td>MF-UB4020C</td>
<td>176-698*</td>
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**Observation image**
- BF (bright-field)
- BD (bright-field/dark-field)

**Illumination unit**
- LED or halogen is required

**Illumination filter**
- One GIF filter is provided as standard (and mountable for both transmitted and reflected illumination)

**Stage**
- Measuring range: 100x100mm, 200x100mm, 300x100mm, 400x200mm
- Tabletop size: 280x280mm, 350x280mm, 410x342mm
- Effective stage glass size: 180x180mm, 250x150mm, 270x240mm, 370x240mm
- Swiveling angle: ±5° (left), ±3° (left)
- Maximum table loading (grip top): 10kg, 20kg
- Quick-release mechanism: Provided as standard for the X and Y axes

**Measurement system**
- High-accuracy digital scale
- Measuring accuracy:
  - X and Y axes, when not loaded: (2.2±0.02L)µm, L: measuring length (mm)

**Digital display**
- Minimum reading: 1/10,000, 1µm switchable
- Display axes: X and Y (or X, Y, and Z only for the MF-UB and -UD types)

**Main unit dimensions (WxDxH)**
- 562x730x667mm, 624x745x667mm, 632x892x782mm, 682x892x782mm, 757x907x782mm

**Control unit dimensions and mass**
- 114x50x250mm, 2.0kg

**Maximum power consumption**
- LED: 70W
- Halogen bulb: 70W

**Replacement halogen bulb**
- Standard: 513667 (12V/50W)
- Long life: 12BA8345 (12V/50W)

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* Note: The following suffixes are added to the order No. (e.g.: 176-668-10) to specify the User Manual’s language: -10 for English; -11 for Chinese; No suffix for Japanese.
*1: Patent registered in Japan  
*2: Measured in conformance with JIS B 7153  
*3: The value only in a transmitted illumination

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### Optical tube
- Tilting trinocular tube (angle of column: 0 to 30°), Siedentoph type (pupil distance adjustment: 51 to 76mm), built-in 1X tube lens, reticle (broken cross-hair, line width: 5µm), optical path switching (observation/TVC camera = 50/50)

### Eyepiece (optional)
- adjustable diopter: 10X (eyepiece field number: 24, two eyepieces provided as standard), 15X, 20X

### Turret (required)
- Bright-field (BF): Adjustable manual turret or adjustable power turret (Select one.)
- Bright-field/dark-field (BD): Adjustable manual turret or adjustable power turret (Select one.)

### Objective (optional)
- Bright-field (BF): All lenses including the M Plan Apo, M Plan Apo SL, and G Plan Apo series
- Bright-field/dark-field (BD): All lenses including the BD Plan Apo and BD plan Apo series

### Z axis
- Table: 150mm, 220mm
- feed mechanism: Coaxial coarse and fine feed, handles on both sides (coarse: 10mm/rotation, fine: 0.1mm/rotation)

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### Stage
- Measuring range: 100x100mm, 200x100mm, 300x100mm, 400x200mm
- Tabletop size: 280x280mm, 350x280mm, 410x342mm
- Effective stage glass size: 180x180mm, 250x150mm, 270x240mm, 370x240mm
- Swiveling angle: ±5° (left), ±3° (left)
- Maximum table loading (grip top): 10kg, 20kg
- Quick-release mechanism: Provided as standard for the X and Y axes
- Zero-set button: Provided as standard for the X and Y axes (and for the Z axis only for the MF-UB and -UD types)
- Measurement system: High-accuracy digital scale
- Measuring accuracy:
  - X and Y axes, when not loaded: (2.2±0.02L)µm, L: measuring length (mm)

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### Digital display
- Minimum reading: 1/10,000, 1µm switchable
- Display axes: X and Y (or X, Y, and Z only for the MF-UB and -UD types)
- Digitally switchable, direction switching, 8-bit 242 output
- Zero-setting, direction switching, 8-bit 242 output

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### Main unit mass
- 65.5kg, 69.5kg, 130kg, 138kg, 144kg
- Control unit mass: 2.0kg
- Maximum table loading (grip top): 10kg, 20kg
- Maximum power consumption (LED): 70W
- Maximum power consumption (Halogen bulb): 70W

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### Control unit dimensions and mass
- 114x50x250mm, 2.0kg
- Maximum table loading (grip top): 10kg, 20kg
- Maximum power consumption (LED): 70W
- Maximum power consumption (Halogen bulb): 70W

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### Measurement system
- High-accuracy digital scale
- Measuring accuracy:
  - X and Y axes, when not loaded: (2.2±0.02L)µm, L: measuring length (mm)

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### Digital display
- Minimum reading: 1/10,000, 1µm switchable
- Display axes: X and Y (or X, Y, and Z only for the MF-UB and -UD types)
- Digitally switchable, direction switching, 8-bit 242 output
- Zero-setting, direction switching, 8-bit 242 output

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### Main unit mass
- 65.5kg, 69.5kg, 130kg, 138kg, 144kg
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- Maximum power consumption (LED): 70W
- Maximum power consumption (Halogen bulb): 70W

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### Control unit dimensions and mass
- 114x50x250mm, 2.0kg
- Maximum table loading (grip top): 10kg, 20kg
- Maximum power consumption (LED): 70W
- Maximum power consumption (Halogen bulb): 70W
Options
System Diagrams

- Monocular unit (with one 10X eyepiece)
  - 176-392
- Binocular unit (with two 10X eyepieces)
  - 176-393
- 10X eyepiece
  - 378-866 (two)/378-866-5 (one)
- 15X eyepiece
  - 378-857 (two)/378-857-5 (one)
- 20X eyepiece
  - 378-858 (two)/378-858-5 (one)
- 10X protractor eyepiece
  - 375-043
- 10X digital protractor eyepiece
  - 176-313
- GIF filter
  - 12AAA645
- LB80 filter
  - 12AAA646
- ND2 filter
  - 12AAA643
- ND8 filter
  - 12AAA644
- Rotary table with fine feed wheel (A)
  - 176-305
- Holder with clamp 176-107
  - V-block with clamp 172-378
  - Swivel center support 172-197
- Stage adapter B
  - 176-310
- Stage adapter
  - 176-304
- Rotary table with fine feed wheel (B)
  - 176-306
- Holder with clamp 176-107
  - V-block with clamp 172-378
  - Swivel center support 172-197
- Rotary table with fine feed wheel (with scale) 172-198
- Holder with clamp 176-107
  - V-block with clamp 172-378
  - Swivel center support 172-197
- 100X ML objective
  - 375-053
- Vibration damping stand
  - 176-308
- Mounting stand (microscope + QM-Data 200)
  - 176-309
- Vertical system rack (for Vision Unit)
  - 998923
- Lens cleaning set
  - 12AAA165
- Stage micrometer
  - 375-056
- Focus pilot FP-05 (LED type)
  - 375-057 (Green)/375-058 (Red)
- RS-232C (crossing) cable 12AAAB80
- Foot switch
  - 12AAAB80
- Foot switch (highly rigid type)
  - 12AAAB80
- Real-time process control program
  - QM-Data 200
- Vibration damping stand
  - 176-308
- Mounting stand (microscope + QM-Data 200)
  - 176-309
- Vertical system rack (for Vision Unit)
  - 998923
- Lens cleaning set
  - 12AAA165
- Stage micrometer
  - 375-056

*: Order No. depends on the destination.
Foot switch 12AAA088
Calibration chart 02AKN020
Calibration chart with holder 02ATN695
Real-time process control program MeasureLink
Inspection table creation program MeasureReport
Note: PC is required.
Thermal printer DPU414*1 (with connecting cable)
Foot switch: 12AAA088
RS232C (crossing) cable 12AAA807
Thermal printer DPU414*1 (with connecting cable)

GIF filter (for light source) 12AAG806
RS232C (crossing) cable 12AAA807
Thermal printer DPU414*1 (with connecting cable)

Foot switch 12AAA088
Calibration chart 02AKN020
Calibration chart with holder 02ATN695
Real-time process control program MeasureLink
Inspection table creation program MeasureReport
Note: PC is required.
Thermal printer DPU414*1 (with connecting cable)
Foot switch: 12AAA088
RS232C (crossing) cable 12AAA807
Thermal printer DPU414*1 (with connecting cable)

GIF filter (for light source) 12AAG806
RS232C (crossing) cable 12AAA807
Thermal printer DPU414*1 (with connecting cable)

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Foot switch 12AAA088
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Real-time process control program MeasureLink
Inspection table creation program MeasureReport
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Thermal printer DPU414*1 (with connecting cable)
Foot switch: 12AAA088
RS232C (crossing) cable 12AAA807
Thermal printer DPU414*1 (with connecting cable)

GIF filter (for light source) 12AAG806
RS232C (crossing) cable 12AAA807
Thermal printer DPU414*1 (with connecting cable)
Motor-Driven Measuring Microscopes
MF/MF-U Series (MF D / MF-U D)

To the next stage
The measuring microscope’s X, Y, and Z axes are now motor driven, and the stage can be operated from a remote control box. A joystick is used to operate the X and Y axes, and a jog shuttle is used to operate the Z axis, thus realizing a natural feeling when handling the equipment. Furthermore, these microscopes are equipped with a Z limit that you can use to set the lower limit of the Z-axis movement, which enables you to prevent the objective lens from colliding with the workpiece.

The operator is relieved from fatigue resulting from repeated handle-turning. Installing a vision unit makes it possible to perform vision AF (auto focus). For the MF-U power type and MF-U power LAF type, selecting the power turret makes it possible for the microscope to automatically recognize the position of the objective lens in the vision unit.

A power model lineup with large stage sizes ranging from 200×170mm to 400×200mm

A button for coarse and fine feed switching and speed-adjustment function that are highly useful during long stroke sliding and fine positioning, are provided as standard equipment.

The buttons on the remote control box, which is used to perform operations, have been placed to provide operations that feel natural.

The remote control box is standard equipped with a data output button and counter reset buttons for the X, Y, and Z axes, which enables you to perform a variety of operations remotely.

Products equipped with LAF (laser auto focus) are also included in the lineup of MF-U power products, which improves the efficiency of the focusing operation. Models that have LAF are equipped not only with the normal Just Focus (JF) function, but also with the Tracking Focus (TF) function that maintains the focus as the stage moves.

These functions cater to focusing requirements in a variety of situations, reducing the amount of work that the operator has to perform.

Features

- The binocular tube, eyepieces, and LED illumination unit are optional accessories.
- A separate LED control unit and control unit are included.

MF-G2017D

* The binocular tube, eyepieces, and LED illumination unit are optional accessories.
* A separate LED control unit and control unit are included.

MF-UG4020D

* The turret, objective lenses, and LED illumination unit are optional accessories.
* A separate LED control unit and control unit are included.

MF-UE2017D

* The turret, objective lenses, and LED illumination unit are optional accessories.
* A separate LED control unit and control unit are included.

*1: A separate vision AF cable (No. 12AAN358) is required.
*2: A separate RS-232C cable (No. 12AAA807) is required.
The X, Y, and Z axes are all motor driven. A joystick is used to operate the X and Y axes, and a jog shuttle is used to operate the Z axis, so operations during measurement can be performed from the remote control box. This eliminates the conventional handle-turning and focusing operations, reducing fatigue for the operator.

The X and Y axes are driven with a maximum feed speed of 40mm/s and the Z axis with a maximum feed speed of 20mm/s. The lineup includes models that have large stages with sizes ranging from 200×170mm to 400×200mm. Furthermore, the change to a motor-driven Z axis enables you to use the new vision AF function, provided you also use the optional vision unit.*1

*A separate vision AF cable (No. 12AAN358) must be connected.

While our motor-driven measuring microscopes inherit the options and functions of our manually operated measuring microscopes, they have even greater expandability. As with our conventional measuring microscopes, our motor-driven measuring microscopes can be equipped with the “QM-Data200” two-dimensional data processing unit and the “Vision Unit” manual image measurement system that detects edges with its installed digital camera.

It is now possible to perform vision AF by using a vision AF cable together with a vision unit, thanks to the new motor drive.

**Combination of the MF-G2017D and the QM-Data200**

**Combination of the MF-G2017D, the 10D vision unit, and a vision AF cable**

By using an optional vision unit and vision AF cable, you can perform vision AF. In the vision unit software QSPAK, the position in the acquired image data with the highest contrast is detected and the auto focus operation performed. This operation can be conducted faster than carrying out focusing with the naked eye, which contributes to reduction in operation time and operator fatigue.
Motor Driven (Option for MF-U Power Product and MF-U Power LAF Product)

A turret must be selected for the MF-U power product and MF-U power LAF product. By selecting the power turret and equipping the measuring microscope with an optional vision unit, it is possible to change and detect the turret position.*1

This is a new function that is available in the QSPAK VUE version 4.1 and subsequent versions of the 10D vision unit software.

You can use the software to change and automatically detect the turret position, so there is no longer any need to handle the turret. Furthermore, this also fixes the problem of forgetting to change calibration values when you change the magnification, thereby providing you with a system that is more reliable and easy to use.

*1: A separate RS-232C cable (No. 12AAAA807) is required.

Turret Position Display in QSPAK

This image corresponds to 4-hole power turrets and 4-hole turrets with sensors.

Laser Auto Focus (Power LAF Type Only)

LAF (laser auto focus) can be performed by the power LAF product. By employing AF that uses the TTL (Through The Lens) method, in which a semiconductor laser beam with a wavelength of 690nm passes through the lens, these microscopes can perform AF even on minutely-small areas.

Laser auto focus has better repeatability than focusing with the naked eye, and it can be used to measure heights. Furthermore, the following two types of focus functions are equipped as standard: JF (Just Focus), which can be used to target the laser on the point where you want to focus in order to detect the height, and TF (Tracking Focus), which always tracks the focus position.
## Specifications for MF D

<table>
<thead>
<tr>
<th>Model No.</th>
<th>MF-G2017D</th>
<th>MF-G3017D</th>
<th>MF-G4020D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>176-781*</td>
<td>176-782*</td>
<td>176-783*</td>
</tr>
</tbody>
</table>

- **Optical tube (eyepiece(s) required)**: Monocular or binocular (angle of column: 25°)
- **Observation image**: Standard TV camera port for all models, reticle (broken cross-hair, line width: 5µm), observation/TV camera = 50/50
- **Observation method**: Bright-field observation
- **Eyepiece (optional)**: Adjustable dioptr
- **Objective (optional)**: ML objective 3X (provided as standard), 1X, 5X, 10X, 20X, 50X, 100X
- **Z axis**: Max. workpiece height 220mm
- **Feed mechanism**: Motor drive (Maximum measuring speed: 20mm/s)

### Illumination unit (required)
- **LED**
  - Transmitted: Telecentric, built-in aperture diaphragm, white LED light source, stepless brightness adjustment, equipped with cooling fan
  - Reflected: Kohler illumination with adjustable aperture diaphragm, white LED light source, stepless brightness adjustment
- **Halogen**
  - Transmitted: Telecentric, built-in aperture diaphragm, 12V50W halogen lamp, stepless brightness adjustment, with cooling fan
  - Reflected: Kohler illumination with adjustable aperture diaphragm, 12V50W halogen lamp, stepless brightness adjustment with cooling fan

### Illumination filter
- One GIF filter is provided as standard (and mountable for both transmitted and reflected illumination)

### Stage
- **Measurement range**: 200×170mm, 300×170mm, 400×200mm
- **Tabletop size**: 410×342mm, 510×342mm, 610×342mm
- **Effective stage size**: 270×240mm, 370×240mm, 440×240mm
- **Swiveling angle**: ±5°, ±3°
- **Maximum table loading (glass top)**: 20kg, 15kg

### Measurement system
- High-accuracy digital scale *1
- **Measuring accuracy**
  - (X and Y axes, when not loaded): (2.2 + 0.02L)µm, L: measuring length (mm)
- **Digital display**: Minimum reading 1/0.5/0.1µm switchable
- **Display axes**: X, Y and Z axes
- **Functions**: Zero-setting, direction switching

### Remote BOX
- Joystick (X and Y axes drive), lock button (X and Y axes), speed adjustment (X, Y and Z axes), coarse/fine adjustment button (X, Y and Z axes)
- Jog shuttle (Z axis drive), limit setting (Z axis), emergency stop switch, power source backup switch
- AF button (vision auto focus): effective when connecting to vision unit (optional)
- Reset button (X, Y and Z axes counter), data output button

### Main unit dimensions (WxDxH)
- 632×892×782mm, 682×892×782mm, 757×907×782mm
- **Main unit mass**: 158kg, 164kg
- **Control unit dimensions**: 355×364×106.5mm
- **Main unit mass**: 7kg
- **Dimensions for control unit for illumination unit (WxDxH)**: 114×365×96mm
- **Mass for control unit for illumination unit**: LED: 3.5kg, halogen: 4kg
- **Maximum power consumption**: 230W

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*1: Patent registered in Japan

*2: Measured in conformance with JIS B 7153.

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* To denote your AC line voltage add the following suffixes to the order No.: A for UL/CSA, D for CEE, E for BS, DC for China, K for EK, C for Taiwan, No suffix is required for JIS/100V

*1: Patent registered in Japan

*2: Measured in conformance with JIS B 7153.
Specifications for MF-UD

### Motorized Without Z-axis scale

<table>
<thead>
<tr>
<th>Model No.</th>
<th>MF-UG0217D</th>
<th>MF-UG3017D</th>
<th>MF-UG4020D</th>
<th>MF-UE217D</th>
<th>MF-UE3017D</th>
<th>MF-UE4020D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>176-784*</td>
<td>176-785*</td>
<td>176-786*</td>
<td>176-790*</td>
<td>176-79*1</td>
<td>176-792*</td>
</tr>
</tbody>
</table>

### Motorized With Z-axis scale

<table>
<thead>
<tr>
<th>Model No.</th>
<th>MF-UH0217D</th>
<th>MF-UH3017D</th>
<th>MF-UH4020D</th>
<th>MF-UF217D</th>
<th>MF-UF3017D</th>
<th>MF-UF4020D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>176-787*</td>
<td>176-788*</td>
<td>176-789*</td>
<td>176-793*</td>
<td>176-794*</td>
<td>176-795*</td>
</tr>
</tbody>
</table>

- **Optical tube (eyepiece: required)**: Built-in 1X tube lens, reticle (broken cross-hair, line width: 5µm), observation TV camera = 50/50
- **Observation image**: Erect image
- **Observation method**: BF, DF (only for MF-UH and UF types), simple polarization, differential interference
- **Eyepiece (optional)**: Adjustable diopter
- **Turret (required)**: Bright-field (BF), transmissive: Telecentric, built-in aperture diaphragm, white LED light source, stepless brightness adjustment, equipped with cooling fan, Reflected: Kohler illumination with adjustable aperture diaphragm, white LED light source, stepless brightness adjustment, equipped with cooling fan
- **Objective (optional)**:
  - **Bright-field (BF)**: M Plan Apo, M Plan Apo SL, G Plan Apo series
  - **Bright-field/dark-field (BD)**: BD Plan Apo, BD Plan Apo SL series
- **Z axis**: Max. workpiece height 220mm
- **Illumination unit (required)**:
  - **LED**: Transmitted: Telecentric, built-in aperture diaphragm, white LED light source, stepless brightness adjustment, equipped with cooling fan
  - **Halogen**: Transmitted: Telecentric, built-in aperture diaphragm, 12V/50W halogen lamp, stepless brightness adjustment, with cooling fan
  - **Control unit**: Power switch (main switch), AC power supply input connector (100 to 240V)
- **Illumination filter**: One GIF filter is provided as standard (and mountable for both transmitted and reflected illumination)
- **Stage**: Measuring range 200x170mm, 300x170mm, 400x200mm, Tabletop size 410x342mm, 510x342mm, 610x342mm, Effective stage glass size 270x240mm, 370x240mm, 440x240mm, Swiveling angle ±5°, ±3°, ±5°, ±3°, Maximum table loading (glass top) 20kg, 15kg, 20kg, 15kg
- **Measurement system**: High-accuracy digital scale *2
- **Measuring accuracy****: X (0.2 + 0.02L)µm per 1mm, Y: 0.2µm per 1mm, L: measuring length (mm)
- **Digital display**: Minimum reading 1/0.5/0.1µm switchable
- **Remote BOX**: Joystick (X and Y axes drive), lock button (X and Y axes), speed adjustment (X, Y and Z axes), coarse/fine adjustment button (X, Y and Z axes), Jog shuttle (Z axis drive), limit setting (Z axis), emergency stop switch, power source backup switch, AF button (vision auto focus): effective when connecting to vision unit (optional)
- **LAF button (laser auto focus)**: effective only for LAF models, just focus (JF), tracking focus (TF)
- **Reset button (X, Y and Z axes counter)**, data output button
- **Laser auto focus (LAF)**: —
- **Main unit dimensions (WxDxH)**: 632x892x782mm, 632x892x782mm, 757x987x872mm, 757x987x872mm, 608x790x846mm, 608x790x846mm, 658x790x846mm, 658x790x846mm, 733x790x846mm
- **Main unit mass**: 150kg, 158kg, 164kg, 155kg, 163kg, 169kg
- **Dimensions for control unit for illumination unit (WxDxH)**: 355x364x106.5mm
- **Main unit mass**: 15kg
- **Main unit (WxDxH)**: 7kg
- **Dimensions for control unit for illumination unit (WxDxH)**: 114x365x96mm
- **Mass for control unit for illumination unit**: LED: 3.5kg, halogen: 3.5kg
- **Maximum power consumption**: 230W

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* To denote your AC line voltage add the following suffixes to the order No.: A for UL/CSA, D for CEE, E for BS, DC for China, K for EC, C for Taiwan, No suffix is required for JIS/100V

*1: Make sure that you use RS-232C cable (No. 12AA4807) to connect a LAF model and a power turret.

*2: Patent registered in Japan.

*3: Measured in conformance with JIS B 7153.
Optional Accessories
System Diagrams
Our eyepieces provide a wide field of view (with field number 24 when using 10X magnification) to enable easy observation and measurement of objects. The standard objectives provide a bright image with a long working distance and less flare. For both the bright-field and dark-field FS objectives, plan apochromat specifications are used. We think that being able to observe and measure objects without fatigue, even for long periods of time, is very important.

### Optional Accessories

#### Lenses

Our eyepieces provide a wide field of view (with field number 24 when using 10X magnification) to enable easy observation and measurement of objects. The standard objectives provide a bright image with a long working distance and less flare. For both the bright-field and dark-field FS objectives, plan apochromat specifications are used. We think that being able to observe and measure objects without fatigue, even for long periods of time, is very important.

### Eyepieces

<table>
<thead>
<tr>
<th>Eyepieces</th>
<th>Magnification</th>
<th>Field number</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>WF10X/24</td>
<td>10X</td>
<td>24</td>
<td>MF C / MF-U C / MF D / MF-D</td>
</tr>
<tr>
<td>WF15X/16</td>
<td>15X</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>WF20X/12</td>
<td>20X</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

#### Optical Tubes

<table>
<thead>
<tr>
<th>Monocular Tube</th>
<th>Magnification</th>
<th>Field number</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No. 176-392</td>
<td>10X</td>
<td>24</td>
<td>Required for MF C / MF D</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Binocular Tube</th>
<th>Magnification</th>
<th>Field number</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No. 176-393</td>
<td>10X</td>
<td>24</td>
<td>Required for MF C / MF D</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tilting Binocular Tube</th>
<th>Magnification</th>
<th>Field number</th>
<th>Angle of column (tilt angle)</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No. 176-393</td>
<td>10X</td>
<td>24</td>
<td>0~30°</td>
<td>Included in MF-U C / MF-U D as standard</td>
</tr>
</tbody>
</table>

### Digital Protractor Eyepiece

<table>
<thead>
<tr>
<th>Order No.</th>
<th>176-313*</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Eyepiece detector unit</th>
<th>Magnification</th>
<th>Field number</th>
<th>Reel width</th>
<th>Line width</th>
<th>Field width</th>
<th>Arc minutes</th>
<th>Arc seconds</th>
<th>Maximum reading</th>
<th>Minimum reading</th>
<th>Output</th>
<th>Power supply</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital counter (standard equipment)</td>
<td>10X</td>
<td></td>
<td>0.01°</td>
<td>1.0 µm</td>
<td></td>
<td></td>
<td></td>
<td>0.00° to ± 369°</td>
<td>0.00° to ± 369°</td>
<td>AC100~120V</td>
<td></td>
<td>MF C / MF D</td>
</tr>
<tr>
<td>Supports CE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>As standard</td>
</tr>
</tbody>
</table>

*This measurement system does not always supply power to the internal scale to display absolute values. The system measures coordinates from any fixed origin.

*1 Order No. depends on the destination.
For inspection or observation using a microscope, high resolution and an ultra-long working distance are important factors for objective usability. Also, using the apochromat specifications (for correction of the red, blue, and yellow wavelengths) to correct chromatic aberration over a wide range of wavelengths and the plan specifications to correct distortion in the image surface, and point aberrations, is also important for getting a clear image across the whole field of view. Mitutoyo’s high quality FS objectives have these characteristics, which expands the range of applications for a microscope and greatly improves its usability. These objectives are also helpful when installed in a measuring microscope. The M Plan Apo series and BD Plan Apo series are provided for bright-field observation. The SL (super long) specifications are available for when a long working distance is required. The G Plan Apo series is available corrected for observation through glass of thickness 3.5mm (or 2 to 5mm to special order).

**ML objectives**  
Limited-correction optical system ... For MF C / MF D

**FS objectives**  
Infinity corrected optical system ... For MF-U C / MF-U D  
For bright-field (BF) observation and measurement

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* Refer to Catalog No. E4191 "MICROSCOPE UNITS AND OBJECTIVES" for details.
Optional Accessories
Illumination

How illumination (a light source) is used is important for observing and measuring various inspected objects such as semiconductors, electronic or electric components, automobile precision components, resin moldings, tools, medical products, and printed materials with clarity and high contrast. Select the best illumination according to the shape, surface conditions, color, and materials in the inspected object.

### A: Reflected illumination and transmitted illumination (required)

#### LED Illumination Unit

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Made up of lamp housing (for reflected illumination and transmitted illumination) and an LED control unit. The LED control unit can be fixed to the rear of the column of the microscope main unit.</th>
<th>White light LED (low power consumption: 65W)</th>
<th>Rated life of approximately 30,000 hours continuously variable brightness control</th>
<th>Built-in cooling fan (includes an alarm for indicating that the fan has stopped)</th>
<th>A color filter can be attached to a reflected or transmitted illumination unit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>176-345 (MF C) / 176-445 (MF D)</td>
<td>Order No.</td>
<td>LED Illumination Unit</td>
<td>Order No.</td>
<td>External dimensions (mm)</td>
<td>Applicable model</td>
</tr>
<tr>
<td></td>
<td>Transmitted illumination unit: 66×103 (maximum protrusion)</td>
<td>LED control unit: 118(W)×365(D)×96(H)</td>
<td>MF C/MF D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Halogen Illumination Unit

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Made up of lamp housing (for reflected illumination and transmitted illumination) and a halogen control unit. The halogen control unit can be fixed to the rear of the column of the microscope main unit.</th>
<th>12V, 50W halogen lamp, continuously variable brightness control</th>
<th>Built-in cooling fan (includes an alarm for indicating that the fan has stopped)</th>
<th>A color filter can be attached.</th>
</tr>
</thead>
<tbody>
<tr>
<td>176-347 (MF C) / 176-348 (MF-U C) / 176-447 (MF D) / 176-448 (MF-U D)</td>
<td>Order No.</td>
<td>External dimensions (mm)</td>
<td>Reflected and transmitted illumination unit: 91×106 (maximum protrusion)</td>
<td>Halogen control unit: 118(W)×365(D)×96(H)</td>
</tr>
<tr>
<td></td>
<td>118(W)×365(D)×96(H)</td>
<td>91(W)×106(D)×96(H)</td>
<td>91(W)×106(D)×96(H)</td>
<td>MF C/MF-U C/MF D/MF-U D</td>
</tr>
</tbody>
</table>

*Note: MF-U C is available only for transmitted illumination.

#### 100W and 150W Fiber Optics Cable Illumination Unit (External Light Source)

<table>
<thead>
<tr>
<th>Order No.</th>
<th>12V, 100W halogen lamp</th>
<th>Continuously variable brightness control</th>
<th>Built-in cooling fan (includes an alarm for indicating that the fan has stopped)</th>
<th>A color filter can be attached.</th>
</tr>
</thead>
<tbody>
<tr>
<td>176-315* (100W)</td>
<td>Order No.</td>
<td>External dimensions (mm)</td>
<td>Fiberglass cable length: 1,500</td>
<td>Applicable model</td>
</tr>
<tr>
<td></td>
<td>LED Illumination Unit</td>
<td>120(W)×273(D)×119(H)</td>
<td></td>
<td>MF-U C/MF-U D</td>
</tr>
<tr>
<td></td>
<td>120(W)×273(D)×119(H)</td>
<td>120(W)×273(D)×119(H)</td>
<td>120(W)×273(D)×119(H)</td>
<td></td>
</tr>
</tbody>
</table>

*To denote your AC line voltage add the following suffixes to the order No. (e.g.: 176-345A):

- **A** for UL/CSA
- **D** for CEE
- **E** for EU
- **K** for EK
- **C** for Taiwan
- **US** for USA
- **EU** for EU
- **JP** for Japan

*Order No. depends on the destination.
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**A: Reflected and Transmitted Illumination**

The light is projected vertically downward onto the surface of an inspected object through an objective. An LED or halogen lamp is selectable as the light source.

**B: Dual swan-neck light pipe**

Light piped from a standalone halogen lamp unit and projected from two heads is suitable for three-dimensional observation. The condenser lens included as standard makes high brightness spot lighting possible.

**C: Fiber-Optic Ring Light**

Light piped from a standalone halogen lamp unit and projected from around the objective enables high contrast observation of deeply colored resins, circuit boards, and small cylindrical objects and is also suitable for image measurement. In addition, adjusting the brightness does not change the coloring.

**D: LED Ring Light**

Light piped from a standalone halogen lamp unit and projected from around the objective enables high contrast observation of deeply colored resins, circuit boards, and small cylindrical objects and is also suitable for image measurement. In addition, adjusting the brightness does not change the coloring.

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**LED Ring Light**

**Order No.** 176-367-2*

- Continuously variable brightness control
- Auto-brightness control can be used for the Vision Unit system (with external light source control cable No. 12AAD128).
- 5W/5W×150/90W: only the control part
- Ring LED part: outside diameter: 70, height: 68 to 93
- LED cable length: 1,500

**External dimensions (mm)**

- 75(W)×150(D)×90(H): only the control part
- Ring LED part: outside diameter: 70, height: 65 to 85
- LED cable length: 1,000

**Applicable model** MF C / MF D / MF C / MF D 10X objective 10X or lower model

* Order No. depends on the destination.

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**LED Ring Light (for FS Objectives)**

**Order No.** Please contact us.

- Continuously variable brightness control
- Auto-brightness control can be used for the Vision Unit system (with external light source control cable No. 12AAD128).
- 5W/5W×150/90W: only the control part
- Ring LED part: outside diameter: 70, height: 65 to 85
- LED cable length: 1,000

**Applicable model** MF C / MF D / MF C / MF D 10X objective M plan Pro 10X or lower model

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**Dual swan-neck light pipe (External Light Source)**

**Order No.** 176-243*

- Fixed to the rear of the microscope column.
- Continuously variable brightness control
- Includes a condenser lens
- Auto-brightness control can be used for the Vision Unit system (with external light source control cable No. 12AAD128).
- 12V, 100W halogen lamp (No. 517181), rated life: 1,000 hours
- 12V, 100W high brightness halogen lamp (No. 12BAD602), rated life: 50 hours
- LB80 filter (No. 12AAG807)

**External dimensions (mm)**

- 70(W)×235(D)×120(H): includes only the light source
- Fiber optics cable length: 700 (from the rear fixed portion to the front edge)
- Maximum fiber bending radius: 50

**Applicable model** MF C / MF-U C / MF D / MF-U D

* Order No. depends on the destination.

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**Fiber-Optic Ring Light (External Light Source)**

**Order No.** 176-366*

- Continuously variable brightness control
- Auto-brightness control can be used for the Vision Unit system (with external light source control cable No. 12AAD128).
- 12V, 100W halogen lamp (No. 517181), rated life: 1,000 hours
- 12V, 100W high brightness halogen lamp (No. 12BAD602), rated life: 50 hours
- LB80 filter (No. 12AAG807)

**External dimensions (mm)**

- 76(W)×235(D)×120(H): includes only the light source
- Circular illumination unit: outside diameter: 60, inside diameter: 35
- Maximum fiber length: 1,000

**Applicable model** MF C / MF D 10X objective 10X or lower model

* Order No. depends on the destination.

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**Order No.**

* Order No. depends on the destination.
Manual Image Measurement
Vision Unit

The Vision Unit turns your measuring microscope into a high-performance vision measuring system capable of significantly increasing productivity in quality assurance operations. Vision measurement simply involves generating enough points from the edges of workpiece features to ensure accuracy and then letting powerful PC-based software calculate the measurement results. An image measuring model that aligns edges during image measurement and a dedicated electronic model that can be used for general purposes are available. Both models can print out the measurement results or output them to spreadsheet software or inspection tables.

Features

- Auto edge detection tool and various macro icons make measurement straightforward
- Easy-to-use graphics and measurement navigation
- Enables measurement results to be output to MS-Excel*1 and an inspection table created on the same PC
- Enables tolerance zone analysis for measurement and calculation results, and various types of statistical processing for each item
- Auto-brightness control that precisely duplicates an illumination setting (when using the measuring microscopes MF C, MF-U C, MF-D and MF-UD together)
- Enables high-accuracy height measurement when combined with the focus pilot
- Enables measurement within one screen
- Images can be input or saved (in BMP or JPEG format).

*1. MS-Excel is a Microsoft product.

More user-friendly manual measurement environments available (Wide-field measurement)

Upsizing of the image sensor has made the field of view approximately 40% wider than conventional for both X and Y directions, thus allowing concurrent observation of the circumference of a measurement point.

Edge detection support tools (One-click tools)

[Patent registered (application country: Japan)]

Each tool has the function of automatically discriminating operations from self tool setup to edge detection/calculation by merely single-clicking the vicinity of a measurement point edge with the mouse. If measurement is performed in one tool window, these tools drastically reduce measurement time thanks to no need for stage travel.
Coordinate system creation key

Specifications

<table>
<thead>
<tr>
<th>Vision Unit</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>MF C: No. 359-796 (Vision Unit 9C) / MF-UC: No. 359-798 (Vision Unit 9UC) / MF D &amp; MF-UD: 359-763 (Vision Unit 10D)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnification of optical system</td>
<td>0.5X: when a microscope is attached (0.5X: when using a TV adapter)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Image detection</td>
<td>High sensitivity 1/2-inch CMOS color camera with 300 million pixels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring accuracy for each axis (in a 20°C environment)</td>
<td>Depends on measuring microscope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy (in a 20°C environment)</td>
<td>Depends on measuring microscope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference: when using a 3X ML objective (performing an inspection using our standard sample)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen-internal measuring accuracy: ±2.5µm or less</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen-internal repeatability (2σ): ±1µm or less</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC system*</td>
<td>Windows 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software*</td>
<td>QSPAK Vision Unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applicable model</td>
<td>MF C / MF-U C / MF D / MF-U D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Software (QSPAK) and calculation processor are required separately.

FORMPAK-QV (Optional software)

FORMPAK-QV allows contour analysis and contour tolerancing against the nominal value, from the data acquired using QSPAK.

- Contour tolerancing function
- Fine contour analysis function
- Report generation function

CAD Import & Export (Optional software)

Operability has been greatly improved, and the time required to create a part program has been greatly reduced, by importing the CAD data (DXF, IGES), as generated at the product-design stage, to QSPAK. The measurement result from QSPAK can be converted to CAD data.

FEATURES

- The nominal value of each measuring item is entered automatically.
- The graphics window can be used to calculate elements.
- Graphics data can be output in a specified CAD data format.
2-D Data Processing Unit
QM-Data 200

Features

- Displays high contrast color graphics on a large, backlit, LCD screen
- Enables frequently-performed complex measurement (such as measuring the distance between two circles) to be performed by pressing just one button
- Teaching function for measuring procedure
- Efficient measurement by performing measuring point navigation in the repeat mode
- Eliminates the need to switch measuring command keys through AI-based measurement (which automatically determines the measured element)
- Includes a user menu in which you can individually register measuring commands or part programs
- Enables tolerance zone measurement for measurement and calculation results, and various types of statistical processing for each item
- Enables measurement results to be output to the MS-Excel*1 PC spreadsheet software in CSV format
- Enables part programs and measurement results to be stored in USB memory*2 or on a USB-FDD (floppy disk)
- A stand that can be tilted to adjust the angle to an easily viewable position
- Enables measurement during printing

*1. MS-Excel is a Microsoft product.
*2. Not all commercially available USB memory is supported.

Specifications

QM-DATA 200 (Stand Type)

<table>
<thead>
<tr>
<th>Order No.</th>
<th>264-TSS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displayed language</td>
<td>Switches among 16 languages (Japanese, English, French, German, Italian, Spanish, Portuguese, Czech, Chinese (traditional), Chinese (simplified), Korean, Turkish, Swedish, Polish, Dutch and Hungarian)</td>
</tr>
<tr>
<td>Unit of measurement</td>
<td>Length: mm, angle: degree/minute/second (switchable)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1µm</td>
</tr>
<tr>
<td>Program function</td>
<td>Creating, performing, and editing measuring procedures</td>
</tr>
<tr>
<td>Statistical processing</td>
<td>The measured item, number of data items, maximum value, minimum value, average value, standard deviation, range, histogram, and statistics for each measuring function (statistics for each command)</td>
</tr>
<tr>
<td>Display field</td>
<td>Color TFT LCD (with a backlight)</td>
</tr>
<tr>
<td>Tilt feature</td>
<td>Available</td>
</tr>
<tr>
<td>I/O connector</td>
<td>XYZ: for linear scale input ... up to 3 axes RS-232C (➀): for connecting a PC (measuring result) RS-232C (➁): for connecting the counter of the measuring machine main unit F5: for connecting a foot switch PRINTER: for connecting a receipt or external printer (measuring result) USB-FDD: for connecting a USB-FDD (measuring result file, measuring procedure file) USB-MEMORY: for connecting USB memory (measuring result file, measuring procedure file)</td>
</tr>
<tr>
<td>File output of measuring result</td>
<td>RS-232C output (CSV format, MUX-10 format)</td>
</tr>
<tr>
<td>Power supply</td>
<td>100V to 240V AC</td>
</tr>
<tr>
<td>Maximum power consumption</td>
<td>17W (without including optional)</td>
</tr>
<tr>
<td>External dimensions (mm)</td>
<td>Approximately 260 x 242 x 310 (including a stand)</td>
</tr>
<tr>
<td>Weight</td>
<td>Approximately 2.9kg</td>
</tr>
<tr>
<td>Applicable model</td>
<td>MF C / MF U C / MF D / MF U D</td>
</tr>
</tbody>
</table>

* Order No. depends on the destination.

External dimensions (unit: mm)

Thermal printer
DPU-414 Manufactured by SII

Specifications

Thermal Printer DPU-414

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Connected to QM-Data 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counter display printing</td>
<td>Please contact with your local Mitutoyo sales office.</td>
</tr>
<tr>
<td>Printing method</td>
<td>Dot-matrix thermosensitive</td>
</tr>
<tr>
<td>Number of printing digits</td>
<td>All digits of normal characters (+ dot matrix)</td>
</tr>
<tr>
<td>Printing speed</td>
<td>Maximum 52.5 normal characters/s</td>
</tr>
<tr>
<td>External dimensions</td>
<td>166mm(W) x 70mm(D) x 11mm(H) (printer)</td>
</tr>
<tr>
<td>Standard accessories</td>
<td>Printer cable, printing paper (5 rolls, AC adapter (for 100V))</td>
</tr>
<tr>
<td>Spare goods</td>
<td>Printing paper (5 rolls) No. 908353 (5 rolls)</td>
</tr>
</tbody>
</table>

Printout example
We offer various optional accessories designed to increase microscope usability. These optional accessories, which have all been well received by customers, include the focus pilot, which can reduce focal point variation; a power turret and power focusing unit, which can be used to change the focus or magnification by under precise power control and a rotary table, which has a fine-adjustment knob for comfortably rotating objects under inspection. You can also select the polarization and differential interference contrast unit to support microscopic observation, the TV port adapter to attach a camera, which is required by many people during simultaneous analysis and evaluation, and other optional accessories as required.

**Others Optional Accessories**

- **Focus Detection Unit**
  - Model type: FP-05, FP-05U
  - Order No.: 375-057* (Green) / 375-058* (Red)
  - Light Source: Concentric circle pattern, Slit pattern
  - The focal point is the position where the top and bottom of the pattern are aligned.
  - The brightness can be adjusted according to the reflectivity of the surface.
  - Observation with a wide field of view on a TV monitor using 5X optical magnification is available.
  - Focusing reproducibility: Approximately 1.5µm (when using a 20X lens) 
  - Optical magnification: 0.5X
  - Magnification accuracy: ± 0.1% (within 2/3 of the center of the field of view)
  - Camera: Supports up to 2/3 inch
  - TV adapter: Equipped with C-mount, centering or parfocal adjusting mechanism
  - Power supply: 100 to 240V AC, Maximum power approximately 10W
  - External dimensions (mm): Main unit: ø110×51(H), Console box: 164(W)×65(H)×137(D)
  - Applicable model: MF C / MF D
  - Note: The lens mounted at the centering mechanism (standard) position and the lens mounted at the focal point adjusting mechanism position are parfocal.
  - The two lenses are not parfocal.

- **Electric Focus Unit**
  - Order No.: Please contact with your local Mitutoyo sales office.
  - Maximum feed: 11.4µm
  - Maximum drive speed: 3.7mm/s
  - Driving method: Stepping motor (jog shuttle/jog dial)
  - Power supply: 100 to 240V AC, Maximum power consumption: approximately 20W
  - External dimensions (mm): Main unit: ø108(W)×72(H)×193(D)
  - Applicable model: MF C / MF-U C
  - Note: This unit is made to order.

- **Turrets**
  - Order No.: 176-211, 378-018, 176-212*, 378-016*, 378-216*
  - Number of ways: 4, 4, 4, 4, 5
  - Driving method: Manual, Electric
  - Power supply: 100 to 240V AC
  - External dimensions (mm): ø110×51(H), ø110×51(H)
  - Cable length: 3m
  - Applicable model: MF-U C / MF-U D
  - Note: This product is a factory-installed option. * Order No. depends on the destination.

- **Other Accessory**
  - Order No.: 176-314-1, 176-314-2
  - Number of ways: 4, 4
  - Driving method: Manual, Centering and parfocal: 3 positions, Centering and parfocal: 3 positions, 5 positions
  - Power supply: —
  - External dimensions (mm): ø110×51(H), ø110×51(H)
  - Cable length: 3m
  - Applicable model: MF C / MF D
  - Note: The combination of MF-U and FP-05U is a factory-installed option. * Order No. depends on the destination.
Other Optional Accessories

**Rotary Table with Fine Feed Wheel (A)**

- **Order No.:** 172-305
- **External dimensions:** 280(W)×342(D)×23.7(H)mm
- **Tabletop:** ø240mm, 360° rotation, no angle scale
- **Mass:** 2.5kg
- **Effective glass diameter:** 182mm

**Applicable model:** 172-305, 17201, 2010 / MF C / MF-U C

Note: The V-block with Clamp, Swivel Center Support and Holder with Clamp can be mounted on the table.

**Rotary Table with Fine Feed Wheel (B)**

- **Order No.:** 172-306
- **External dimensions:** 342(W)×342(D)×23.7(H)mm
- **Tabletop:** ø270mm, 360° rotation, no angle scale
- **Mass:** 2.4kg
- **Effective glass diameter:** 238mm

**Applicable model:** Size 2017, 3017, 4020 / MF C / MF-U C / MF D / MF-U D

Note: The V-block with Clamp, Swivel Center Support and Holder with Clamp can be mounted on the table.

**Rotary Table with Fine Feed Wheel (with Scale)**

- **Order No.:** 172-198
- **External dimensions:** 240(W)×172(D)×19.7(H)mm
- **T-groove pitch of the tabletop:** 120
- **Effective glass dimensions for one piece (mm):** 35
- **Minimum angle adjustment:** vernier 2°
- **Mass:** 2.4kg
- **Effective glass diameter:** 96mm

**Applicable model:** / MF C / MF-U C

Note: Size 2010 is used with stage adapter B. Sizes 2017, 3017, and 4020 are used with stage adapter.

**Stage Adapter / Stage Adapter B**

- **Order No.:** 172-304 (for 2017, 3017, 4020), 176-310 (for 2010)
- **External dimensions for one piece (mm):** 50(W)×1340(D)×175(H)
- **Note:** Adapter B is 280(D).
- **Mass:** 1.5kg / B: 1.2kg

**Applicable model:** MF C / MF-U C / MF D / MF-U D

Note: The two pieces are provided as one set.
C-Mount Adapter
Order No. 970441
This standard adapter is used to mount a device such as a digital camera to the TV camera port of a microscope. Note: This is not used when the Vision Unit is mounted.
External dimensions (mm) ø45x22.5(H)
Applicable model MF-U C / MF-U D

0.5X TV Adapter (Including C-Mount Adapter)
Order No. 375-054
This standard adapter is used to mount a device such as a digital camera to the TV camera port of a microscope. This adapter enables observation with a wide field of view using a 0.5X minimum relay image. Magnification accuracy: ±0.1%, Image field diameter: 11mm
Note: This adapter is included with the Vision Unit as standard.
External dimensions (mm) ø45x123(H)
Applicable model MF C / MF-U C / MF D / MF-U D

Polarization Unit
Order No. 378-092
For both the bright-field model and the bright-field and dark-field model
Each polarizer/analyser is provided as a one-piece set.
Applicable model MF-U C / MF-U D

Differential Interference Contrast Unit
Order No. 378-080
For 5X and 10X
378-079 (for 20X)
378-078 (for 50X and 520X)
378-076 (for 100X, SLB2X, and SL50)
Applicable model MF-U C / MF-U D
Note: Use this with a polarization unit.

External dimensions (mm) ø45x22.5(H)

Illumination Filter
Order No. 12AA645
G1 filter 12AA646
BG3 filter 12AA643
ND2 filter 12AA644
ND8 filter 12AA680
L880 filter 12AA687

Applicable model: MF-U C / MF-U D
*MF C (for both transmitted illumination and reflected illumination), MF-U C (only for transmitted illumination)

Stage Micrometer
Order No. 375-056
Scale length 1mm
Maximum graduation 0.1mm
Scale accuracy (20°C) 1+L(µm). L: length between any two lines (mm)
Scale Negative type / Positive type
External dimensions (mm) 76(W)x26(D)
Mass 16g
Applicable model MF C / MF-U C / MF D / MF-U D

Lens Cleaning Set
Order No. 12AAA165
This exclusive set includes cleaner, cloth, a blower, cotton wads, and other items for maintaining eyepieces and objectives.

Vibration Damping Stand
Order No. 176-308
Supporting method Spring pad
Maximum loading 20kg
External dimensions (mm) 750(W)x550(D)x360(H)
Mass 16g
Applicable model MF C / MF-U C / MF D / MF-U D

Mounting Stand (for Microscope)
Order No. 176-309
Maximum loading 300kg
External dimensions (mm) 1200(W)x500(D)x850(H)
Mass Approximately 50kg
Applicable model MF C / MF-U C / MF D / MF-U D

Note: When specifying a microscope with the Vision Unit or DV-520L, we recommend selecting the large mounting stand No. 960945, which has external dimensions of 1,800(W)x900(D)x740(H).
Other Optional Accessories

Reticles

For MF C / MF D

- No.12AAG838 (MF C / MF D)
  - Chain line pitch: 0.2 to 0.2
  - Line width: 7µm
- No.12AAG836 (MF C / MF D)
  - Chain line pitch: 0.2 to 0.2
  - Line width: 7µm
- No.12AAG873 (MF C / MF D)
  - Chain line pitch: 0.2 to 0.2
  - Line width: 3µm

For MF-U C / MF-U D

- No.12AAG840 (MF-U C / MF-U D)
  - Chain line pitch: 0.2 to 0.2
  - Line width: 5µm
- No.12AAG841 (MF-U C / MF-U D)
  - Chain line pitch: 0.2 to 0.2
  - Line width: 5µm

Each reticle includes an attachment board.

*1. Use this with an eyepiece that has 10X magnification.
*2. This is the comparison chart specific to a 3X ML objective. Use this with an eyepiece that has 10X magnification.
The LED illumination unit is included in the following figures. The control unit is placed to the side of the microscope or directly attached to the rear of the column. For the external dimensions for MF-D / MF-UD, please contact with your local Mitutoyo sales office.
Small Tool Instruments and Data Management

Digital Scale and DRO Systems
Test Equipment and Seismometers
Sensor Systems
Optical Measuring
Form Measurement
Coordinate Measuring Machines
Vision Measuring Systems

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F +81 (0) 44 813-8231
http://www.mitutoyo.co.jp

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Digital Scale and DRO Systems
Small Tool Instruments and Data Management

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