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Three good reasons to choose oil hydraulic micromanipulators

Oil-hydraulic joystick micromanipulator is the prime choice of a micromanipulator to perform microinjection to floating cells. What are the decisive factors? This issue of Narishige Web News makes comparisons in terms of structural characteristics of oil-hydraulic, motor-driven and mechanical manipulators.

1. Simultaneity in Operation and Movement

Microinjection experiments with floating cells require micromanipulators being very precise and higyly efficient enough to complete microinjection work swiftly. For such operations, micromanipulators should be able to duplicate movement in the same manner and speed as created in the control unit. Also it should be able to respond to the movement of joystick accurately while being manipulated slowly but absolutely precisely.
In hydraulic micromanipulators, joystick maneuvered by the user physically presses diaphrams of responsible movement directions. The pressed diaphrams in the control unit instantly transmit movement to corresponding diaphrams in the drive unit though hydraulic tubes. With well-maintained oil-hydraulic micromanipulators in good condition, a drive unit responds almost simultaneously to movement of control unit.
On the other hand, electrical micromanipulators are supposed to go though a process of encoding for changing movement of joystick to electric signals and then activate motors of the drive unit, that course of process sometimes makes the user feel slight time lag in coordinate calculation and risetime of motor.

2. Remote-control Ability

In oil-hydraulic micromanipulators, movement created by joystick is transmited to a drive unit through hydraulic tubes, thus vibration occurred in the control unit is never transmitted to the drive unit (and a microscope).
On the other hand, mechanical manipulators have its drive unit structurally connected to a control unit, and the drive unit equipped with a joystick is directly connected to a microscope. Therefore, vibration occurred by user's hand holding the joystick can be transmitted straightly to a pipette being held on the manipulator.

3. Craftsman's Excellence Pursuing Absolute Precision

Naturally, the drive principle of hydraulic system does not have concept of resolution. In other words, it is a history of challenge for "absolute precision" by our craftsmans pursuing it and challenging to micro-world with their distinctive techniques. Electrical micromanipulators, despite emphasized a sub-micron order resolution, still definitely require some structures (such as dovetail and gears) as with other micromanipulators to convert original motor rotation into practical micromanipulator movement, and every single part involves accuracy difference in processing and structure. That is to say, real excellence of a product does not appear in a written specifications sheet but appear in elsewhere beyond the specifications sheet.
With deep insight of precision instruments, Narishige make the most of accumulated know-how of micromanipulation production techniques and explore the best way of pipette/electrode manipulation in micro-world, with conscientious craftsmans' descipline.

Electrical micromanipulators are detailed with "resolution" in a catalogue. It is a minimum theoretical value in step-controlled movement virtualized in coordinates. It is a value which is calculated out of electrical compression rate and usually it ishows a very small value. However, if a system is activated at the minumum value setting in reality, a stroke of joystick creates only insufficient range of movement and it may not be practical in actual microinjection work.
By turning up a resolution setting, a large working range can be gainded, but it also increases movement distance per step, and it can result in shaky movement of a pipette tip. This way of movement is not recognized as movement controlled at will.

	Motorized	Oil-hydraulic	Mechanical
Drive Principle	Movement of joystick is encoded to electric signals to be transmitted to a drive unit materialize movement by stepping motor control.	Movement is controled by diaphrams pressed or eased in the control unit that transmits movement to the diaphrams in the drive unit through responsible hydraulic lines.	Mechanical structures (such as spring, gear, beam structure, etc) reduce movement created by joystick.
Advantage	Remotely controlled, thus vibration in the control unit is not transmitted to the drive unit. Coordinates are memorable, and thus functionally returnable to a memorized coordinates even under high magnification.	Remotely controlled, thus vibration in the control unit is not transmitted to the drive unit. Hydraulic movement is analogue movement, thus theoretical resolution is infinitesimal. Joystick renders large working range with sensitive and highy simultanious movement which surpasses movement of the other drive principles.	Simple structures allow easy, intuitive control. Easy to maintain.
Disadvantage	Under technical constraint in reliably recognizing quick motion of joystick and sensitive movement expression in digital manners, and also in real-time interlocking of the digital signals and the drive unit movement. (leaping, shaking, time-lag in movement etc.)	Less resistant to temperature fluctuation compared with the other drive principles. Hydraulic tubes linking control unit and drive unit might look untidy around microscope.	The control unit directly connecting to the drive unit transmits vibration to the entire structure included a pipette being manipulated. Skilled techniques are required for ensuring uniformity of micromanipulation.
Simultaneity	×	◎	◎
Remote-control Ability	◎	◎	×
Overall rating	△	◎	△

If you have any questions or need further information, please contact us.

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