

## Nikon MF-501-MPM Encoder

MF-501-MPM Encoder is one of the smallest DigiMicro family encoders from Nikon. It employs a newly designed mechanical guide structure offering extremely smooth and precise linear motion suitable for applications in motion control systems in nanometer scale. The encoders feature resolution down to 1 nanometer with sub-micron accuracy.

MF-501-MPM features a Nikon exclusive diffraction-type optical encoder. The encoder mechanism is enclosed in a sealed compact extruded-aluminum housing, which resists contamination and dirt.



Figure 1. Nikon MF501-MPM encoder

The encoders come with an 8 mm diameter holder enabling quick and easy set-up at user site. The flexible cable also dampens the vibration. Figure 2 shows the standard 18-pin connector, which is directly compatible with NanoWave MPM300/OEM and Nikon MPM300.



Figure 2. One click connector for MPM300 compatibility

## STANDARD FEATURES

- 1 Nanometer Resolution with MPM300
- Extremely smooth plunger motion
- Better than 1,000,000 cycles reliability
- Direct and easy connection to MPM300
- Flexible choice in the probe tips
- On-axis measurement
- Easy to set-up
- 50mm measurement range

## Incremental Encoders for Motion Control

Combined with MPM300 motion co-processing unit, Nikon's MF-501-MPM encoders instantly provides a compact motion control solution with an obtainable resolution of 1 nanometer.

MPM300 outputs standard A-Quad-B digital signals, which are compatible with many commercially available encoder counters and motion control boards.

Since all Nikon DigiMicro encoders are "on-axis" measurement instruments, they can be easily mounted on the relevant measurement plane. As a result, Abbe errors are greatly reduced or even eliminated (vs. side-mounted encoders placed on underlying translational stages).

Due to DigiMicro encoder's self contained optical units, there is no need to mount and align read-heads with diffraction grating scales. This avoids many mechanical complications saving expensive engineering time while eliminating a host of measurement errors and reliability problems, typical with this type of installations.

## A Reputation for Excellence

Recognized as a leader in shop-floor digital height gauges, the DigiMicro product line from Nikon has established a reputation as a high-precision and highly reliable measurement instruments throughout Japan and other Asian countries.

When used as position encoders in motion control systems, DigiMicro products fulfill the needs of some of the most demanding applications in semi-conductor and other manufacturing processes.

### Nikon DigiMicro Encoder Accessories

Also available from NanoWave are a variety of DigiMicro accessories. These include several different types of probe tips which can be attached to the end of the plunger.

These plunger tips are interchangeable with many probes as offered by Nikon (shown in Figure 3) as well as customer-designed probes.



Figure 3. Probe tip accessories

Nikon also offers a standard ceramic stand for MF501-MPM.



Figure 4. MS-11C stand with MF501-MPM

### Product Applications

MF501-MPM encoders have a wide variety of industrial and research applications.

- Optical fiber alignment
- Calibration Instruments
- Medical Equipment
- Robotics
- Industrial Automation
- Precision Machining
- Semiconductor Equipment



The simple set-up and “on-axis” measurement allows user to quickly construct custom nano-precision motion system with MPM300 unit as illustrated in Figure 5.

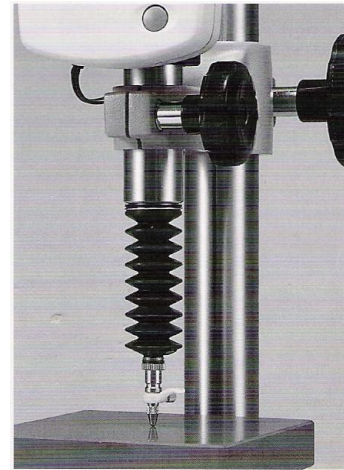


Figure 5 – Bellows can be purchased for further protection for MF-501-MPM and MF-1001-MPM encoders from dust particles.

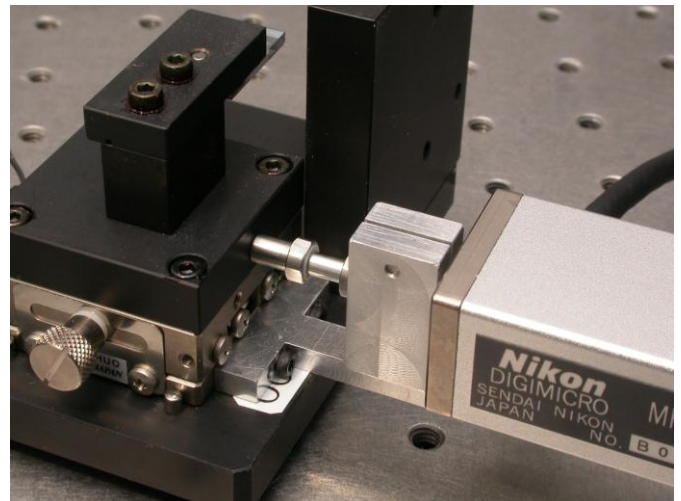


Figure 6 – Low-cost nano-stage built using Nikon DigiMicro family encoder (MH12-MPM head), commercial micrometer stage and piezo actuator.

|  | MH12-MPM             | MF-501-MPM           | MF-1001-MPM          |
|--|----------------------|----------------------|----------------------|
| <b>Specifications</b>                      |                      |                      |                      |
| travel range (plunger stroke)              | 12 mm                | 50 mm                | 100 mm               |
| minimum resolution                         | 1 nm                 | 1 nm                 | 1 nm                 |
| response speed (@ 1 nm res.)               | 400 mm/s             | 400 mm/s             | 400 mm/s             |
| lifetime without degradation               | > 1,000,000 cycles   | > 1,000,000 cycles   | > 1,000,000 cycles   |
| <b>Accuracy (@ 20 C +/- 1 C)</b>           |                      |                      |                      |
| across full travel range                   | 700 nm or better     | 1 micron             | 3 micron             |
| repeatability (per JIS 8.7509-8-4)         | 200 nm               | 500 nm               | 500 nm               |
| return error                               | 150 nm               | 500 nm               | 500 nm               |
| certification & unit accuracy profile      | (optional)           | (optional)           | (optional)           |
| <b>Physical Characteristics</b>            |                      |                      |                      |
| size (excl. plunger casing, plunger & tip) | 58 x 31 x 24 mm      | 163 x 42 x 30 mm     | 274 x 42 x 30 mm     |
| plunger casing diameter                    | 8 mm                 | 25 mm                | 25 mm                |
| total mass                                 | 145 g                | 310 g                | 480 g                |
| mass of moving parts                       | 20 g                 | 37 g                 | 56 g                 |
| force to compress plunger spring*          | 0.44 to 0.64 N       | 0.39 to 1.42 N       | 0.39 to 1.42 N       |
| operating radial force tolerance           | 0.981 N              | 0.981 N              | 0.981 N              |
| operating torsion tolerance                | 0.0049 Nm            | 0.0049 Nm            | 0.0049 Nm            |
| non-operating radial force tolerance       | 9.8 N                | 1.961 N              | 1.961 N              |
| non-operating torsion tolerance            | 0.39 Nm              | 0.294 Nm             | 0.294 Nm             |
| <i>*Default, adjustable at factory</i>     |                      |                      |                      |
| <b>Electrical</b>                          |                      |                      |                      |
| operating DC voltage                       | 5 V                  | 5 V                  | 5 V                  |
| USB cable supplied**                       | 2000 +/-50 mm        | 2000 +/-50 mm        | 2000 +/-50 mm        |
| <i>**connects to MPM300 or MPM300/OEM</i>  |                      |                      |                      |
| <b>Environmental</b>                       |                      |                      |                      |
| operating temperature                      | 20 C to 40 C         | 20 C to 40 C         | 20 C to 40 C         |
| non-operating temperature                  | -20 C to 60 C        | -20 C to 60 C        | -20 C to 60 C        |
| operating humidity                         | < 95% non-condensing | < 95% non-condensing | < 95% non-condensing |
| non-operating humidity                     | < 95% non-condensing | < 95% non-condensing | < 95% non-condensing |
| non-operating humidity                     | < 80% (@ 40 to 60 C) | < 80% (@ 40 to 60 C) | < 80% (@ 40 to 60 C) |



MH12-MPM



MF-1001-MPM \*

\* Photo of the cable length and the connector may vary from actual products.

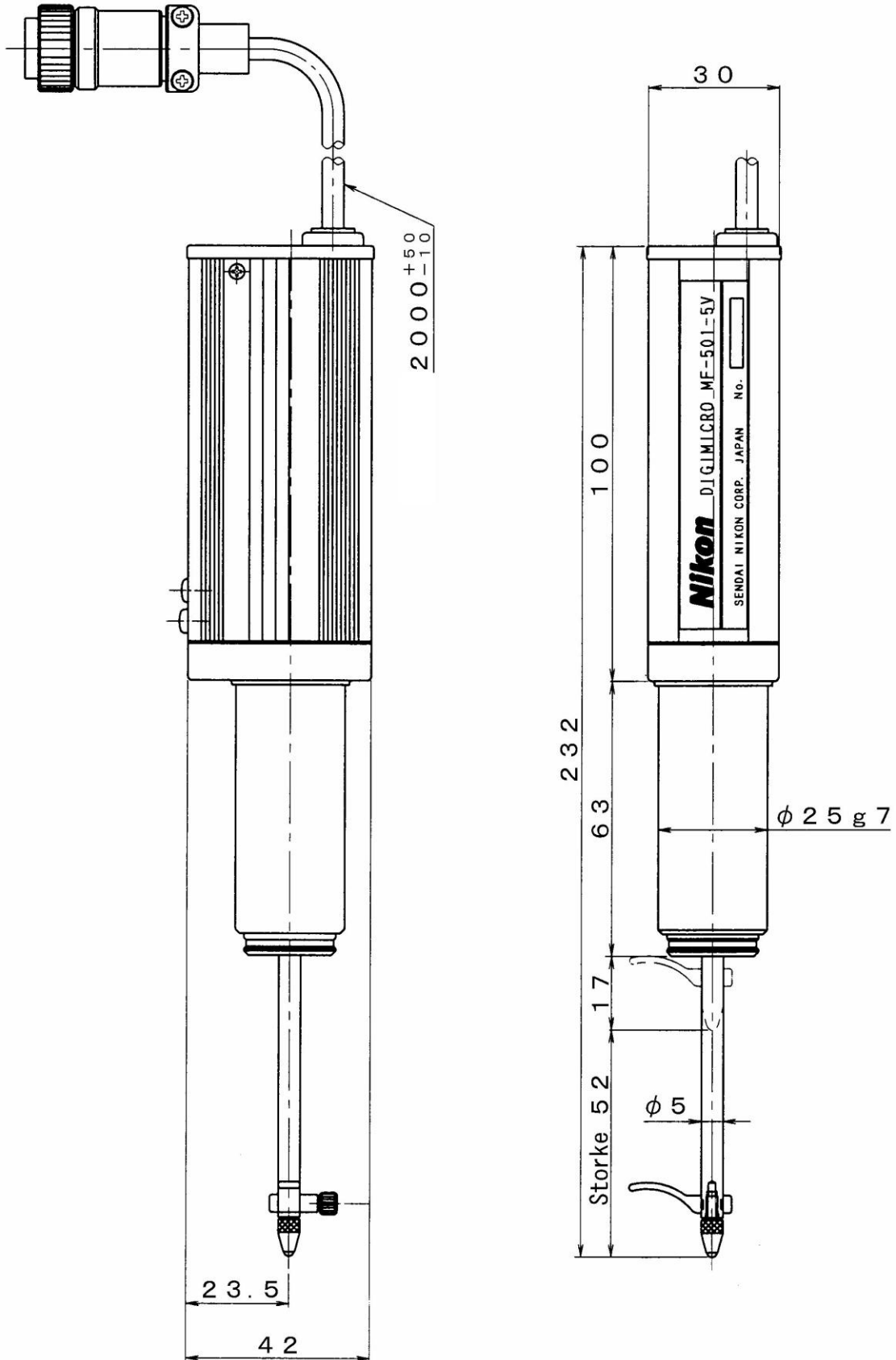




Figure 7 – MPM300/OEM Board



Figure 8 – MPM300 shown with Cable, and Wall USB power supply.

## Distributed & Supported by NanoWave

NanoWave is pleased to bring these advanced measuring Instruments to the North American market with technical support and advanced engineering services. We have over 30 years of combined experience in high-performance, high precision measurement and motion control systems.

NanoWave has also teamed with Nikon Corporation to leverage their advanced encoder technologies and widely respected manufacturing expertise to bring new market opportunities.

For more information on products, services, prices, and deliveries, please visit our website at [www.nanowave.com](http://www.nanowave.com) or send any questions to [info@nanowave.com](mailto:info@nanowave.com)

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