

Manipulation System



Making difficult things easier and simpler for everybody!



Easy Operation



Precise Motion

Highly reproducible, accurate, and minute operations



Automation

of burdensome operations

Easy Injection

The manipulation system has been developed with the aim of facilitating cell manipulation under a microscope visual field by using an electric drive system and by applying our unique high-precision positioning techniques.

The system runs on a single control program that enables the integrated control of all components. Thus, not only can each component be driven in linkage with each other, but also these operations can be partially automated so that various applications can be used. Furthermore, the control program enables operations to be performed quantitatively because the driving conditions are finely set as numerical values. In addition, it can make up for the differences between users because multiple users can share the same driving conditions.

Application

Applications for biology

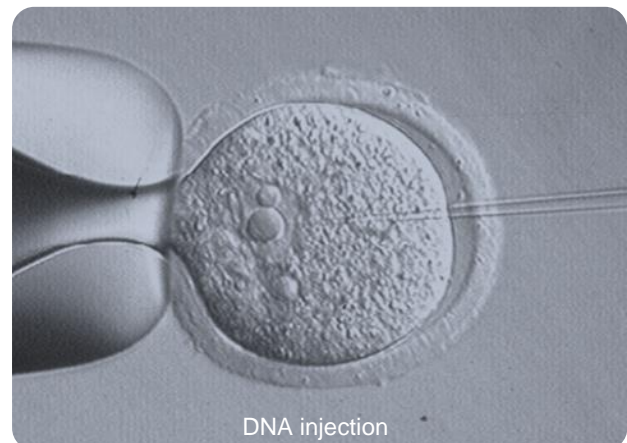
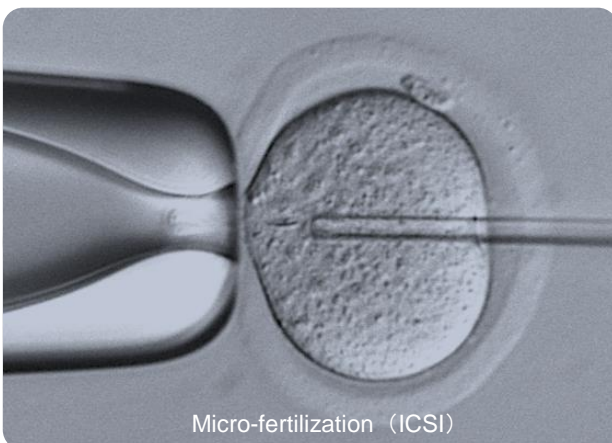
ES cell injection

Micro-fertilization
(ICSI)

DNA injection

Our unique egg cell perforation technique and automation technology not only provide easier micro-fertilization operation on mice, but also enable the application of ES cell injection to create chimera animals.

Note: This system has been implemented through the joint research with the Central Institute for Experimental Animals.



Applications for industrial machinery

Micro-sampling

Assembly of micro
components

Inspection in
manufacturing
electronic
components



Usability



The user can easily perform lengthy operations while sitting!

- All operations can be controlled by the joystick (except for some operations such as changing the magnification of the microscope). Workload is reduced because the user can operate the system in a comfortable position while sitting and looking at the monitor screen.
- The operation unit can be installed in a place away from the microscope and the manipulator, improving freedom in layout design.



High precision



Even a novice could become an expert!

- The user can perform the work of moving a micro-tool in a straight line with a single touch of a button on the joystick—an operation difficult to perform with conventional manipulators.
- The joystick operation has high accuracy in a small region.
- Not only an expert but also a novice can perform burdensome, delicate work, free from stress.

The manipulation system was created with NSK's world-class technology that has been cultivated in the development of bearings

We have achieved a new backlash-free structure consisting of NSK products such as bearings, ball screws and linear guides. The structure features high reproducibility in a small region and enables high-precision position control.

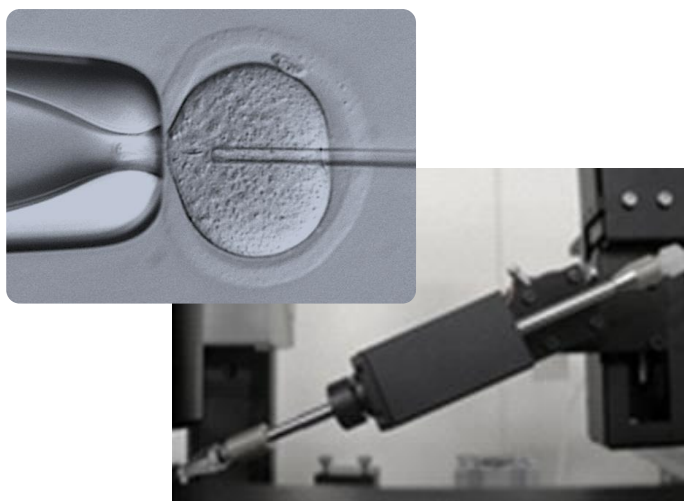
Furthermore, the sequence control technique is based on our mechatronics technology. It enables high-precision positioning work in a three-dimensional space. In addition, usability is greatly improved because the joystick controls almost all operations.

- The automated functions of the manipulator system enable each component to automatically return to its pre-set position or to move to a designated position in a three-dimensional space, so that the user does not lose sight of the object. In addition, these functions enable the user to make and use various operation patterns according to the user's purpose.
- For egg-perforation operations, we have developed a unique piezoelectric actuator based on NSK's bearing technology.
- The piezoelectric actuator is equipped with a glass needle filled with a liquid called Fluorinert. A high-frequency voltage is given to the piezoelectric element in the actuator to minimize the damage to the egg during perforation operations.

easier and simpler for everybody!



Minor damage



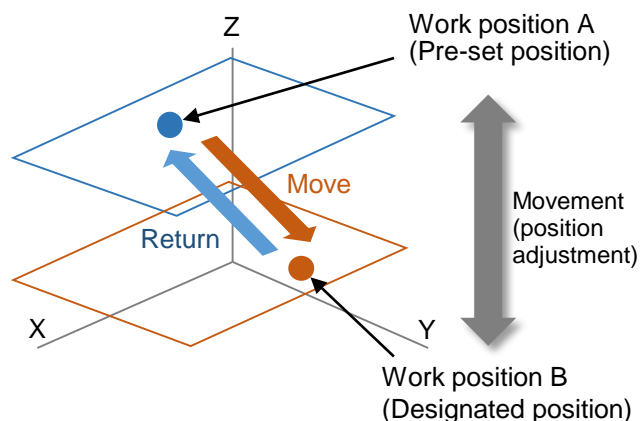
Unique techniques that enable smooth perforation operations with minor damage!

- The joystick controls the piezoelectric actuator that uses NSK's unique positioning techniques to facilitate delicate egg cell perforation operations.



Automation

Example of three-dimensional positioning work



Repetitive work is automated! Workload is reduced, and work efficiency is improved.

- Operations can be automated by registering a series of work processes or complicated operation procedures such as position adjustment or position movement including return movement.
- We used our high-precision positioning and sequencing techniques to achieve the technology.

Automatic operational flow (example)

ES cell injection

- 1** Position adjustment into an automatically operable state
- 2** Automatic movement to another egg cell dropping
- 3** Position adjustment into an automatically operable state
- 4** Automatic movement to another egg cell dropping

Micro-fertilization (ICSI)

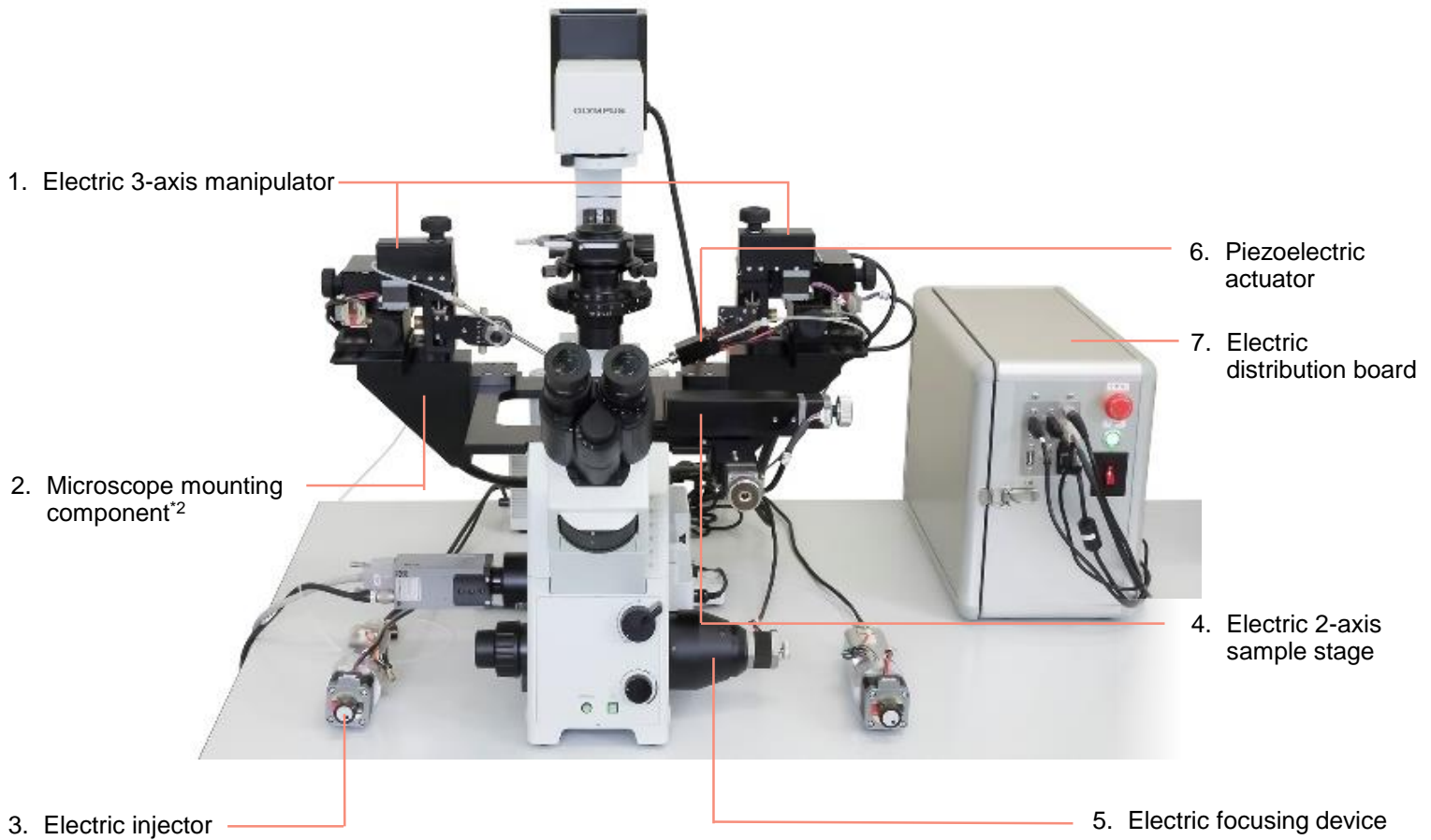
- 1** Perforation with little damage
- 2** Cell collection operation
- 3** Position adjustment to perforation position
- 4** Injection operation

Automatic position adjustment

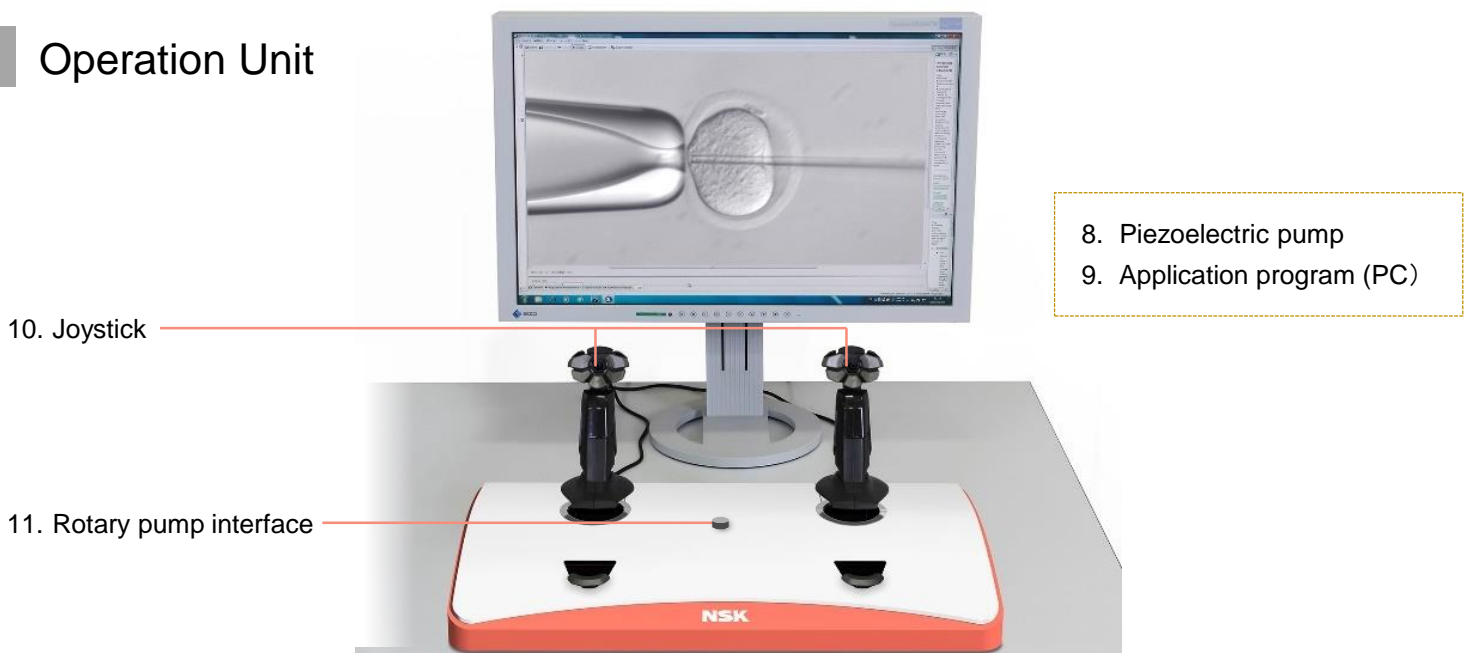
Automatic return to original position

Manipulation System: Product components*1, 3

Manipulation Unit





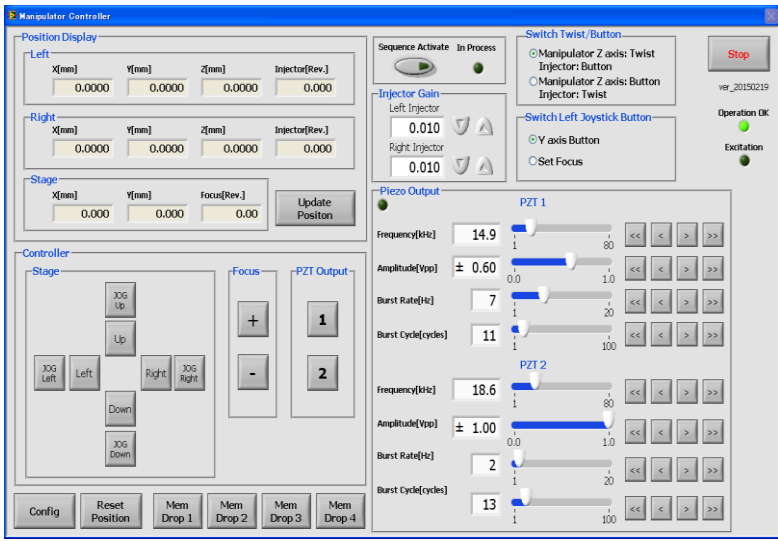


Operation Unit



- Notes: 1. This product's components are based on the system configuration for egg cell injection operation systems. However, the components can be changed according to application.
2. This component can be mounted on other company's microscopes.
3. Does not include a microscope and a camera.

Specifications

| | Electric 3-axis manipulator | Electric 2-axis sample stage | Electric injector | Piezoelectric actuator |
|-------------------------------------|--|---|--|---|
| |  |  |  |  |
| Stroke / Capacity | 20 [mm] | | 1,178 [μl] | 5 [μm] |
| Resolution [μm] | 0.1 | | - | - |
| Maximum speed | 5 [mm/s] | | 5 [rps] | |
| Drive method | 5-phase stepping motor | | | Piezoelectric element |
| Dimensions [mm] | 143 x 144 x 149 | 296 x 294 x 80 | 42 x 42 x 167 | 20 x 20 x 43.5 |
| Weight [kg] | 1.5 | 1.5 | 1 | 0.13 |
| Distribution board dimensions [mm] | 250 x 400 x 500 | | | 320 x 350 x 149 |
| Distribution board weight [kg] | 19 | | | 7.5 |
| Power source for distribution board | 100 VAC - 125 VAC, 50/60 Hz, 3 A | | | 100 VAC – 125 VAC, 50/60 Hz, 2 A |
| Control program | Install the program into an Windows PC | | | |
| Communication method | Serial communication | | | |
| Control software window |  | | | |

- Can be mounted on other company's microscopes.
- An expert's lecture is provided at start-up.
- Consult us for micro-tools to be used.



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