Optical Heads

Type 1, 2 and 3 – Standard magnification zooming heads

- Printed circuit board (optical magnification 1x)
  - Type 1 / 8 segment LED ring light
- Printed circuit board (optical magnification 2x)
  - Type 2 / 8 segment LED ring light
- High density PCB (optical magnification 1x)
  - Type 2 / coaxial top light

Type 4 and TZ – High magnification zooming heads

- Plastic molded part (optical magnification 0.35x)
  - Type 4 / coaxial top light
- IC chip (optical magnification 8x)
  - Type 4 / coaxial top light
- Resin parts (optical magnification 0.35x)
  - Type TZ / dark field illumination

Type A – Wide FOV zooming head

- Plastic molded part (optical magnification 0.35x)
- Coaxial top light

Stage Sizes

300mm(X) × 200mm(Y) × 200mm(Z) – Standard stroke
VMZ-R 3020

Suitable for small components used for products such as mechanical, electric/electronic, automotive, and medical devices.

- Connectors, semiconductor packages, small PCB’s, small stamped sheet metal parts, lead frames, watch components, etc.
- High density PCB’s, lead frames, semiconductor packages, MEMS, probe cards, etc.
- Plastic molded parts, sheet metal parts, rubber parts, mechanical parts, implant components, watch components, etc.

450mm(X) × 400mm(Y) × 200mm(Z) – Middle stroke
VMZ-R 4540

Designed for middle size components and/or series measurements of multiple pieces on the stage.

- Middle size PCB’s, stamped sheet metal parts, etc.
- Middle size mechanical parts, plastic molded parts, etc.

650mm(X) × 550mm(Y) × 200mm(Z) – Large stroke
VMZ-R 6555

Suitable for large size components and/or ‘step-and-repeat’ measurements of multiple pieces on the stage.

- Large PCB’s, large plastic molded parts, etc.
- Large stamped sheet metal parts, large plastic molded parts, etc.

Optical magnification

| Type   | 0.35 | 0.5 | 0.6 | 1   | 1.8 | 2   | 3.5 | 4   | 7.5 | 8   | 15  | 16  | 30  | 32  | 60  | 64  | 120 |
|--------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Type 1 |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type 2 |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type 3 |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type 4 |      |     |     | 18  | 16  | 12  | 9   | 7.2 | 5.9 | 3.6 | 2.6 | 1.9 | 1.75| 1.33| 1.00|     |     |
| Type TZ|      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type A |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

* Total magnification is that of video window with 640 × 480 pixels on 24 inch WUXGA monitor (1920 × 1200 pixels) recommended for VMZ-R series.
Type 1, 2 and 3 – Standard magnification zooming heads

Zooming heads are equipped with 15x zoom optics made exclusively for the NEXIV VMZ-R series. These Nikon optics feature a long working distance, a high NA of 0.35, low distortion, and low magnification error.

<table>
<thead>
<tr>
<th>Type</th>
<th>Magnification Type</th>
<th>(W.D.: 36mm)</th>
<th>0.5x</th>
<th>1x</th>
<th>2x</th>
<th>4x</th>
<th>8x</th>
<th>16x</th>
<th>30x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>(0.5 to 7.5x)</td>
<td>Horizontal × Vertical (mm)</td>
<td>9.31</td>
<td>7.01</td>
<td>4.7</td>
<td>3.5</td>
<td>2.33</td>
<td>1.75</td>
<td>1.165</td>
</tr>
<tr>
<td>Type 2</td>
<td>(1 to 15x)</td>
<td>Horizontal × Vertical (mm)</td>
<td>14</td>
<td>7.3</td>
<td>4.8</td>
<td>3.6</td>
<td>2.57</td>
<td>1.92</td>
<td>1.39</td>
</tr>
<tr>
<td>Type 3</td>
<td>(2 to 30x)</td>
<td>Horizontal × Vertical (mm)</td>
<td>28</td>
<td>1.8</td>
<td>1.2</td>
<td>0.8</td>
<td>0.62</td>
<td>0.48</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Total magnification on Video Window (640 × 480 pixels) recommended for VMZ-R series.

- **Type 1** – For maximum magnification
- **Type 2** – For medium magnification
- **Type 3** – For low magnification

### TTL Laser AF with 50mm working distance (TTL - Through the lens)

Type 1, 2 and 3 zooming heads are equipped with TTL Laser AF with a long working distance 50mm. TTL Laser AF can work and show a high repeatability, independent from magnification used. It can also be used for scanning the surface by detecting a maximum of 1000 points per second. TTL Laser AF can detect both top and bottom surfaces of a transparent layer for measuring thickness of the transparent layer or the depth to surface of the layer under the transparent layer.

**Focusing mode**
Zooming head moves to focus point, pauses it and returns to it.

**Trigger mode**
Zooming head moves to focus point and pauses it (for reduction of measuring time).

**Tracking mode**
Zooming head moves to focus point and stops there and does not pass it (for further reduction of measuring time).

**Searching mode**
Zooming head detects 2 surfaces reflecting laser beam and you can choose a surface to detect.

**Measurement support provided by Image AF**

LED light sources have now replaced all the halogen light sources used on previous models. LEDs have a stable high color temperature, which does not change with intensity. This gives more natural images and shorter measurement times.

- **Surface mode**
  Focus on surface of objects

- **Contrast mode**
  Focus on edges defined by the bottom light

- **Multi mode**
  Measure height of multiple points in the FOV

- **2 peak detection**
  Obtain higher or lower focus points

**Versatile illumination designed for highlighting obscure edges**

LED light sources have now replaced all the halogen light sources used on previous models. LEDs have a stable high color temperature, which does not change with intensity. This gives more natural images and shorter measurement times.

- **LED inner ring light**
  37° W.D.: 50mm

- **LED outer ring light at 55 degree position**
  55° W.D.: 36mm

- **LED outer ring light at 78 degree position**
  78° W.D.: 10mm

The inner 8 segment LED ring illuminator has 37 degree oblique angle to optical axis and the outer 8 segment LED ring illuminator has 55 and 78 degrees, that can easily define edges which are almost invisible to coaxial top light.

- **Coaxial top light / 37 degree oblique light**
  (Concentrating the optical magnification 5x)

- **Coaxial top light / 78 degree oblique light**
  (Drill at optical magnification 5x)

- **Coaxial top light / 78 degree oblique light / 55 degree oblique light**
  (Drill at optical magnification 5x)

An obscure edge under coaxial top light is visible with oblique lights. 55 degree oblique light with a 36 mm working distance has an effect similar to the 78 degree oblique light with a working distance of 10 mm.
Type 4 – High magnification zooming head

Ideal for measuring high density samples with tiny features

Type 4 has a 4 to 60× optical magnification, twice that of Type 3. The objective lens is designed with a high NA of 0.46 and a long working distance of 30mm.

8-segment LED ring illuminator suited for various samples

Type 4 is equipped with an 8-segment LED ring illuminator, as well as episcopic and diascopic illuminators, that make obscure edges stand out.

Subtle edges can be detected by utilizing the 50 degree oblique angle of the 8-segment ring illuminator.

2 types of AF available as standard

TTL Laser AF

TTL Laser AF, with a working distance of 30mm, can detect both the top and bottom layers of thin samples, such as transparent samples of 0.1mm thickness. By scanning 1000 points per second, the TTL Laser AF not only offers high accuracy, but also speed.

Image AF

Image AF can detect surfaces that cannot be reached with the Laser AF. The bottom surface of deep holes and the height of steep surfaces can be detected and measured with Image AF.

TTL Laser AF schematic

Type TZ – High magnification zooming head

Type TZ high magnification zooming head is equipped with two objective lenses that can be easily switched, offering a total of 1 to 120× optical magnifications. From low magnification to high magnification to measure tiny features, such as 1 micrometer line width, Type Z covers a wide range of measurement area.

TTL Laser AF highest among the VMZ-R series

Type TZ main objective lens has TTL Laser AF built-in. High NA (0.55) lens has the highest performance in terms of detecting and scanning.

CNC controlled illuminations

Offers coaxial, episcopic, and darkfield illuminations to detect edges of tiny features.

Objective lenses for Type TZ

Left: 1 to 7.5×
Right: 16 to 120×

Cross section of a small groove
**Type A – Wide FOV zooming head**

**Features a wide FOV and long working distance**

With a maximum of $13.3 \times 10\text{mm} \text{FOV}$ at $0.35\times$, the wide FOV is available for samples with large features.

At all magnifications, a working distance of 73.5mm can be realized. Type A is suitable for measuring low density samples with wide steps and/or deep holes.

**Optical magnification**

<table>
<thead>
<tr>
<th>Magnification</th>
<th>0.35x</th>
<th>0.6x</th>
<th>1x</th>
<th>1.8x</th>
<th>3.5x</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOV size on stage</td>
<td>Horizontal</td>
<td>13.3</td>
<td>10.0</td>
<td>7.8</td>
<td>6.1</td>
</tr>
<tr>
<td>Vertical</td>
<td>4.8</td>
<td>5.8</td>
<td>7.6</td>
<td>9.8</td>
<td>13.8</td>
</tr>
<tr>
<td>1/3” CCD size</td>
<td>Horizontal</td>
<td>4.8</td>
<td>5.8</td>
<td>7.6</td>
<td>9.8</td>
</tr>
<tr>
<td>Vertical</td>
<td>4.8</td>
<td>5.8</td>
<td>7.6</td>
<td>9.8</td>
<td>13.8</td>
</tr>
<tr>
<td>Video magnification</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Total magnification on Video Window (640 × 480 pixels)</td>
<td>12.6</td>
<td>21.6</td>
<td>36</td>
<td>64.8</td>
<td>126</td>
</tr>
<tr>
<td>Size of 1 pixel (micrometer)</td>
<td>21.8</td>
<td>12.6</td>
<td>7.36</td>
<td>2.15</td>
<td>1.62</td>
</tr>
<tr>
<td>Size of objects on Video Window (640 × 480 pixels)</td>
<td>0.016 (mm)</td>
<td>0.126</td>
<td>0.216</td>
<td>0.36</td>
<td>0.648</td>
</tr>
<tr>
<td>Size of objects on Video Window (1/3” CCD)</td>
<td>0.1x (mm)</td>
<td>0.256</td>
<td>0.436</td>
<td>0.736</td>
<td>1.448</td>
</tr>
<tr>
<td>Total magnification on Video Window</td>
<td>12.6</td>
<td>21.6</td>
<td>36</td>
<td>64.8</td>
<td>126</td>
</tr>
</tbody>
</table>

*Total magnification is that of video window with 640 × 480 pixels on 24 inch WXGA monitor (1920 × 1200 pixels) recommended for VMZ-R series.

**Image AF and Laser AF**

The search probe can detect misaligned parts, and rotate the program to suit, allowing for successful measurement with the Image AF. With a 63mm working distance, the Laser AF option for Type A offers high accuracy, independent of magnification and its depth of focus.

Equipped with episcopic, diascopic and 8-segment ring illuminators. Obsolete edges can be visualized by using the 8-segment ring illuminator with an oblique angle of 18 degrees.

**Illumination lineup for various needs**

- Plastic molded part
- Under coaxial top light at 0.35x optical magnification
- Under coaxial top light at 0.6x optical magnification
- Under coaxial top light at 1x optical magnification
- Under coaxial top light at 1.8x optical magnification
- Under coaxial top light at 3.5x optical magnification
- Episcopic illumination
- 8-segment LED ring light

**Software**

**Edge and point selection**

Preset rules for selecting the correct edge with multiple edge candidates and a filter to avoid abnormal points to minimize errors.

**Intelligent search function**

Measures by searching preset shapes/patterns. Misaligned samples can be found and measured without failure.

“At rotate search” detects the misaligned samples and automatically rotates the program to suit for measurement.

**Evaluation of shapes**

Errors can be visualized by overlaying nominal and measured shapes. Can be used for both geometrical shapes and free-form shapes.

- Calculation of errors can be made in normal or axis direction
- Nominal shapes can be made from CAD data or XYZ coordinate values
- Measured shapes can be output as CSV or DXF files
- Evaluation reports can be made in PDF files

**Calculations based on ISO and JIS standards**

- Circle (Roundness)
- Plane (Flatness)
- Line (Straightness)

**Reporting measured data**

Reports can be easily made by choosing the needed results and graphics and changing the layouts. Once the report is made, it can be automatically created every time the program is run.

**Other functions**

- Import of CAD data
  CAD data can be imported and shown in the graphic window.
- Export of DXF data
  Features measured can be exported as DXF data.
- Off-line teaching
  Teaching files can be made on CAD data.
MountainsMap X
Sample surfaces can be analyzed, based on ISO, with the data exported from VMZ-R.
Manufactured by Digital Surf (France)

EDF/Stitching Express
Images taken with the VMZ-R can be stitched to get a larger image, while images at different heights can result with an image with Extended Depth of Focus (EDF). Stitching and EDF can produce 3D graphics.

Custom Fit QC
Suitable for lot control of inspection data such as maximum value, minimum value, range, standard deviation, and process capability index.
- Customization of inspection result sheets are possible, in addition to the 10 standard sheets.
- BMP and JPEG files can be pasted onto the inspection result sheets.
- Graphs can be automatically generated.
- Easy to generate histograms, X-R control charts, and scatter diagrams.
- Excel is required

MapMeasure Pro
MapMeasure Pro creates wafer maps and is capable of automatically measuring any die on the wafer map. Tray maps can also be created.

Optional Software

Dimensions

VMZ-R 3020
Controller: 190×450×440 mm / 15 kg
Main body with table: 700×730×1795 mm / approx. 245 kg
Footprint including a PC on table: 2100×1100 mm

VMZ-R 4540
Main body with table: 1000×1340×1820 mm / approx. 500 kg
Footprint including a PC on table: 2300×1700 mm

VMZ-R 6555
Main body with table: 1200×1640×1820 mm / approx. 665 kg
Footprint including a PC on table: 2400×2000 mm
Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>VMZ-R 3020</th>
<th>VMZ-R 4540</th>
<th>VMZ-R 6555</th>
</tr>
</thead>
<tbody>
<tr>
<td>XYZ strokes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 1, 2, 3 and 4</td>
<td>300×200×200 mm</td>
<td>450×400×200 mm</td>
<td>650×550×200 mm</td>
</tr>
<tr>
<td>Type TZ with high magnification lens</td>
<td>300×200×200 mm</td>
<td>450×400×200 mm</td>
<td>650×550×200 mm</td>
</tr>
<tr>
<td>Type TZ with low magnification lens</td>
<td>250×200×200 mm</td>
<td>400×400×200 mm</td>
<td>600×650×200 mm</td>
</tr>
<tr>
<td>Type A</td>
<td>300×200×200 mm</td>
<td>450×400×200 mm</td>
<td>650×550×200 mm</td>
</tr>
<tr>
<td>Minimum readout</td>
<td>0.01 micrometer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sample weight</td>
<td>20 kg</td>
<td>40 kg</td>
<td>50 kg</td>
</tr>
<tr>
<td>Maximum permissible error (L. Length in mm)</td>
<td>EUX, MPE. EUY, MPE: 1.2+4L/1000 µm</td>
<td>EUX, MPE: 2+4L/1000 µm</td>
<td>EUY, MPE: 1.2+5L/1000 µm</td>
</tr>
<tr>
<td>Camera</td>
<td>Black &amp; white 1/3&quot; CCD, Color 1/3&quot; CCD (Option)*</td>
<td>&quot;Color camera option is available only with Type 1, 2 and A.</td>
<td></td>
</tr>
<tr>
<td>Working distance of objective lens</td>
<td>Type 1, 2 and 3</td>
<td>50 mm with 37 degree oblique angle, 36 mm with 55 degree oblique angle, 10 mm with 78 degree oblique angle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type 4</td>
<td>30 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type TZ</td>
<td>11 mm with right objective lens, 32 mm with left objective lens</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type A</td>
<td>73.5 mm without Laser AF, 63mm with Laser AF</td>
<td></td>
</tr>
<tr>
<td>Magnification and FOV</td>
<td>Type 1: 0.5~7.5× / 9.33 × 7 ~ 0.622 × 0.467 mm</td>
<td>Type 2: 1~15× / 4.67 × 3.5 ~ 0.311 × 0.233 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type 2: 2~30× / 2.33 × 1.75 ~ 0.155 × 0.117 mm</td>
<td>Type 3: 4~60× / 1.65 × 0.875 ~ 0.078 × 0.058 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type TZ: 1~120× / 4.67 × 3.5 ~ 0.039 × 0.029 mm</td>
<td>Type A: 0.35~3.5× / 13.3 × 10 ~ 1.33 × 1 mm</td>
<td></td>
</tr>
<tr>
<td>Autofocus</td>
<td>Laser AF (option for Type A) / Image AF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illumination</td>
<td>Type 1, 2, 3, and 4</td>
<td>Episcopic, diascopic, and 8-segment ring with 3 angles *All white LED/Type 4 has only 1 angle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type TZ</td>
<td>Left objective lens: Episcopic, darkfield ; Right objective lens: Episcopic, diascopic, darkfield</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type A</td>
<td>Episcopic, diascopic, and 8-segment ring with 1 angle *All white LED</td>
<td></td>
</tr>
<tr>
<td>Power source</td>
<td>AC 100-240V±10%, 50/60 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>5A-2.5A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NIKON CORPORATION Industrial Metrology Business Unit is certified as an ISO/IEC 17025 accredited calibration laboratory for CNC video measuring systems by the IAJapan (International Accreditation Japan) as Accreditation No.JCSS0241.

ISO/IEC 17025: International standard, which specifies the general requirements to ensure that a laboratory is competent to carry out specific tests and/or calibrations

Nikon Corporation Industrial Metrology Business Unit for NIKON CORPORATION

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https://www.nikon.com/products/industrial-metrology/