Micro Part Handling System
Ultimate Micro Handling Device for Ultafine Workpieces

In the micro machining field it has been considered to be impossible to machine workpieces with a size of 0.02 to 1 mm (0.0008 to 0.04 in.). The Micro Part Handling System was developed to meet ever-growing "sub-millimeter" demands from the medical and other industries. This revolutionary system, which enables ultrafine parts to be carried and assembled easily, dramatically improves micro part handling that used to be performed by hand, and significantly increases mass-productivity as well as efficiency of a finishing process. Providing excellent cost performance, accurate movements and outstanding operability ensured by the use of high-precision components, the Micro Part Handling System opens up new possibilities for your production.
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Micro Part Handling System

Basic structure/Operation

Highly precise parts manufactured with ultra precision machines are used for the system itself and the drive mechanism. The accurate movements of the grip (G-axis), coupled with the 324° rotary axis (C-axis) rotation, offer unparalleled operability.

The grip arm (B-axis) with a large movable range moves in an arc, and can carry a micro workpiece smoothly and easily. The grip angle can be changed with its grip tip kept in a fixed position.

Camera
- 5-million-pixel CMOS color, CCTV lens
- Standard field of vision: 8.3 × 6.2 mm (0.33 × 0.24 in.)
- Enlargement/reduction ratio: Monitor magnification: 69 times (100%)
  Capture magnification: 10% — 1,600%

Grip travel per handle revolution
- Horizontal (right and left) traveling axis (X-axis): 1.0 mm (0.04 in.)
- Back and forth traveling axis (Y-axis): 1.0 mm (0.04 in.)
- Up and down traveling axis (Z-axis): 0.5 mm (0.019 in.)
- Horizontal rotary axis <manual type> (A-axis)
- Vertical rotary axis <manual type> (B-axis)
- Back and forth in/out axis (W-axis): 0.9375 mm (0.037 in.)
- Rotary axis (C-axis): 324°

The X, Y and Z axes provided on both left and right arms enable fine positioning of the grips with the handles.

The basic structure/operation diagram shows the various axes and their movements, indicating the system’s capabilities and precision.
Features/Operability

Micro parts handling by manipulating the left and right grips with the handles
The single grip movable in eight-axis directions allows flexible manipulation
Images taken from the top and front of the workpiece with cameras can be simultaneously displayed on the monitor
Clear images by flexible light adjustment
Lightweight design for portability

Table height adjuster
In addition to its key feature of multiple movable axes, the system has a height adjuster to adjust table heights in units of 0.1 mm (0.004 in.), offering greater ease of use.

Table position fine-adjustment dials
These dials are used to make fine-adjustments of table positions in the X- and Y-axis directions when setting a micro part on the table. These dials enable accurate movements of the hands.

Workpiece setting slider
Setting/removing ultrafine workpieces on/from the table, which requires extremely delicate handling, can be performed easily by sliding the table back and forth. This facilitates setup operations and significantly increases productivity.

Monitor <Cameras (for 2 directions)>
Front and top views taken with two cameras can be displayed on the 23-inch full high definition monitor, improving space recognition, visibility and operability.
Application example

Extra machining of a micro-size, injection-molded part

<Example: drilling of powder gears>

1. Minute, injection-molded powder gears (you can see how small they are when compared to the size of the fingerprints) can be easily carried and placed with the high-precision grips.

A powder gear is picked up by the right grip, and then placed into the fixture by the left grip. The Micro Part Handling System allows you to move a micro part precisely, but naturally as if it were done by bare hands.

2. The fixture with the workpiece placed on it is set on the NVD1500 DCG HSC, a vertical machining center suitable for micro machining, which allows less thermal displacement and is able to control by programming in units of 0.0001 mm (0.00001 in.).

Start of hole drilling of the powder gear. The NVD1500 DCG HSC equipped with various functions and equipment for micro machining is capable of realizing φ0.03 mm (φ0.001 in.) superfine hole drilling of ultrafine workpieces.

3. The powder gear is removed from the fixture and carried to a designated case by the grip. Each of the eight axes able to move widely allows smooth adjustment of position changes for workpieces.

4. 0.03 mm (0.001 in.)

The powder gear with five involute teeth created by injection molding <diameter: 0.147 mm (0.006 in.), thickness: 0.08 mm (0.003 in.), weight: one millionth gram> The Micro Part Handling System is capable of conducting a series of actions (hold→carry→place) easily and accurately for micro parts which are only visible with a microscope. As the system was developed aiming to allow any operators to surely handle micro parts, it enables accurate setting of workpieces within a micro area and pre-programmed additional shape machining of micro parts. The system thoroughly supports every possibility of micro cutting of parts created by injection molding and metal insert molding, which has been considered impossible by now.

5. Completion of hole drilling of the powder gear with the world’s smallest weight of one millionth gram. The Micro Part Handling System supports new possibilities of research and product development that need ultrafine parts.
Application example

Handling of superfine pin

<Example: work to pass a $\phi 0.05 \text{ mm (}\phi 0.0019 \text{ in.})$ wire through a $\phi 0.06 \text{ mm (}\phi 0.0023 \text{ in.})$ hole>

The single grip movable in eight-axis directions realizes precise positioning of workpieces when conducting painstaking work that uses superfine wires. The highly precise movement enables a $\phi 0.05 \text{ mm (}\phi 0.0019 \text{ in.})$ wire to pass through a $\phi 0.06 \text{ mm (}\phi 0.0023 \text{ in.})$ hole from directly above.

Assembly process in the development of spring contact probes for inspecting printed boards and electronic components. The Micro Part Handling System maximizes its capabilities when handling the superfine pin that requires a high level of accuracy. The cameras installed on the upper and front sides of the system allow high spatial understanding and visibility. The grip arms (the B-axes) are able to move in an arc while fixing the grip tip position, which contributes to significant improvement of operating efficiency. The Micro Part Handling System realizes the assembly of the micro spring contact probe with a size of 0.2 mm (0.008 in.) or less with its high capabilities.
Defects in printed boards themselves (patterns, through holes, lands) and the lack of solder balls caused by insufficient soldering are problems when solder ball placement is conducted automatically. Placement of micro-size solder balls is very difficult even when it is conducted manually by craftsmen.

The Micro Part Handling System is capable of holding, carrying and placing φ0.1 mm (φ0.004 in.) ultrafine solder balls with a high level of accuracy in a short time. Improved mass productivity and increasingly efficient finishing process contribute to drastic cutdown on costs.

It has been considered to be impossible to perfectly complete solder ball placement (BGA) with the present technology when it comes to conducting the work automatically. There has been no other way than to spend a tremendous amount of time and labor on repair work that are resulted from placement defects. However, the Micro Part Handling System achieves high-density and high-accuracy placement of a φ0.1 mm (φ0.004 in.) solder ball in a short time. The system achieves reduction in operating time, improvement of productivity and highly-accurate work to provide customers with new possibilities.
It has been considered difficult to manufacture ultrafine screws of φ 0.3 mm (φ 0.01 in.). With the Micro Part Handling System, multiple movable axes including the rotary axis (C-axis) which is necessary for tightening screws and two cameras with high visibility enable high-density part assembly by tightening screws at a minimal pitch. Ultrafine screws of φ 0.1 mm (φ 0.004 in.) also can be tightened, which overturns the concept of production because the system enables what used to be infeasible. This will contribute to future development of new machines and research and development in the various fields. This system brings customers not only improvement in operability and mass production but also unprecedented high level of added value.
Option

Grip

T30
For high-density, minimum space and ultrafine parts. Extremely effective when holding parts of 0.1 mm (0.004 in.) or smaller.

T45
All-purpose grip for ultrafine parts to fine wiring. It can be used for any parts because it is good for various pitches.

A45
This grip is suitable for carrying and placing parts with edges. The tips of the grip are flat and the area to capture parts is large, which enables operators to hold parts without dropping them.

Table

Other than the standard sized table, three different sized tables are available -- small, medium, and large. These different sized tables can be used for different features or purposes of micro parts, contributing to improvement of productivity and promotion of efficiency.

Camera (Zoom Lens)

A macro zoom lens for FA with an optical magnification of 0.3 X to 1.0 X (made in Japan). The camera can be easily mounted/dismounted, demonstrating the effect when handling ultrafine parts.

Training Kit

Bonding
This is a repetition kit to hold, carry, and place micro solder balls by a grip. Practical skills like placement of solder balls (BGA) can be cultivated.

Micro Block
- Size of one block
Width x Depth x Height: 1.0 x 0.5 x 0.5 mm
(0.04 x 0.01 x 0.01 in.)

This is a basic kit to assemble blocks into various shapes with the idea of placing blocks by utilizing all the movable axes and table movements. You can enjoy practicing handling operations and acquire a skill to move each axis finely.

Assembly
This is a kit to hold and put in star-shaped or round-shaped micro parts with the idea of placing fit-in blocks. High level of assembly skills can be cultivated because minute movements that make the most of the rotary axis (C-axis) are required.
General view

Machine

Plan view

Front view

Side view

Grip

Standard
### Machine specifications

#### Grip travel

<table>
<thead>
<tr>
<th>Travel Axis</th>
<th>Travel (mm/in)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal (right and left)</td>
<td>30 (1.2)</td>
<td></td>
</tr>
<tr>
<td>Front and back traveling</td>
<td>40 (1.6)</td>
<td></td>
</tr>
<tr>
<td>Up and back traveling</td>
<td>14 (0.6)</td>
<td></td>
</tr>
<tr>
<td>Horizontal rotary</td>
<td>80°</td>
<td></td>
</tr>
<tr>
<td>Vertical rotary</td>
<td>50°</td>
<td></td>
</tr>
<tr>
<td>Front and back in/out</td>
<td>15 (0.6)</td>
<td></td>
</tr>
<tr>
<td>Rotary axis</td>
<td>360°</td>
<td></td>
</tr>
</tbody>
</table>

#### Grip travel per handle revolution

<table>
<thead>
<tr>
<th>Travel Axis</th>
<th>Travel (mm/in)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal (right and left)</td>
<td>1.0 (0.04)</td>
<td></td>
</tr>
<tr>
<td>Front and back traveling</td>
<td>1.0 (0.04)</td>
<td></td>
</tr>
<tr>
<td>Up and back traveling</td>
<td>0.5 (0.02)</td>
<td></td>
</tr>
<tr>
<td>Horizontal rotary</td>
<td>(manual type)</td>
<td></td>
</tr>
<tr>
<td>Vertical rotary</td>
<td>(manual type)</td>
<td></td>
</tr>
<tr>
<td>Front and back in/out</td>
<td>0.0375 (0.037)</td>
<td>324°</td>
</tr>
<tr>
<td>Rotary axis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Table movable range

<table>
<thead>
<tr>
<th>Movement</th>
<th>Travel (mm/in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left-right movement</td>
<td>13 (0.5)</td>
</tr>
<tr>
<td>Back-forth movement</td>
<td>13 (0.5)</td>
</tr>
<tr>
<td>Up-down movement</td>
<td>28 (1.1)</td>
</tr>
</tbody>
</table>

#### Camera

- **Resolution / Lens**: 5-million-pixel CMOS color, CCTV Lens
- **Standard field of vision**: 8.3×4.2 (0.3×0.2)
- **Enlargement / reduction ratio**
  - Monitor magnification: 64 times (100%)
  - Capture magnification: 10% ~ 1,600%

#### Electrical power supply

- AC 100V-10A, 50-60Hz

#### Machine size / Max. mass

- **Width**: 475 (18.7) mm
- **Depth**: 437 (17.2) mm
- **Height**: 466 (18.3) mm
- **Max. mass**: 14 (30.8) kg

#### PC

- Windows7, dedicated screen capturing software, 23-inch full high definition monitor

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*The information in this catalog is valid as of October 2012.*

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**<Precautions for Machine Relocation>**

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**MORI SEIKI CO., LTD.**

- **Nagoya Head Office**: 2-35-16 Miki, Nakamura-ku, Nagoya City, Aichi 455-0002, Japan
- **Tokyo Branch**: 18th floor, Shinagawa Intercity Tower A, 1-1-5-1 Koron Minato-ku, Tokyo 108-6018, Japan
- **Nara Campus / Nara No. 1 Plant**: 362 Idono-cho, Yamato-Koriyama City, Nara 639-1183, Japan
- **Nara No. 2 Plant**: 106 Kita-Koriyama-cho, Yamato-Koriyama City, Nara 639-1160, Japan
- **Iga Campus**: 261 Iga-cho, Iga City, Mie 519-1414, Japan
- **Chiba Campus**: 499-19 Suzumizu cho, Funabashi City, Chiba 274-0052, Japan

**IRISO SEIMITSU CO., LTD.**

- **Head Office Plant**: 36-1 Sajomipaihara, Itama City, Saitama 358-8032, Japan

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