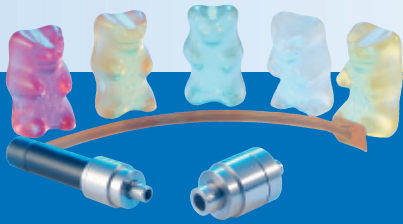
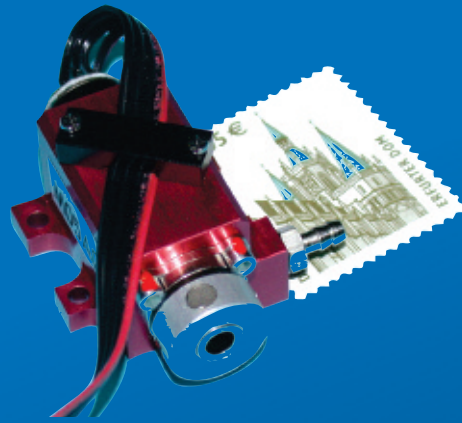


Precision in Miniature



Rotary Bond Tools for High Speed Assembly

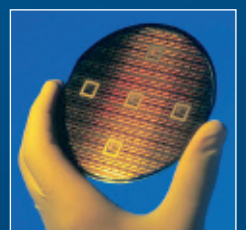


Higher productivity
- due to reduced cycle times

Higher assembly accuracy
- due to high angular resolution

Higher thermal stability
- due to low moving mass

Higher throughput
- by mounting multiple bond tools in parallel





Trends in Precision Assembly

As long as miniaturised systems and hybrid micro-systems need to be manufactured in large series there is a requirement for automated assembly. For small scale products of this type the assembly process is often a major cost-driver, making up to 80 % of total production costs. Manual assembly is either too expensive, or does not achieve the required process stability. Automated microassembly requires, in turn, specialised production equipment for handling miniature components. The assembly process typically requires movements in several degrees of freedom, which are enabled by power transmission components, such as motors, gears, ballscrews etc.

Until recently the physical size of these drive components was much larger than that of the components to be handled and the necessary workspace, with the result that many machines and robots for microassembly have dimensions far in excess of the necessary working area. There is now a clear trend to equip physically smaller machines with micro drive systems. These machines have a smaller footprint and often higher assembly accuracy than the previous generation of machine.

Micro gear systems represent a key element in such micro drive systems. To access new innovative fields of application Micromotion GmbH has developed a new generation of high precision and zero backlash micro-gear system: the Micro Harmonic Drive. This unique zero-backlash microgear is at the heart of a new range of miniaturised rotary bond tools for use in machines for high speed assembly.



Parallel Rotary Bond Tool (RBT)



Micro Harmonic Drive: Gearbox (right) and Hollow-shaft Servo Actuator

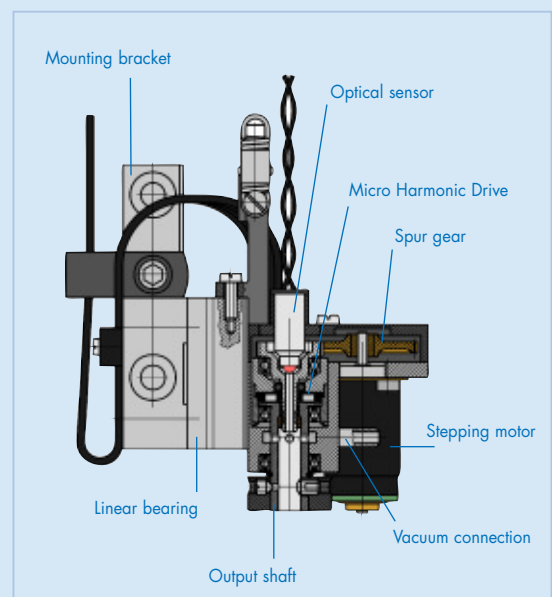
The Challenge

The permanent pursuit of shorter cycle times presents manufacturers of machines for high speed assembly with new challenges. Higher speed and higher accelerations can lead to thermal instability which, in turn, causes a loss in assembly accuracy and process stability. Machine designers need to reduce the moving mass and here microtechnology can provide a solution.

The new rotary bond tools from Micromotion are not only smaller and lighter, but also more accurate than previous solutions. Small dimensions allow multiple bond tools to be mounted in parallel, with a dramatic increase in productivity as a result.

The Solution: Rotary Bond Tools from Micromotion

- **Precise:** Angular repeatability better than 0.005 degrees
- **Fast:** 180 degrees in less than 80 milliseconds
- **Light:** Moving mass less than 10 grams
- **Compact:** Dimensions smaller than 10 mm x 35 mm
- **Multi-functional:** Integrated optical sensing, vacuum feed-through and tool holder
- **Durable:** More than 200 million cycles in real applications

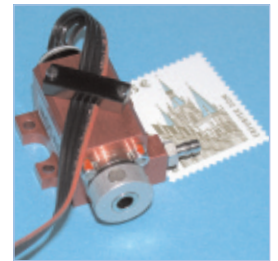


Rotary Bond Tool Variants

At the heart of the Rotary Bond Tool is a Micro Harmonic Drive gearbox in a customized design. The gear is driven by means of a stepping motor. A high level of integration reduces design and assembly effort at the customer. Various options, including integrated optical sensing, are available.



Micromotion
Production Facility



Co-axial Rotary
Bond Tool

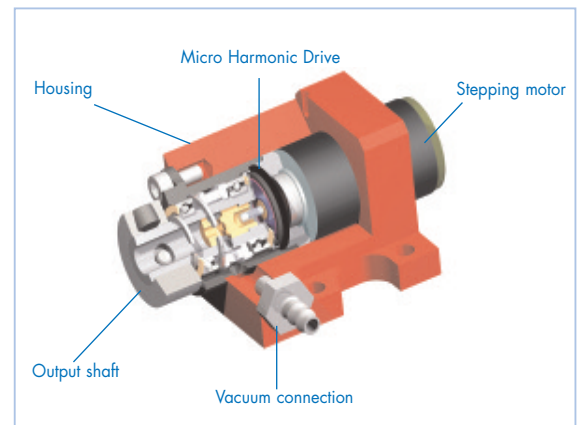
Co-axial Design

This design offers highest speed and lowest weight.

| Criterion | Value / Unit |
|------------------------------|---------------------|
| Angular repeatability | 0.005 degrees |
| Maximum angular speed | 120 rpm |
| Typical indexing performance | 15 degrees in 50 ms |
| Mass | 20 grams |

Highlights of the co-axial design:

- Integrated vacuum feed
- Stepping motor for easy control
- High resolution
- Low system costs



Parallel Design

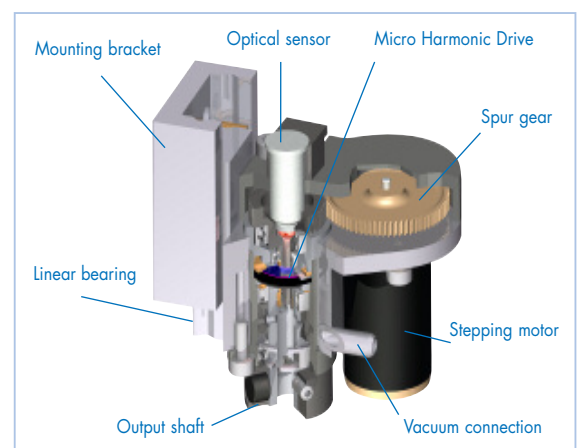
This design offers additional functions, such as integrated optical sensing, to ensure that the workpiece has been successfully gripped.

| Criterion | Value / Unit |
|------------------------------|--|
| Angular repeatability | 0.01 degrees |
| Maximum angular speed | 200 rpm |
| Typical indexing performance | 90 degrees in 140 ms |
| Mass | 25 grams excl. linear bearing 45 grams incl. linear bearing |

Highlights of the parallel design:

- Hollow shaft for optical sensor
- Integrated vacuum feed
- Stepping motor for easy control
- Integrated linear bearing

On our website under www.micromotion-gmbh.de we offer dimensioned drawings for direct download.



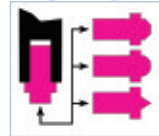
Some of Our Customers:



Special Options

Tool changing station

Manual or automatic tool changing capability for rapid exchange of individual tools.



Integrated linear adjustment

Additional integrated X- or Y-axis for position correction of the die. This can avoid the need for additional adjustment axes for the lead frame or the wafer.



Overload protection

Integrated safety mechanism to avoid damage to the micro gear and / or motor in the event of a collision or mishandling.



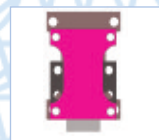
Initialisation station

Integrated reference switch for homing and to check the output position to ensure reliable operation.



Customized interfaces

Tailor-made housings to allow easy and direct integration into the customer machine.



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