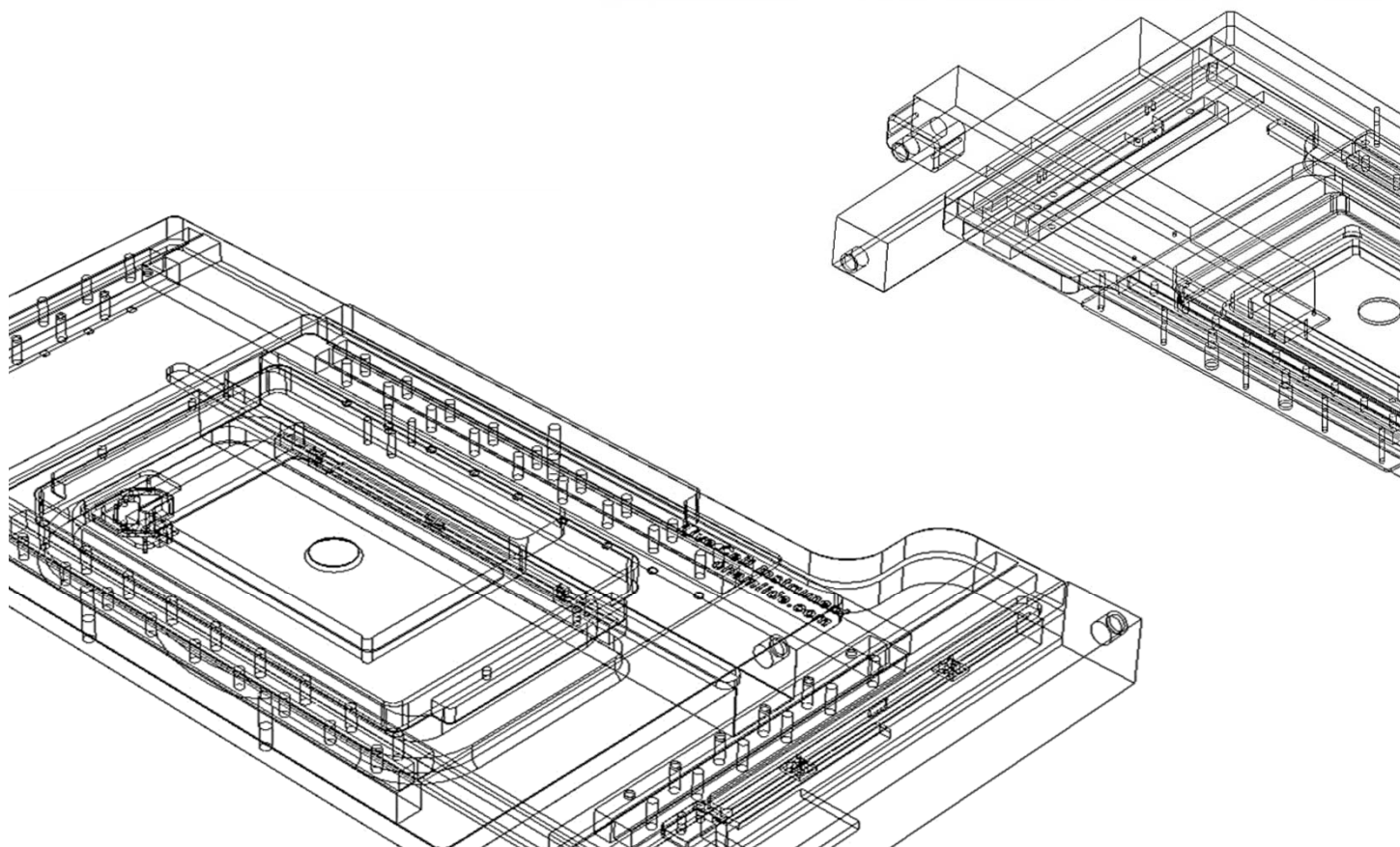


IncuStage®

Precise motorized XY stage
with live cell incubator system

Efficient use
High performance
Best for HTS experiment
Revolutionary concept for live cell imaging





Recently, there are increasing demands of multi-well or multi-position/ multi-dimensional imaging experiments that is common to change the manual stage of microscope to the motorized linear stage. LCI is also designed to offer the high-precision motorized systems in order to provide users the best position possible to investigate accurately and automatically the multiple samples. IncuStage consists with the sample moving stage, its controller and the convenient joystick. Our product can be used with all kinds of microscope such as Olympus, Nikon, Zeiss, Leica, etc.

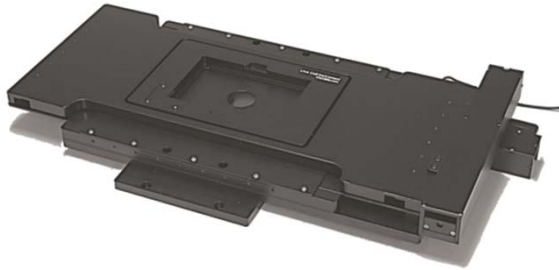
IncuStage can provide not only for the upright and inverted microscope, but also for *In vivo* animal experiments.

Particularly, due to high usage of inverted microscopes in the biological experiments, LCI supplies two types of brilliant

stages for the inverted microscope, which are the standard high-precision motorized stage and the flat-top stage. Specifically, the upper part of the flat-top stage comprised with completely wide and flat plane, which advantageous feature can offer the additional device to be attached for user's convenience. Furthermore, the actual stage or the tread holes on the upper part of the stage can be altered by the user's request for their special purposes. In order to move the samples more accurately and precisely, IncuStage operates the high-precision stepping motor and actuators to give the best performance. This is because the stepping motor is controlled by the microprocessor, which can control the high level of resolution within the few nanometers. This key feature can deliver the smooth movement of samples and hence, it is very suitable for transferring the liquid samples, which require the user's awareness and carefulness. The biocompatibility is one of the most important characteristics for the bio-instruments whose surface is required to interact with biological systems such as organic reagent or culture medium. In order to satisfy these arising issues, IncuStage uses biocompatible materials, as it is consist with the strong aluminum metal through the black anodized surface. Through this design, there is no erosion or structural change (no physical scratches) for a long time. In addition, it is possible that due to the changes in ambient temperature, the metal can be expanded or contracted, which consequently reduce the proper functions of stage. Thus, in our product of IncuStage, the plate and sample holder was separated each other in order to minimize these problems. This separation technique provides users to accomplish the experiment more accurately either in the low or high temperature environments due to the fact that it will prevent the heat transfer to the entire stage.

The joystick can be used while the users are operating the microscope intuitively, depending on the angle of the joystick. In the default mode, the direction and the movement axis can be changed freely by the increasing speed of the movement for the stage. Also, In order to move the samples very slowly for the high magnification imaging, IncuStage is divided into 3 sections of the movement buttons such as ultra-fine, fine and coarse. Hence, the users can select the speed of the movement for their purpose. IncuStage has a hole to fit the universal K insert for the samples. Our company also provides a variety type of stage inserts for the various specimens that it retains the mounting frame of universal K insert size but the inside is altered to fit the slide, culture dish and the well plate. There are few more accessories available for inserting the samples from our company (the pictures are shown on the page 8). We sincerely believe that the IncuStage is very beneficial and valuable for all researchers and the scientists who are doing the bio-imaging experiments.

Motorized stage



- High precision actuators for XY-axis.
- High performance stepping motors.
- Can be attached on all kinds of microscope.
- Has a hole to fit the universal mounting frame of K size insert.
- Black anodized coating which has high hardness.

Motion controller



- Can be used to drive the movement of X-axis and Y-axis. (The movement of Z-axis is an option)
- Can control the movement of a high level resolution by using the high performance stepping motor driver.
- RS-232 Serial communication with computer.
- Can freely access to AC volt

Joystick



- The speed can be controlled specifically , which allows as much or as little movement.
- The buttons are divided into 3 sections (ultra fine, fine or coarse) for moving slowly and selectively for the high magnification imaging.

Control specification

Metric accuracy (per mm of travel) : 0.15 μ m

Step frequency (Max) : 2.5 MHz

Step motor angle : 1.8 deg. (micro step 0.0072 deg.)

Step motor : 4 phase, micro stepping

Minimum step size : 0.04 μ m (1:50000 step)

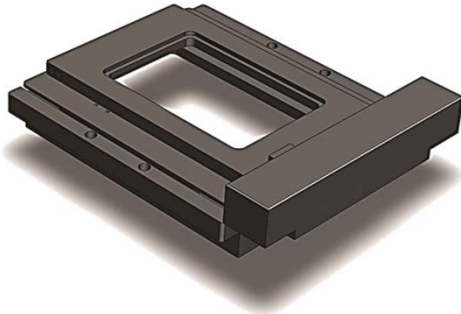
Travel range : 160x110 mm (standard type)

Drive screws : lead 2mm

Positioning repeatability : 3 μ m (Backlash 2 μ m, after Backlash calibration 1 μ m)

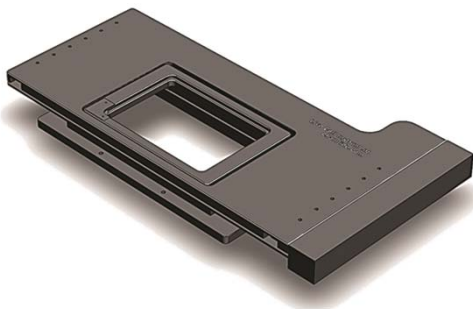
- The functions of the stage can be changed slightly by the physical environments such as ambient temperature changes, sample's movements, vibrations and the status of the microscopes.

Incustage for inverted microscopes; standard type



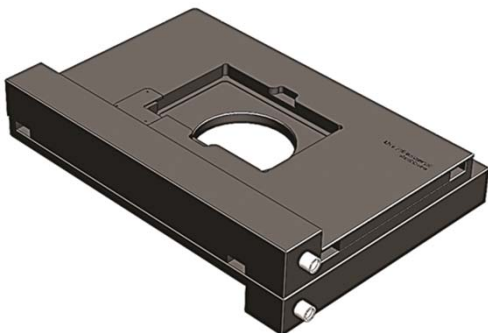
- This is designed to achieve the most outstanding performance.
- The basic type consists with the hole to fit the universal K sized insert.
- This can be used for all kinds of inverted microscopes.
- The moving distance can be altered by the user's request for their purposes.

Incustage for inverted microscopes; flat-top type

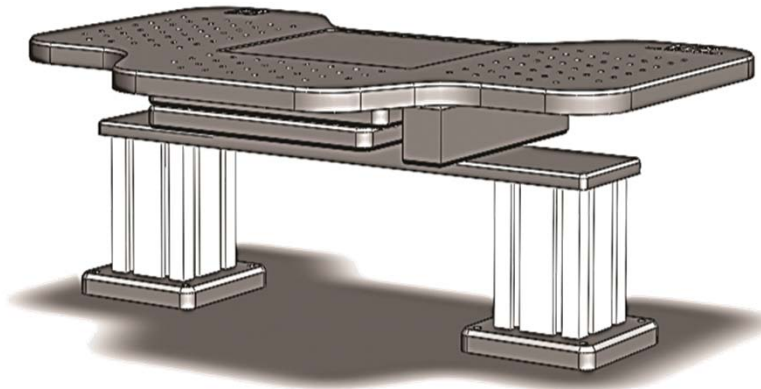


- The upper part of the stage is flat and wide to perform the various experiments.
- The upper part of the stage can be customized by user's request and also external device can be attached through the tread hole.
- The basic type consists with the hole to fit the universal K sized insert.
- This can be used for all kinds of inverted microscopes.
- The moving distance can be altered by the user's request for their purposes.

Incustage for up-right microscopes



- This is designed according to the upright microscopes that has the light weight and small size, but gives the best accuracy performance.
- This is designed to have the same focal length with the manual stage of microscopes and hence, no adjustments are needed.
- The basic type consists with the hole to fit the universal K sized insert. This wide insert prevents the collisions when the magnification of a microscope lens is converted.
- By using the universal K sized insert, the slide, well plate and such large samples can be fixed and moved with the stage.
- This can be used for all kinds of upright microscopes.
- The moving distance can be altered by the user's request for their purposes.

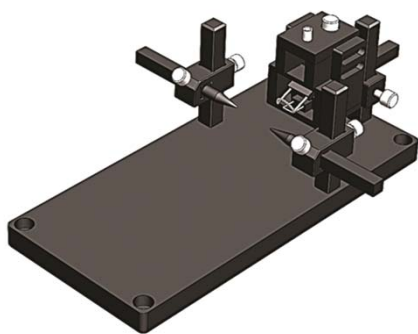


Currently, *In vivo* imaging has emerged as a novel tool to study the functions from live animals. Especially, multi-photon microscope becomes popular that is now possible to observe the changes in the tissues directly from live animals such as brain. For *In vivo* imaging, it is very significant that an appropriate plate must be attained for stabilizing the animal during the experiment.

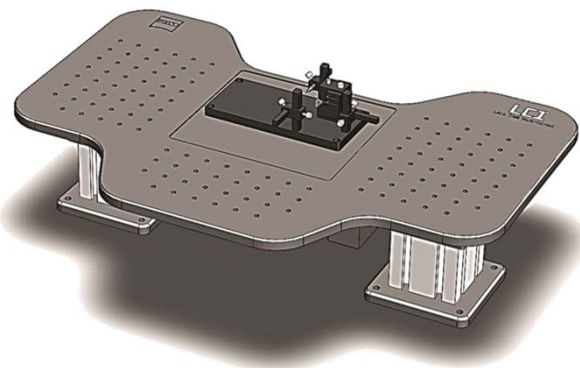
However, the limitation of this technique was that the manual stage is used for the animal movement in the fixed stage. As a result, it raised the problems and gives inconvenient method to utilize the stage due to the fact that the researcher must change the direction of manual stage in XY direction while watching the microscope. Also, if the users are attached the additional devices into the animal during the experiments, the manual stage cannot offer the movement of the animal and devices simultaneously.

In vivo motorized stage is thus, developed and designed to solve these problems. It consists with the wide dimensions, similar to the current fixed-stage, but with the automated motor and the joystick. The stage can be moved within the 50mm x 50mm dimensions, but users can customize the size by their own request.

With *In vivo* motorized stage, it is recommended to use the stereotaxic heating plate for fixing the animal because it has a function to maintain the body temperature consistently while stick the animal head onto the plate. This is also designed to easily transfer the anesthetic gas into the animal, which is very beneficial for the animal experiments. Similar to the general motorized linear stage, this *In vivo* motorized stage is made by the aluminum metal, coated with black anodized surface. The middle of stage is attached strongly with the underneath of stereotaxic heating plate, which has the magnetic characteristics.

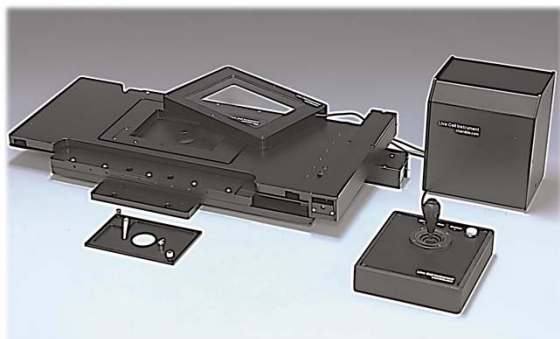


Stereotaxic heating plate for mouse

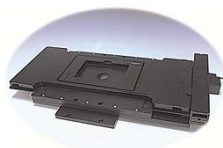


Stereotaxic heating plate for mouse on the motorized stage for *In vivo* experiment

IncuStage with incubator system for inverted microscope



4 channel temperatures & gas flow controller (CU-109), humidifier and lens warmer



XY motorized stage with electric heater



Controller for XY motorized stage



Joystick



Incubator cover



Adaptors

Live-cell imaging is the most significant and vital tools in the biological research area. Recently, live-cell imaging experiment is performed not only with the one sample but also multiple samples simultaneously. This is considered due to the time consuming and wasting to collect the multiple data. The nature of live-cell imaging takes longer time to observe the one result, which is so inefficient and unproductive.

The current technique for the multi-well imaging is that the multi-well plate (6, 12, 24, 48 or 96 well type), its incubator and XY motorized stage is essential. However, this method is quite disadvantageous since the heater must be accompanied with each of multi-well to balance the temperature consistently. Also, by using the short working focus distance lens for the high resolution imaging, the lens is moving upward and downward due to the bottom of incubator heater.

This consequently leads the longer time for the imaging and the sample is only limited in the automated microscope. IncuStage is the new concept and fascinated design that is combined with XY motorized stage and the incubation in order to solve these raised problems.

The main advantage is that there is no limitation to use with the culture dish, multi-well plate or any of the samples for the live cell imaging. Most importantly, the temperature heater is attached inside of the stage, and the heating cover is wrapped on the top of the stage to maximize the functional properties. Since the temperature heater is internally allocated in the stage, there is no consideration of the temperature change during the experiments.

This creates a stable cell environment for live- cell imaging. Moreover, the humidifiers, the lens warmer or the temperature controller can be attached with existing incubator accessories.

- The XY-motorized stage is enabled with the revolutionary patented of our incubator system, which creates a stable cell environment for live cell imaging.
- Top-stage incubator has disadvantages in multi-well imaging using by high resolution lens.
- Very good for HTS.
- Can be used with any types of well plate, there is no number of well limit.
(384 well plates are even possible)
- Working well with high N.A. objective lenses.
- Stage is in perfect control of the temperature.
- Intelligent temperature control system allows each well to maintain the same temperature conditions.
- Can be used with every chamlide products such as FC-5 (CO2/air mixer) to control pH.
- It is possible to control the temperature and movement of XY-motorized stage by using Metamorph.
- IncuStage can be controlled by the most of microscope control softwares such as NIS, Metamorph, Micromanager.



With Nikon Ti inverted microscope



With Zeiss Axiovert inverted microscope

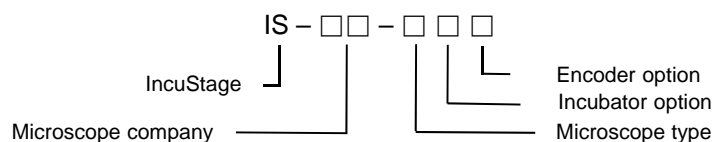
Precise motorized XY stage with incubator system

- Can be set up with most major brand microscope.
- Can be use as XY-motorized stage without heating accessories.
- Can observe any culture wares by using wide range of adaptors.
- Intelligent incubator system for live cell imaging.
- Economically profitable and sturdy.
- Proven operation with many popular software package

Ordering chart

IncuStage			
Microscope company	Microscope type	Incubator option	Encoder option
NI (Nikon)	I (Inverted)	Y (Yes)	Y (Yes)
OL (Olympus)	U (Upright)	N (No)	N (No)
ZE (Zeiss)	O (Other)		
LE (Leica)			
OT (Other)			

According to the users request, we can customize into any size or shape of IncuStage.



Accessories

- IS-B-001 Universal K insert for slide and dish (adjustable)
- IS-B-002 Universal K insert for well plate
- IS-B-003 Universal K insert for custom-shape
- IS-D-001 Well plate size insert for slide and dish (adjustable)
- IS-D-002 Well plate size insert for chamber slide or chambered cover glass
- IS-D-003 Well plate size insert for culture dish
- IS-D-004 Well plate size insert for custom-shape

