# Creating the ideal environment

**ZEISS Incubation Solutions for Life Sciences**

Environmental Control Tailored to the Requirements of Your Samples

Seeing beyond

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› The Advantages
› The Applications
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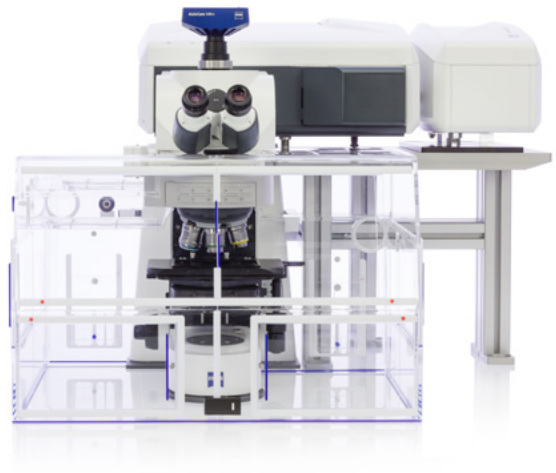
# Environmental Control Tailored to the Requirements of Your Samples

Experiments with living cells or organisms are gaining more attention as numerous processes can be studied only on living samples. Stem cell differentiation, cell migration, tissue and organ development, kinetic studies in drug screenings and observation of molecular processes are examples of such experiments that also reflect the complexity of modern life science research.

You expect your imaging systems to support these experiments without the burden of technical difficulties and time-consuming monitoring tasks. Cultivation conditions stimulating the living organisms must be created precisely and kept stable over hours, days and sometimes weeks.

With ZEISS incubation systems, you create the optimal environment for even the most sensitive specimens. The solution portfolio allows the flexibility to combine different housings, incubators, and sample holders as required. Simple setup procedures and precise control over environmental parameters help you to create meaningful, reproducible results.



# Stable. Flexible. Precise.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**Stable conditions**

In-vivo experiments often yield new insights to dynamic biological systems. Some processes take less than a millisecond while others require days or even weeks to complete. Because the specimen is alive, it responds to changes in temperature, pH or gas levels. For this reason, the stability of the environmental conditions is one of the most important factors for a successful experiment. Any unwanted fluctuation will inevitably lead to a less conclusive results.

ZEISS incubation equipment creates stable environmental conditions, so you know your experiments are proceeding as intended and you can correctly interpret the results.

**Flexible setups**

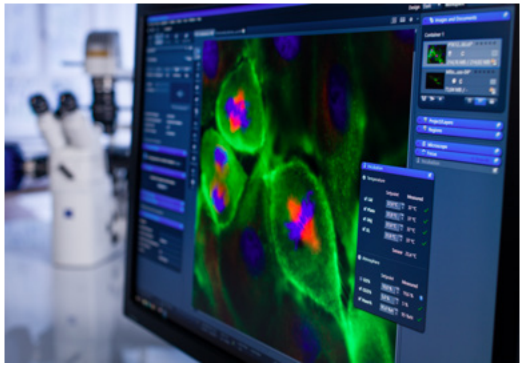
The requirements placed on sample carriers, environmental parameters and imaging conditions may vary with each experiment. For example, environmental parameters like temperature, $O_2$, pH and humidity must be controlled simultaneously to ensure the viability of living specimens.

To support a great variety of studies, ZEISS allows you to control the incubation components individually. Combine components to achieve the level of precision, sophistication and flexibility required by your experiment. With a large selection of compatible components within the ZEISS incubation portfolio, you can build a system that meets your current experimental needs while being assured of compatibility for future applications.

**Precise control**

Precisely controlled environmental conditions are required to make experiments reproducible. Built-in feedback systems ensure correct regulation. Integrating your incubation equipment with the ZEN imaging software allows you to control and record all conditions through a unified user interface. Also you can directly adjust parameters on the microscope TFT.

Sensors and controls are seamlessly integrated and important parameters are recorded together with the imaging data to enable you to trace a result to a specific condition. Being able to recall these data later and plot them significantly assists you in documenting and interpreting your results.



# Your Insight into the Technology Behind It



The broad portfolio of ZEISS incubation solutions allows you to choose the ideal configuration for each experiment.

*A selection of the ZEISS incubation accessories*

# Your Insight into the Technology Behind It



**Sample Holders**

Shape and size of your samples may vary greatly; therefore, a wide range of sample carriers have been created over the years, each addressing the specific needs of both typical and unique applications.

Select the sample holder that fits your sample carrier and stage. Most sample holders include suitable lids for humidification and pH / gas control, whether you use dishes for cell or tissue culture, multi-well plates, chamber slides or perfusion chambers. Heated holders allow easy execution and precise control for temperature-sensitive experiments.

Sample holder use clamps, magnets or springs to secure your sample.

The universal mounting frame K-M is designed to fit almost every type of multi-well plate. In addition, it can accomodate a variety of click-in inserts that convert it into a holder for slides, chamber slides, and dishes of different diameters.

If higher throughput is required and multi-wells are not an option, you can choose holders that allow for more than one slide or petri dish. Additionally, all sample holders can be used with a piezo stage for demanding applications requiring high travel speed and precision.

*Heatable universal mounting frames*

*Universal mounting frame K-M with click-in inserts*

*Universal mounting frame K-M with adapter and $CO_2$-lid*

# Your Insight into the Technology Behind It

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**Environmental Control**
Matching the physiological conditions of organisms is crucial for live cell experiments; however, microscope components can be affected by these same environmental parameters, especially temperature. ZEISS Incubator solutions ensure a stable and homogeneous temperature for your specimen as well as for the microscope.

The new XL Incubator was designed to provide a homogeneous temperature, easy startup, and maximum experimental flexibility – no matter if you use a cover glass, a petri dish, or a multiwell plate. You always have direct access to your sample, room for additional accessories and a homogeneous temperature in the entire compartment.

*The transparent sliding door and LED lights allow you to observe your sample without disturbing the environmental conditions.*

Silicon-sealed openings for tubes and cables allow all connections to remain in place for a fast and convenient setup. Large sliding doors at the front and at the side provide you with convenient access for changing your specimen or replacing sample medium. The foldable lid at the top of the incubator enables the condenser to be moved backward for full access to the sample area, allowing you to modify even the most complex experimental setups inside the incubator.

The XL Incubator is available in black or transparent versions. The black XL Incubator transforms your microscope into a fully equipped dark room, with LED light to illuminate the incubator interior when needed. It features an additional transparent sliding window allowing you to view your sample without disturbing the environment. Internal shelves for preheating media and storing the $CO_2$ lid permit an efficient setup with a small footprint. Convert your microscope into an isolated laboratory and perform demanding live cell, low light fluorescence experiments, no matter where it is located.

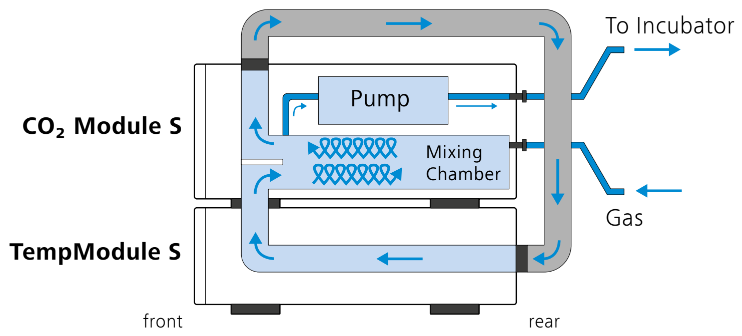
# Your Insight into the Technology Behind It



**Temperature**
All organisms are adapted to the environmental conditions in which they live. If the deviation from these ideal parameters becomes too great, the organisms react and change their behavior. For this reason, it is crucial to create and maintain optimal conditions to study the natural behavior of your specimens.

The temperature must match the needs of the organism, otherwise processes like cell adhesion, proliferation and protein expression can change significantly. Also, biophysical parameters such as membrane phase, fluidity and rigidity are temperature-dependent and will alter the activity of membrane proteins and subsequent cellular processes.

ZEISS incubation solutions allow you to maintain a stable temperature for your specimen, no matter if you want to use large volume incubators or smaller stage top chambers.




**Atmospheric $O_2$ and $CO_2$ levels**
Controlling the atmosphere is necessary for live cell experiments. Depending on the type of cell line, the level of oxygen needed to maintain cell function varies greatly. While tumor cells are known to profit from low oxygen levels, most other cell types suffer when oxygen concentration is depleted.

Carbon dioxide levels must be adjusted to maintain the required pH level in carbonate buffered culture medium. Levels of $CO_2$ that are too low will lead to a degassing of $CO_2$ from the solution into the atmosphere, acidifying the medium. In physiological studies a stable medium pH is important, as most cells and organisms will react to a change in pH level.

ZEISS incubation solutions allow you to precisely define atmospheric $O_2$ and $CO_2$ levels tailored to your research and keep them stable.

*Schematic illustration showing how the carbon dioxide level is adjusted and the mixture is tempered. Pure $CO_2$ from a bottle is mixed with air until the $CO_2$ level reaches the level set in the software. The mixed gases circulate and are heated. A pump then pumps the tempered gas mixture to the incubator. This allows equilibration in the sample, with gas having the correct $CO_2$ level and temperature. Concentration or temperature gradients are effectively eliminated.*

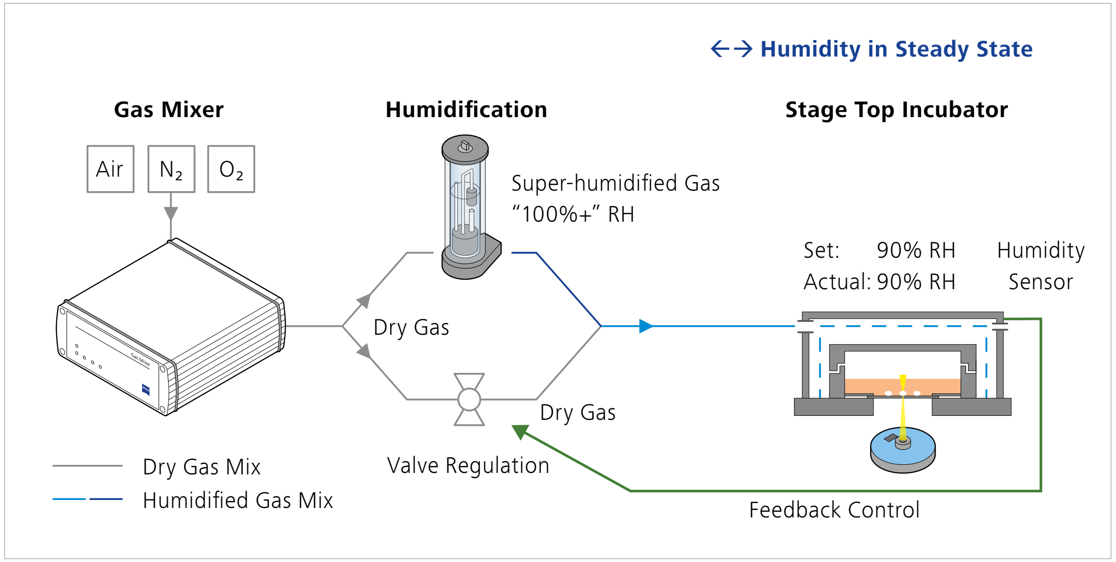
# Your Insight into the Technology Behind It



**Relative Humidity**

Humidity is an often neglected parameter which indirectly has a strong influence on cellular physiology. If high humidity is not maintained, water evaporation from the sample dish will occur. This changes the concentration of salts and nutrients inside the cell media, subsequently leading to an osmotic pressure between cell and medium. Osmotic pressure stresses cells, changing their normal behavior and shape. This impacts gene expression and cell proliferation or may trigger apoptosis.

ZEISS humidification equipment uses a feedback control system to precisely regulate the humidity in the incubator, thereby avoiding artifacts. You can be confident that changes in cell shape, gene expression or proliferation are the result of your experiment and not unstable environmental conditions.




*Schematic illustration showing how the humidity of the atmosphere is controlled. A dry gas flow is split into two streams. A valve regulates if the dry gas can enter the incubation chamber directly or needs to pass a humidity chamber first. If the relative humidity is too low, the valve closes, and the gas passes the humidification chamber. The humid gas then reaches the incubation chamber, increasing the relative humidity of the atmosphere. If the relative humidity is too high, the valve opens and only dry gas enters the incubation chamber, decreasing the relative humidity.*

# Your Insight into the Technology Behind It

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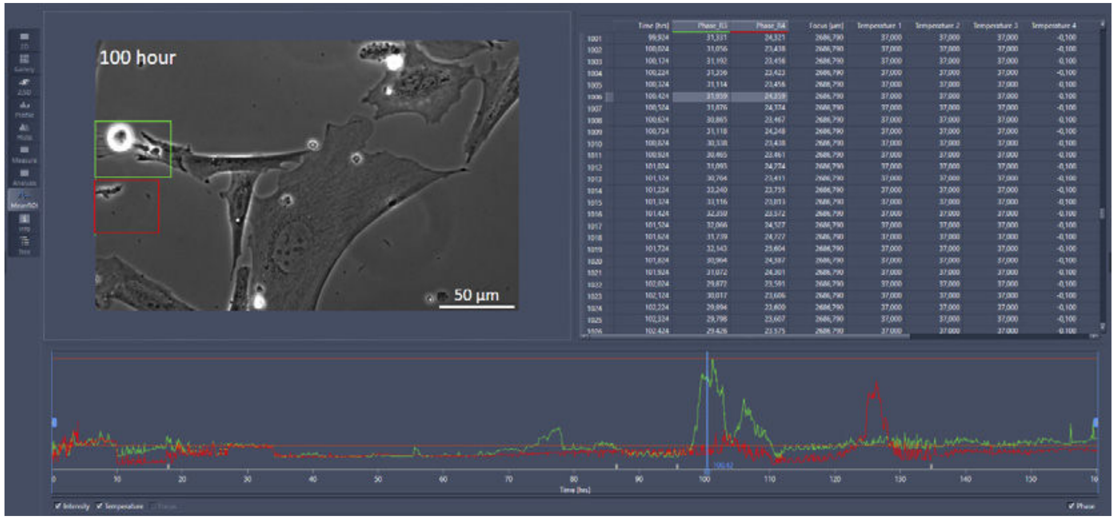
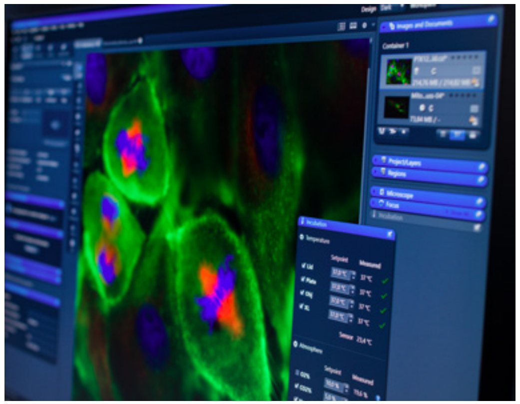
**Software Integration**
Access to all experimental parameters is necessary for both validating processes and interpreting results. ZEISS incubation solutions are fully integrated in the ZEN software environment to streamline data collection. Temperature and atmospheric parameters for each experiment are recorded in a single file which prevents mis-matched information and ensures reproducible experiments.

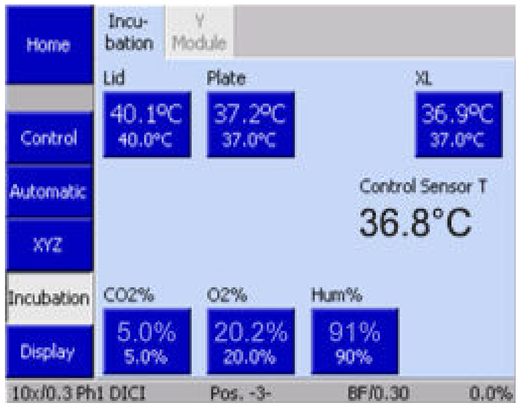
ZEN also allows you to manage all aspects of your experiment from a single interface. This simplifies operation and increases efficiency. Set the desired environmental conditions with just a few clicks and access microscope control panels from the same interface. The system automatically makes adjustments according to your input.




*Relevant parameters like temperature, atmosphere levels and intensity are stored with the image file in ZEN and can be plotted or exported.*



*ZEISS ZEN user interface with integrated incubation solution*




*Control panel of a ZEISS microscope providing access to all incubation parameters.*

# Environmental Control for Your Applications



| Typical Applications | Task | ZEISS Solution |
| --- | --- | --- |
| **Label-free live cell cultures** | Evaluation and documentation of cell culture status | Single file format for environmental and experimental data, PlasDIC, Definite Focus 3 |
| **Transfected live cell cultures** | Evaluation and documentation of transfection rate and transfection stability using fluorescent markers | Incubator XLmulti S1 / S2, stable pH, stable temperature, gentle excitation with Colibri, PlasDIC, Definite Focus 3 |
| **Reproductive or adherent cells and cell cultures** | Mechanical manipulation of cells (e.g., injection of germ cells), injection of dyes and other biologically active substances | Heated microscope stages and mounting frames, Incubator XLmulti S2 DARK with space for many accessories, support for micromanipulators |
| **Living neuronal or muscular cell culture or tissue slices** | Observation of fast densitometric, radiometric and electrical signals | Incubator XLmulti S2 DARK to efficiently exclude light, Colibri for gentle excitation, fast and sensitive Axiocam cameras |
| **Multi-labelled living tissue section, organs, organoid, spheroid, or cell culture preparations** | Short-term or long-term observation of physiological and morphological parameters in 2D / 3D during growth, differentiation, motility, and interaction | Autocorr, LCI objectives optimized for live cell imaging, LD objectives for large specimen, arivis Vision4D for multichannel, 3D visualization |
| **Working with tumor cells, hypoxia studies (analyzing the effects of hypoxia)** | Working in reduced $O_2$ concentrations | Reduced $O_2$ concentrations, 1% – 21%, stable pH |
| **Investigating cell migration in chemotaxis assays or wound healing assays** | Tracking of cell movement | Stage-top incubator, stable atmospheric control, stable pH, stable temperature, Definite Focus 3, LCI objectives optimized for live cell imaging, BioApps Confluency |
| **Studying angiogenesis with tube formation assays** | Observation of tubular networks, analysis of network shape and size | Heated microscope stages and mounting frames, PlasDIC, ZEN Intellesis |
| **Measuring cell proliferation over time** | Quantification of dividing cells | Stage-top incubator, stable atmospheric control, stable pH, stable temperature, LCI objectives optimized for live cell imaging, BioApps Confluency |
| **Analyzing inter- and intracellular signaling using specific fluorescence staining and high-resolution microscopy** | Detection of fast, transient events | Fast multichannel imaging with Colibri, fast and sensitive Axiocam cameras, arivis Vision4D, Incubator XLmulti S1 / S2: stable atmospheric control, stable pH, stable temperature |
| **Gaining insight into the cytoskeletal dynamics** | Observation of transient changes in cytoskeletal morphology | Heated microscope stage and mounting frames, gentle fluorescence with Colibri, fast and sensitive Axiocam cameras, ZEN Intellesis |
| **Fast processes in live cell cultures** | Imaging of Calcium waves, muscle contractions, blood flow, beating cilia | Incubator XLmulti S1 / S2, heating inserts for stable temperature, Airyscan 2 with Multiplex mode for gentle imaging at very high frame rates at confocal resolution |
| **Dynamics in cell compartments** | Acquire information about dynamics and concentration of molecules in living cells | Incubator XLmulti S1 / S2, heating inserts for stable temperature, LSM 980 with 7 channel FCS |
| **Image Living organisms and animals** | Capture the interaction of cells within living tissue | LSM 980 NLO on Axio Examiner with Incubator XLmulti S1 / S2. Use multiphoton excitation for deep tissue imaging |

# Environmental Control for Routine Microscopy



**Stage-top incubation**

- Robust temperature and pH stabilization for short and long-term experiments
- Fully integrated in ZEN for convenient experiment setup and data logging
- Supports high NA immersion objective for demanding applications
- Suitable for slides, chamber slides and petri dishes

**Heating plate**

- Well suited for combination with micromanipulation accessories
- Compatible with all petri dish sizes
- Optimized for processing large batches of samples
- Control via external control panel for convenient operation

*Axio Vert.A1 with manual stage combined with heating plate and micromanipulation setup*

*Axio Vert.A1 with transmitted light illumination, manual stage and stage-top incubation system*

*Axio Observer with scanning stage, Colibri fluorescent illumination and stage-top incubation system*

# Environmental Control for Routine Microscopy

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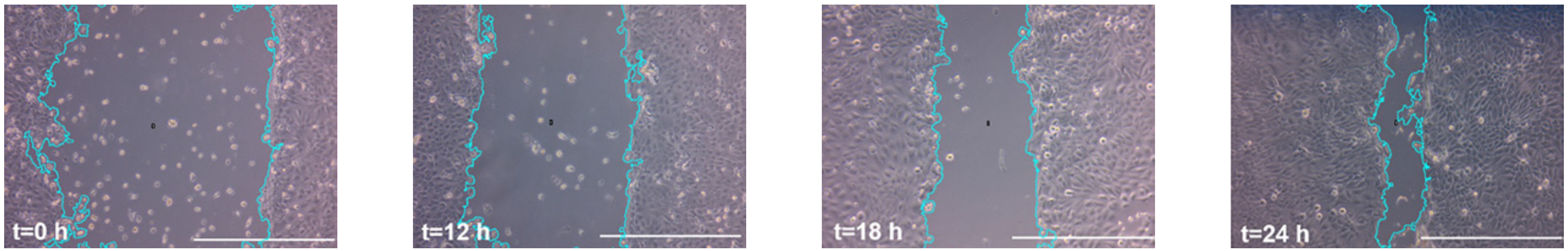
Assisted Reproductive Technology (ART) includes various microscopic procedures such as microinjection of spermatozoa into oocytes and examination of embryo quality and development. It is critical that these precious specimens are maintained at a constant temperature during observation and manipulation.

Scratch or wound healing assays are used to study the collective and coordinated movement of cells, a process important to understanding cancer metastasis. This standard in-vitro assay is used in many disciplines and is based on the creation of a cell-free area in a confluent monolayer. The cells then collectively migrate into this cell-free area to close the gap. The migrating cells are imaged with a low magnification objective over several hours up to two days to study this coordinated movement. A constant environment is the foundation for meaningful and reproducible results.

In the development of novel drugs for disease treatment, genetically modified organisms are widely used as disease models. Transgenic animals can be generated by microinjection of DNA, embryonic stem cells, or more recently via the CRISPR / Cas9 system. Such procedures can benefit from a temperature-controlled environment at the microscope.

*PlasDIC image of an Oocyte with Zona pellucida*




*Time lapse of wound healing closure in HaCaT exposed to hAdMSCs conditioned medium. Wound healing size tool test comparing HaCaT exposed to hAdMSCs conditioned medium and HaCaT cultured only with basic medium (DMEM +1%P/S) as control of the assay. https://doi.org/10.1371/journal.pone.0232565.g004*

# Environmental Control for Research Microscopy



### General features

- Variety of sample holders allow diverse experiments
- Automatically logs incubation conditions in ZEN with your acquired images
- Stage-top incubation systems for robust temperature stabilization during both short and long-term experiments
- Heated microscope enclosure compensates for fluctuations in room temperature
  - Ensures a constant temperature at the specimen
  - Equilibrates microscope components to match sample temperature to prevent focus drifts

### Temperature control

- Feedback control for all heated components to maintain stable temperature
- System calibration using a temperature probe directly at the sample

### Atmospheric stabilization

- $CO_2$-gasing to stabilize pH by carbonate buffer system
- $O_2$ control for simulation of body conditions / tissue conditions
- Humidification of all gasses to avoid evaporation at the sample for stable osmotic conditions

*Axio Observer with stage-top incubation including temperature control and atmospheric stabilization*

*LSM 980 confocal microscope on Axio Observer combined with Incubator XLmulti S2 DARK for environmental control, light protection and system stabilization*

# Environmental Control for Demanding Long-term Experiments



Long-term experiments have proven to be a valuable tool for gathering scientific data on complex processes like the development of whole organisms or slowly growing cells.

The correct interplay of different experimental aspects ranging from stable environmental parameters, gentle imaging conditions and a reliable focus strategy, are crucial for successful experiments. ZEISS incubation solutions allow you to control all relevant parameters from a single software solution. Benefit from the robust design of ZEISS microscopes and full traceability by saving all imaging and environmental parameters in a single file format.

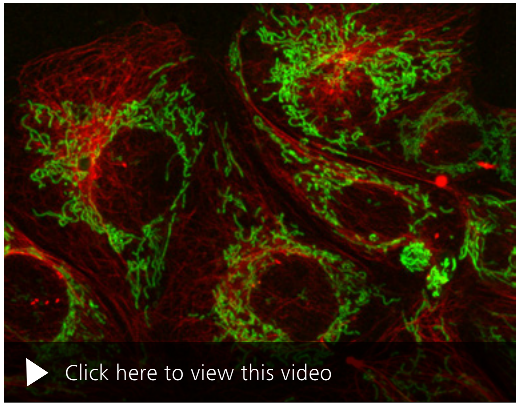

*Long-term phase contrast time lapse of Indian muntjac cells (7 days, 1 image every 6 mins). This slowly growing cell line requires stable conditions over days. Cells show high dynamics – mitotic events were observed after 100 h and 125 h indicating that ideal physiologic conditions of 37 °C, 5% $CO_2$ and 100% rel. humidity were matched even after days of imaging.*

# Environmental Control for Investigation of Dynamic Processes

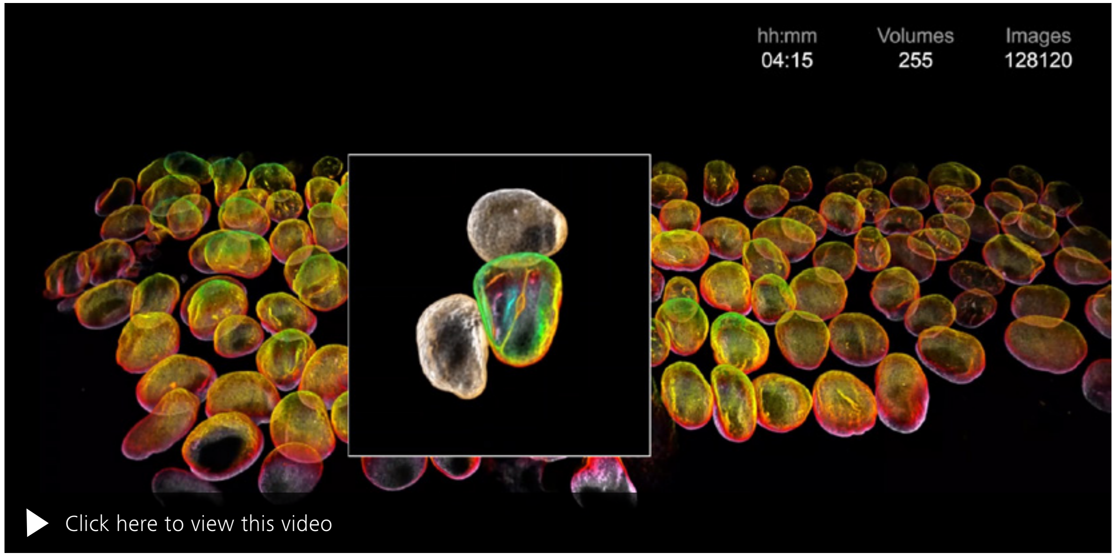


With functional biology becoming more important, the investigation of highly dynamic processes such as vesicle trafficking or the interaction of different cell organelles has yielded new scientific insights. These applications require not only the highest frame rates and resolution but also gentle imaging conditions over minutes or even hours. Unaltered development of whole organisms in 3D, like *C. elegans* or *Drosophila*, can be observed only by combining the lowest phototoxicity with fast volumetric imaging. Additionally, imaging conditions must be adapted to the natural environment of the specimen. Only when the physiological conditions of the specimen are matched perfectly, highly sensitive processes like mitosis can be observed.

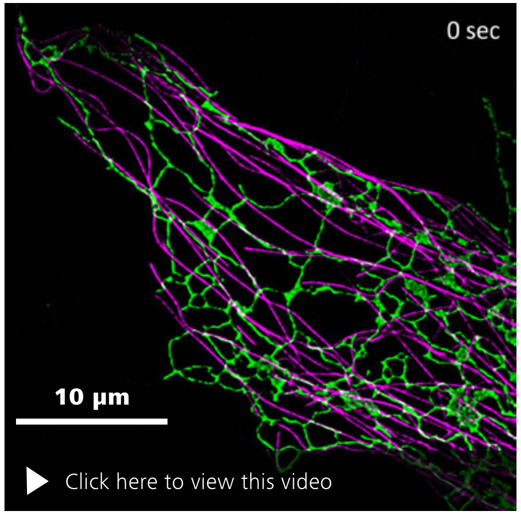
By intentionally changing the environment, the reaction of the organisms to external influences can be monitored. Treatment with chemicals allows the investigation of cell movement or growth rate. Heat shocks and hyper-/hypotonic conditions can alter protein expression and cell shape significantly. Fast, precise, and reproducible control of the environmental conditions is the prerequisite for these experiments.




*Kidney medulung cells stained with MitoView Green and SiR-tubulin are exposed to chemical stress. The cells recover fully after removing the chemical by washing. Courtesy of Sarita Patnaik, PhD, University of Mainz, Germany.*




*Human induced pluripotent stem cells which endogenously express mEGFP-tagged lamin B1 (AICS-0013). Images generated using AICS-0013 (LMNB1-mEGFP) from the Allen Institute for Cell Science.*



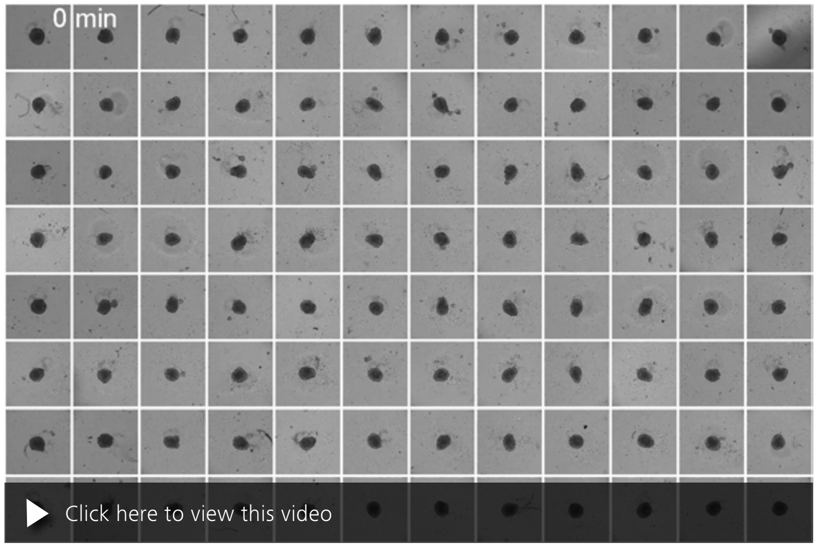

*Dynamics of GFP labeled microtubules (magenta) and tdTomato labeled endoplasmatic reticulum (blue/green) in a Cos7 cell.*

# Environmental Control for High Content Screening Applications

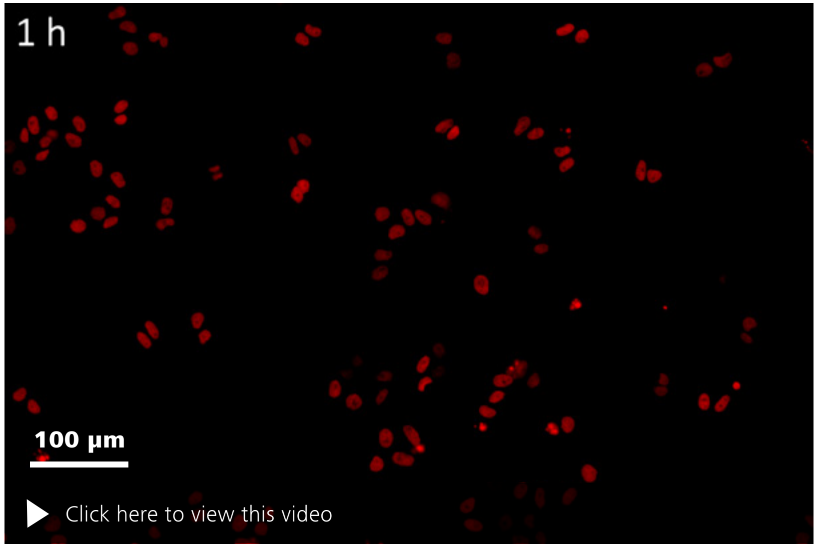


Throughput is important to obtain meaningful results for complex life cell studies. High content experiments increase statistical evidence by using larger sampling sizes. Therefore, it is necessary that specimens in different vessel containers are treated with identical environmental conditions. For investigation of highly sensitive specimens such as embryotic stem cells, simultaneously maintaining a consistent environment and gentle imaging conditions is essential.

Cell proliferation assays require gentle imaging over many hours or days. The environmental requirement strongly depends on the cell type. Therefore, the temperature within the sample chamber can be set within a broad range. $CO_2$ and $O_2$ levels can be controlled to accommodate a vast array of different cell types and organs or even small organisms. With the increasing number of automation features, ZEISS microscopes are an ideal platform for high-throughput automated live cell imaging.




*Mouse embryonic stem cells: High content screening of growing organoids.*
*Sample courtesy of S. Reither, Advanced Light Microscopy Facility, EMBL, Heidelberg, Germany.*




*HeLa Kyoto cells expressing H2B-mCherry in a 48h cell proliferation assay.*
*Sample courtesy of S. Reither, Advanced Light Microscopy Facility, EMBL, Heidelberg, Germany.*

# Your Flexible Choice of Components

## Incubation for Inverted Routine Microscopes


### Microscopes
- Axio Vert.A1
- Axio Observer 3, 5

### Microscope Stages
- Mechanical stage 130×85 R/L with short coaxial drive
- Mechanical stage 130×85 R/L

### Microscope Condensers for Axio Vert.A1
- LD condenser 0.3 for slider
- LD condenser 0.4 for slider
- LD condenser 0.4 for H Ph PlasDIC DIC iHMC
- LD condenser 0.55 for H Ph PlasDIC DIC

### Microscope Condensers for Axio Observer
- LD condenser 0.35
- LD condensers 0.55, manual

### Environmental Control
- Mounting Frame K Thermo Plate with Controller or
- Temperature Controller with Heated Plate K, ibidi and Glass Lid $CO_2$/$O_2$ heated, ibidi and
- Gas Mixer System $CO_2$, ibidi or Gas Mixer System $CO_2$/$O_2$, ibidi

### Software
- ibidi IncuControl for ibidi controllers via USB control

### Micromanipulation
- Only possible in combination with Mounting Frame K Thermo Plate

### Objectives
- Objectives (A-Plan/Plan-Neofluar) recommended for Mounting Frame K Thermo Plate:
  - Objective 2.5×
  - Objective 5×
  - Objective 10×/LD 10×
  - Objective LD 20×
  - Objective LD iHMC 63×

### High magnification objectives for for Mounting Frame K Thermo Plate:
- Objective LD A-Plan 40×/0.55 for Thermo Plate M27
- Objective LD A-Plan 40×/0.55 Ph1 for Thermo Plate M27
- Objective LD A-Plan 40×/0.55 iHMC for Thermo Plate M27
- Objective LD Plan-Neofluar 40×/0.4 for Thermo Plate M27
- Objective LD A-Plan 63×/0.65 for Thermo Plate M27

# Your Flexible Choice of Components

## Stage Top Incubation for Inverted Research Microscopes



**Microscope**
- Axio Observer 7

**Microscope Stages**
- All manual and motorized ZEISS stages with K-frame opening
- Stage attachment Z PIEZO WSB 500

**Microscope Condensers**
- LD condenser 0.35
- LD condensers 0.55, manual and motorized
- LD condenser 0.55 mot.; AI Sample Finder (recommended)

**Components for environmental control / incubation**
- Heated stage inserts for various sample holders
- Heated lids with gas inlets for temperature control and $CO_2$ / $O_2$ gasing
- Heated gas humidification
- Objective heaters
- Temperature sensors for temperature control at the sample

**System Control**
- TFT Axio Observer
- ZEN (blue edition)

**Compatibility**
- LSM 900 / 980, Elyra 7
- Recommended cameras: scientific class Axiocams
- Recommended light source: Colibri 7

**Recommended Objectives**
- LD LCI Plan-Apochromat 25× Imm (with objective heater)
- LCI Plan-Neofluar 25× Imm (with objective heater)
- LD C-Apochromat 40× W, 63× W (with objective heater)
- C-Apochromat, 40× W, 63× W (with objective heater)
- LD Plan-Neofluar 20×, 40×, 63×

# Your Flexible Choice of Components

## XL Incubation for Inverted Research Microscopes



**Microscope**
- Axio Observer 7

**Options for XL enclosure**
- Slide-In module standard
- Slide-In module camera
- Standard or premium internal illumination

**Compatibility**
- Stage-top incubation
- LSM 900 / 980
- Apotome 3
- Scientific class Axiocams
- Colibri 7, X-Cite Xylis, HXP 120 V
- Definite Focus 3

**With Slide-In Module Camera**
- Double camera adapter Duolink
- All Axiocams
- Third party camera models

**Microscope Stages**
- All manual, motorized and scanning ZEISS stages
- Stage attachment Z PIEZO WSB 500

**Microscope Condensers**
- LD condenser 0.35
- LD condensers 0.55, manual and motorized
- LD condenser 0.55 mot.; AI Sample Finder (recommended)

**Recommended Objectives**
- LD LCI Plan-Apochromat 25× Imm, 40× Imm, 63× Imm
- LD C-Apochromat 40× W, 63× W
- C-Apochromat 10× W, 40× W, 63× W, 100× W
- LCI Plan-Neofluar 25× Imm
- LD Plan-Neofluar 20×, 40×, 63×

# Your Flexible Choice of Components

## XL Incubation for Inverted Research Microscopes



**Options for XL temperature control**

- TempModule S1 or Temperature Controller, ibidi

**XL temperature regulation with (heated) stage-top incubation**

Option 1

- Heating Insert P S1
  (or other PeCon heating insert)
- $CO_2$-Cover
- Control Sensor T S1
- TempModule S1
  and
- $CO_2$ Module S1 with Heating Device Humidity
- Optional: $O_2$-Module S1

Option 2

- Temperature Controller, ibidi
- Heated Plate K, ibidi
- Glass Lid $CO_2/O_2$ unheated, ibidi
  and
- Gas Mixer System $CO_2$, ibidi
  or
- Gas Mixer System $CO_2/O_2$, ibidi

**System Control**

- TFT of Axio Observer
- Software: ZEN (blue edition)

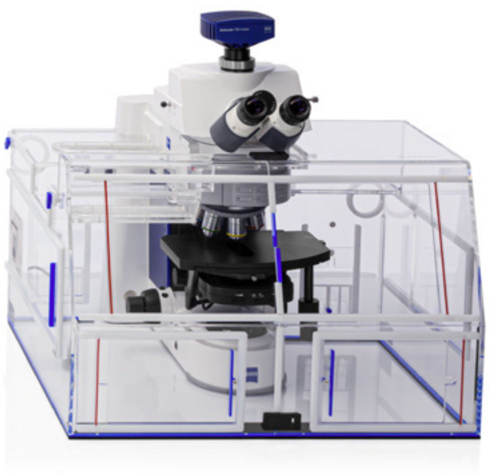
**Incubation of multi-well plates**

- Universal mounting frame K-M with
  $CO_2$-Cover
  or
- Mounting frame K for multi-well plates, ibidi
  with Glass Lid $CO_2/O_2$ unheated, ibidi

# Your Flexible Choice of Components

## Incubation for Axio Imager





**XL enclosure for Axio Imager**
- Temperature regulation
- TempModule S1

**Compatibility**
- LSM 900 / 980
- Apotome 3
- Scientific Class Axiocams
- Other "scientific / third party" camera models
- Colibri 7, X-Cite Xylis, HXP 120 V
- Docking Station for TFT-Display required

**Microscope Stages**
- All manual, motorized and scanning ZEISS stages

**System control**
- TFT of Axio Imager
- Software: ZEN (blue edition)

**Recommended objectives**
- LD LCI Plan-Apochromat 25× Imm, 40× Imm, 63× Imm
- LCI Plan-Neofluar 25× Imm
- W Plan-Apochromat 20× / 1.0, 40×, 63×

**Heating for Axio Imager**
- Heatable universal mounting frame A-H S1 for manual stage KT 75 × 50
- TempController 2000-2

**Microscope condensers for heating**
- Only condensers 0.8 can be used with A-H S1 (see price list for details)

# Your Flexible Choice of Components

## Fully Integrated Incubation for Automated Box Microscopes



**Microscope**

- Celldiscoverer 7

**Microscope Stage:**

- Build-in motorized xy scanning stage and z-drive for Celldiscoverer 7 with adaptive lens guard for collision protection of the objectives with any hardware or sample vessels

**Incubation:**

- TempModule S1 for Celldiscoverer 7
- $CO_2$ Module S1 for Celldiscoverer 7
- $O_2$ Module S1 for Celldiscoverer 7
- Humidifier unit for Celldiscoverer 7 with automatic display of liquid level
- Refrigerated circulator Corio CP-200F for air objectives

**System Control:**

- TFT of Celldiscoverer 7
- Software: ZEN (blue edition)

**Sample mounting:**

- Compatible with all Celldiscoverer 7 insert plates and sample carriers
- Insert plate for 1 Petri dish 35 / 60
- Insert plate for 6 Petri dishes 35
- Insert plates for 2 or 3 slides 76 × 26 mm
- Insert plate for 2 slides / Lab-Tek™ chambers 57 × 26 mm
- Insert plate for perfusion with POC-R2

**Dispensing unit:**

- For semi-automated pipetting of multi-positions without disturbing environmental conditions. Software control via ZEN (blue edition)

**Objectives:**

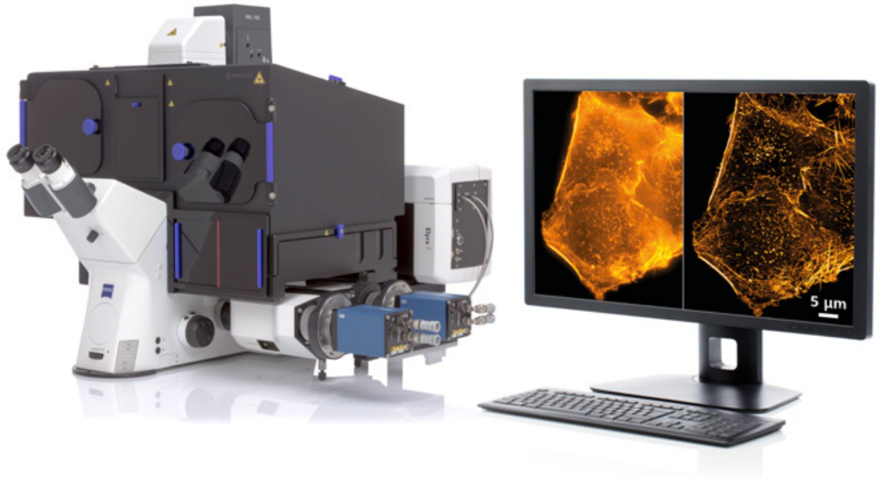
- Compatible with all Celldiscoverer 7 objectives from 2.5× up to 100× magnifications. All objectives are equipped with heating elements for automatic temperature control.

- Objective Plan-Apochromat 5× / 0.35
- Objective Plan-Apochromat 20× / 0.7 autocorr
- Objective Plan-Apochromat 20× / 0.95 autocorr
- Objective Plan-Apochromat 50× / 1.2 W autocorr with autoimmersion

# Your Flexible Choice of Components

## Fully Integrated Incubation for Fast and Gentle 3D Superresolution Microscopy






**Microscope**
- Elyra 7

**Microscope Stage:**
- Motorized XY Piezo scanning stage with a range of 130 mm × 100 mm and max. speed of 100 mm / s.
- Z-Piezo stage insert with the smallest Z step size of 5 nm

**Incubation:**
- Large chamber incubation with Incubator for superresolution microscopy, also prevents exposure to ambient light
- Stage-top incubation including temperature and $CO_2$ control possible with z-piezo stage insert

**System Control:**
- TFT
- ZEN (black edition)

**Sample mounting:**
- Sample holders available for standard 3" × 1" slides, LabTek™ chambers, multiwell plates and 36 mm round glass-bottom dishes
- Level-adjustable and universal stage insert available for standard slides, glass-bottom dishes and LabTek™ chambers

**Objectives:**
- C-Apochromat 63× / 1.2 W Corr (DIC)
- Plan-Apochromat 63× / 1.4 Oil (DIC)
- alpha Plan-Apochromat 100× / 1.46 Oil DIC
- alpha Plan-Apochromat 100× / 1.57 Oil HI Corr (DIC)
- alpha Plan-Apochromat 63× / 1.46 Oil Corr
- C-Apochromat 40× / 1.2 W
- Plan-Apochromat 40× / 1.4 Oil (DIC)
- LD LCI Plan-Apochromat 25× / 0.8 Imm Corr
- Plan-Apochromat 20× / 0.8
- EC Plan-Neofluar 10× / 0.3

# Your Flexible Choice of Components

## Fully Integrated Incubation for Lightsheet Microscopy


- › In Brief
- › The Advantages
- › The Applications
- › **The System**
- › Technology and Details
- › Service


**Microscope**

- Lightsheet 7

**Microscope Stage:**

- Motorized 4 axis stage with a range of 10 mm (X) × 50 mm (Y) × 10 mm (Z) × 360 °C (α); speed of 200 mm / s.
- Smallest step size X-Y-Z of 50 nm – 1000 nm – -50 nm

**Incubation:**

- Chamber Temperature control via Peltier element
- $CO_2$-Module Lightsheet
- Heating Device Humidity S1

**System Control:**

- ZEN (black edition)

**Sample mounting:**

- Sample holder for capillaries
- Sample holder for syringes
- Universal sample holder for capillaries and pedestals
- Smart sample holder for various pedestals and outside sample loading

**Objectives:**

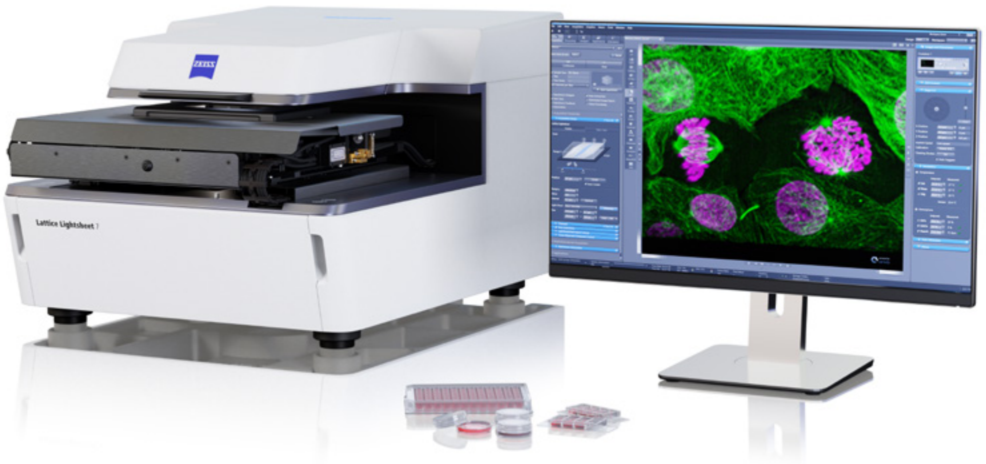
- Fluar 2.5× / 0.12
- EC Plan-Neofluar 5× / 0.16
- Plan Apochromat 10× / 0.5
- W Plan-Apochromat 20× / 1.0
- W Plan-Apochromat 40× / 1.0
- W Plan-Apochromat 63× / 1.0

- EC Plan-Neofluar 5× / 0.16
- EC Plan-Neofluar 5× / 0.16
- Clr Plan-Apochromat 10× / 0.5
- Plan-Apochromat 20× / 1.0
- Plan-Neofluar 20× / 1.0
- Plan-Neofluar 20× / 1.0

# Your Flexible Choice of Components

## Fully Integrated Incubation for Lattice Lightsheet Microscopy






**Microscope**

- Lattice Lightsheet 7

**Microscope Stage:**

- Motorized 5 axis multi-coordinate with Piezo motors with a range of ±36 mm (X) × ±54 mm (Y) × ±0.5 mm (Z) × ±0.5° (TiltX) × ±0.5° (TiltY)
- Smallest step size X-Y-Z-TiltX-TiltY of 200 nm – 200 nm – 100 nm – 0.1° – 0.1°

**Incubation:**

- Stage Top incubation
- Temperature control
- Gas concentration ($CO_2$ and $O_2$) control
- Humidity control
- Perfusion prepared

**System Control:**

- ZEN (blue edition)

**Sample mounting:**

- 35 mm cell culture dishes (glass bottom)
- Slides with coverslip
- Multi-well plates with glass bottom
- Multi-well chamber slides with glass bottom

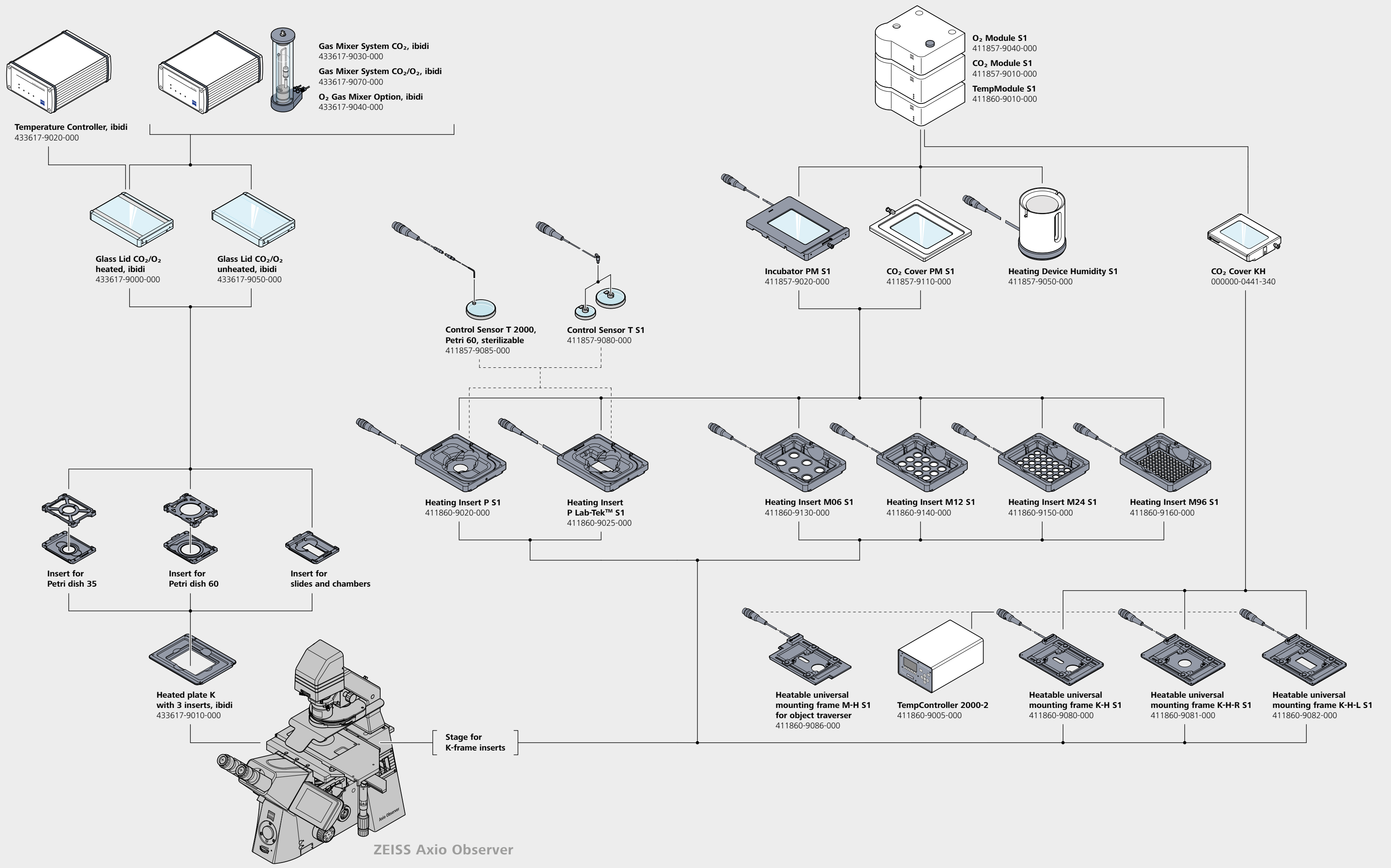
**Objectives:**

- µSPIM optics 48× / 1.0 NA (effective)

# System Overview



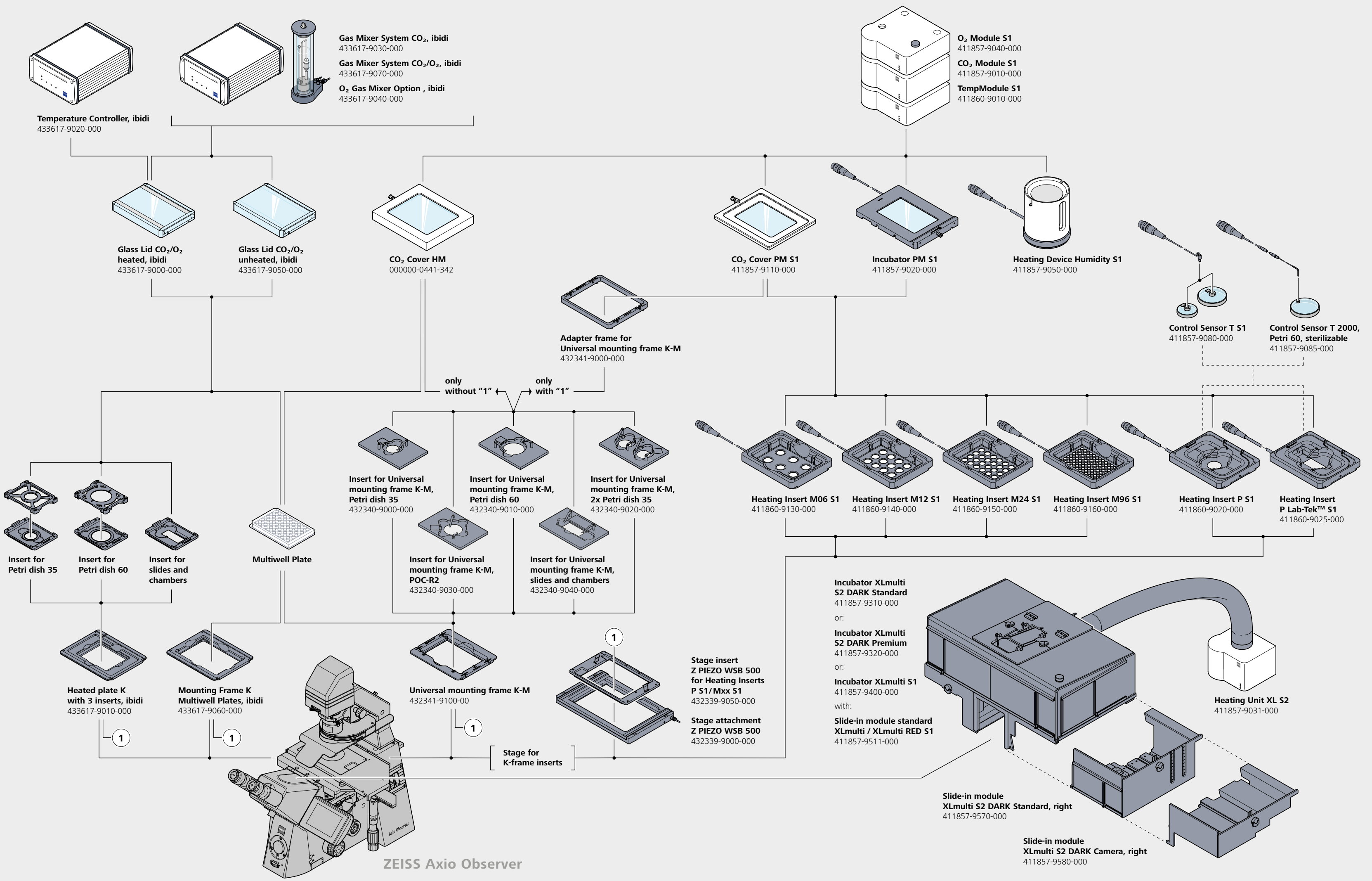
## Stage-top Incubation



# System Overview



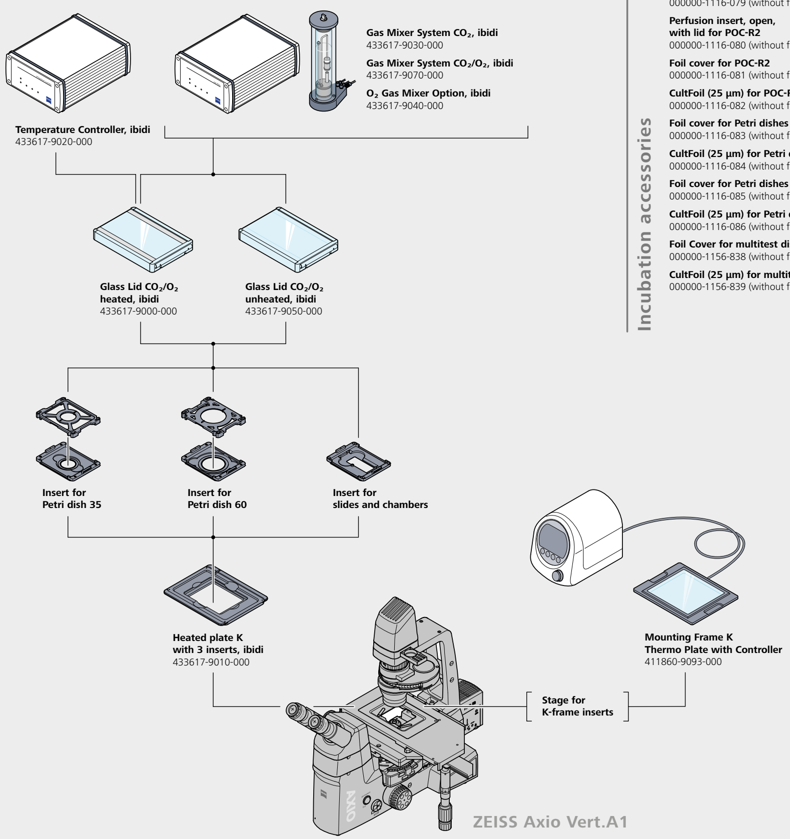
## XL Incubation



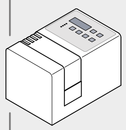
# System Overview



## ZEISS Axio Vert.A1 and accessories




### Incubation accessories



**Multichannel peristaltic pump IPC-4**
000000-1116-111

**POC-R2 cell cultivation system**
000000-1116-079 (without fig.)

**Perfusion insert, open, with lid for POC-R2**
000000-1116-080 (without fig.)

**Foil cover for POC-R2**
000000-1116-081 (without fig.)

**CultFoil (25 µm) for POC-R2**
000000-1116-082 (without fig.)

**Foil cover for Petri dishes "35"**
000000-1116-083 (without fig.)

**CultFoil (25 µm) for Petri dishes "35"**
000000-1116-084 (without fig.)

**Foil cover for Petri dishes "60"**
000000-1116-085 (without fig.)

**CultFoil (25 µm) for Petri dishes "60"**
000000-1116-086 (without fig.)

**Foil Cover for multitest dishes**
000000-1156-838 (without fig.)

**CultFoil (25 µm) for multitest dishes**
000000-1156-839 (without fig.)

### Components for ZEISS Axio Imager

**Heatable universal mounting frame A-H S1 for KT**
411860-9088-000

**TempController 2000-2**
411860-9005-000
or

**TempModule S1**
411860-9010-000

**Incubator XL S1 for Axio Imager mot LSM**
000000-2082-320

**Heating Unit XL S2**
411857-9031-000

**Air duct tube, extension, 1m**
000000-2180-519

**TempModule S1**
411860-9010-000

Additionally required with Incubator XL S1
**Extension cable 2 m for illuminators HAL 100/LED**
457411-9051-000

**Docking station for TFT-Display**
432907-9901-000

### Components for ZEISS Axio Examiner

**Incubator XL S1 DARK for Axio Examiner D1/Z1/Z1 LSM**
411857-9431-000

**LED in-cabin illuminator for incubator XL S1 DARK**
411857-9600-000

**Heating Unit XL S2**
411857-9031-000

**Air duct tube, extension, 1m**
000000-2180-519

**TempModule S1**
411860-9010-000

# Technical Specifications – PeCon



| System requirements | |
|---|---|
| Microscope + Software | Axio Observer Z.1, 7 with CAN-Port and TFT |
| | Microscope stage with K-frame opening |
| | Settings controlled via TFT or ZEN through CAN-Connection |
| Environmental Operating Conditions | Temperature: 5°C – 40°C |
| | Rel. Humidity: < 80% |
| | Altitude: < 2000 m |

| TempModule S1 | |
|---|---|
| AC operating voltage | AC 100–240 V, 50–60 Hz |
| Power consumption | 460 VA max. |
| Output Voltage | DC 24 V; max 4 A per channel, max. 14 A total power |
| Temperature resolution | 0.1°C |
| Dimensions (W × H × D) | 313 mm × 85.5 mm × 301 mm |
| Weight | 5.4 kg |

| $CO_2$ Module S1 | |
|---|---|
| AC operating voltage | via TempModule S1 – no stand-alone unit |
| Operating voltage | 24 V DC |
| Power consumption | max. 610 mA |
| $CO_2$ supply | 1 bar (14,5 psi), max 2 bar (29 psi) |
| $CO_2$ display range | 0.0 – 10.0 Vol % |
| Resolution | 0.1 Vol % |
| Dimensions (W × H × D) | 313 mm × 128 mm × 301 mm |
| Weight | 5.7 kg |

| $O_2$ Module S1 | |
|---|---|
| AC operating voltage | via TempModule S1 – no stand-alone unit |
| Operating voltage | 24 V DC |
| Power consumption | max. 370 mA |
| $N_2$ supply | 1 bar (14.5 psi), max. 2 bar (29 psi) |
| $O_2$ display range | 0.0 – 25.0 Vol % |
| Resolution | 0.1 Vol % |
| Dimensions (W × H × D) | 313 mm × 85.5 mm × 301 mm |
| Weight | 4.2 kg |

| Heating Device Humidity S1 | |
|---|---|
| DC operating voltage | 24 V DC |
| Power consumption | < 2.1 A |
| Heating range | Ambient temperature up to 60°C |
| Dimensions (D × H) | 104 mm × 124 mm |
| Weight | 1.5 kg |

| Heating Insert P S1 | |
|---|---|
| DC operating voltage | 24 V DC |
| Power consumption | < 1.7 A |
| Heating range | Ambient temperature up to 60 °C |
| Observation area | 32 × 30 mm (oval) |
| Dimension (W × H × D) | 160 mm × 135 mm × 22 mm |
| Weight | 800 g |

| Heating Insert P Lab-Tek S1 | |
|---|---|
| DC operating voltage | 24 V DC |
| Power consumption | < 1.7 A |
| Heating range | Ambient temperature up to 60°C |
| Observation area | 48.9 × 25.5 mm |
| Dimension (W × H × D) | 160 mm × 135 mm × 22 mm |
| Weight | 800 g |

| Heating Insert Mxx S1 | |
|---|---|
| DC operating voltage | 24 V DC |
| Power consumption | < 0.4 A |
| Heating range | Up to 30°C above ambient |
| Dimension (W × H × D) | 160 mm × 135 mm × 25 mm |
| Weight | 400 g |

| Incubator PM S1 | |
|---|---|
| DC operating voltage | 24 V DC |
| Power consumption | < 1.1 A |
| Heating range | Up to 30°C above ambient temperature |
| Observation area (W x D) | 118 mm × 75.2 mm |
| Dimension (W × H × D) | 136 mm × 13.4 mm × 189 mm |
| Weight | 235 g |

# Technical Specifications – PeCon



| $CO_2$ Cover PM S1 | |
|---|---|
| Observation area (W × L) | 81.5 mm × 114.5 mm |
| Dimensions (W × H × D) | 147.5 mm × 9.0 mm × 170.5 mm |
| Weight | 150 g |

| Heating Unit XL S2 | |
|---|---|
| AC operating voltage | AC 100 … 115/230V – autorange, 50 – 60 Hz |
| Power consumption | 615 VA max. |
| Operating Voltage (from TempModule S1) | DC 24 V |
| Power consumption (from TempModule S1) | 250 mA max |
| Dimension (W × H × D) | 206 mm × 154 mm × 210 mm |
| Weight | 3.7 kg |

For Axio Imager

| TempController 2000-2 | |
|---|---|
| AC operating voltage | AC 90 – 260 V, 50 – 60 Hz |
| Power consumption | 200 W max |
| Output Voltage | DC 24 V; max 4 A per channel, max. 4.2 A total power |
| Temperature resolution | 0.1°C |
| Dimension (W × H × D) | 190 mm × 130 mm × 255 mm |
| Weight | 4.25 kg |

| Heatable universal mounting frame A-H S1 for KT 75 × 50 | |
|---|---|
| DC operating voltage | 24 V DC |
| Power consumption | < 0.5 A |
| Heating range | Up to 30 °C above ambient temperature |
| Clamping range | max. 128.0 mm; min. 27.0 mm |
| Specimen size | max. 68.0 mm |
| Observation Area | circular 30.0 mm; slotted 30.0 mm × 10.0 mm |
| Dimensions (WxHxD) | 153 mm × 110 mm × 8 mm |
| Weight | 250 g |

# Technical Specifications – ibidi stage top



| System requirements | | |
|---|---|---|
| **Microscope + Software** | Axio Observer D.1, Z.1, 5, 7 Firmware 02.695 or higher (for CAN control) | |
| | ZEN 2.3 SP1 (blue edition) Hotfix 9 or higher | |
| | Axio Vert.A1 with K-Frame stage and computer with USB | |
| **Environmental Operating Conditions** | Temperature: 18–30 °C / 64–86 °F | |
| | Rel. Humidity: < 80% | |
| | Altitude: < 2000 m (atmospheric pressure 800–1060 hPA / 11.6–15.4 psi) | |
| **Storage conditions** | –5–50°C / 23–122°F, < 60% RH | |

| Temperature Controller, ibidi | | |
|---|---|---|
| **AC operating voltage** | AC 100 To 240 V, 50–60 Hz | |
| **Output Voltage** | Glas Lid $CO_2$ / $O_2$ heated, ibidi: DC 10 V, 5 A | |
| | Heated Plate K with 3 inserts, ibidi: DC 24 V, 5 A | |
| | Objective heater: DC 24 V, approx. 300 mA | |
| | XL-Inc: DC 24 V, approx. 300 mA | |
| **Temperature control range** | Glas Lid $CO_2$ / $O_2$ heated (Channel 1) | ambient (min. 18 °C) – 46 °C |
| | Heated Plate K with 3 inserts (Channel 2) | ambient (min. 18 °C) – 45 °C |
| | Objective heater (Channel 3) | ambient (min. 18 °C) – 40 °C |
| | XL-Inc (Channel 4) | ambient (min. 18 °C) – 40 °C |
| **Dimensions Temperature Controller (W × H × D)** | 170 mm × 90 mm × 230 mm | |
| **Dimensions of Heated Plate K with Glas Lid $CO_2$ / $O_2$ (W × H × D)** | 160 mm × 30 mm × 130 mm | |
| **Weight** | 350 g | |
| **Connections** | USB for computer control via IncuControl software (ibidi) | |
| | CANbus for connection to Axio Observer or CAN-Hub for control via TFT and ZEN (blue edition) | |
| | 4 control channels (see above) | |
| | Thermocouple Type K | |
| | External power supply | |

# Technical Specifications – ibidi stage top



| Gas Mixer System | |
|---|---|
| **AC operating voltage** | AC 100 To 240 V, 50 – 60 Hz |
| **Output Voltage** | DC 24 V |
| **Entry Voltage** | DC 24 V, 5 A, 120 W |
| **Dimensions Gas Mixer (W × H × D)** | 170 mm × 90 mm × 230 mm |
| **Weight** | 2.2 kg |
| **$CO_2$-Control** | Control range: 0 – 15 % |
| | Accuracy: ± 0.35 % at 5 % $CO_2$ |
| | Resolution: 0.1 % |
| | Self-calibrating |
| **$O_2$-Control** | Control range: 1 – 21 % |
| | Accuracy: ± 0.2 % typical / ± 0.5 % maximal |
| | Resolution: 0.1 % |
| **Humidity control** | Control range: 20 – 99 % (lower limit depending on environmental conditions) |
| | Accuracy: 2.5 % |
| | Resolution: 1 % |
| **Gas supply ($CO_2$, Air, $N_2$)** | 1 bar / 14.5 psi optimum (0.8 – 1.2 bar / 11.6 – 17.4 psi) |
| **Gas flow rate** | 10 l / h |
| **Connections** | USB for computer control via IncuControl software (ibidi) |
| | CANbus for connection to Axio Observer or CAN-Hub for control via TFT and ZEN (blue edition) |
| | 3 Push-in fittings for $CO_2$, Air, $N_2$ input (Tubing ID 4 mm, OD 6 mm) |
| | 2 Push-in fittings for mixed gas outputs (Tubing ID 2.5 mm, OD 4 mm) |
| | Heater of humidifying column |
| | Humidity sensor |
| | External power supply |

# Technical Specifications – Tokai Hit



| Mounting Frame K Thermo Plate with Controller | | |
|---|---|---|
| **System requirements** | Manual control via control pad | |
| | Microscope stage with K-frame opening | |
| **Environmental operating conditions** | Temperature 25 °C ± 2 °C | |
| | Rel Humidity: 5–70 % | |
| | Altitude: < 2000 m | |
| **Storage Conditions** | Temperature: −10–50 °C, RH 5–70 % | |
| | AC operating voltage | AC 100–240 V |
| | Temperature Control Range | Ambient +5 °C – 60 °C |
| | Temperature Accuracy | 0.1°C |
| | Increments | 0.1°C |
| | Maximum Power Consumption | 50W |
| **Dimensions of Mounting Frame K Thermo Plate** | 160 mm × 110 mm | |

# Technical Specifications



| Compatible with: | | Incubator XLmulti S1/S2 configurations<br>Incubator XLmulti S1 (411857-9400-000) with:<br>Slide-in module standard S1 (411857-9511-000) | Incubator XLmulti S2 DARK (411857-9310-000/411857-9320-000) with:<br>Slide-in module S2 DARK Standard, right (411857-9570-000) | Slide-in module S2 DARK Camera, right (411857-9580-000) |
|---|---|---|---|---|
| 424533-9110-000 *<br>424533-9120-000 * | Definite Focus | ● | ● | ● |
| **Double Adapter Duolink 60N – 2× 60N man. (426143-9000-000) at sideport left:** | | | | |
| | Axiocam, e.g. 503 / 506 / 512 / 702 / 705 / 712 (Axiocam 202 / 208 **NOT** compatible) | ● | ● | ● |
| 000000-1964-944 | EMCCD Camera evolve 512 | ● | ● | ● |
| 000000-2034-186 | EMCCD Camera evolve 512 delta | ● | ● | ● |
| | Hamamatsu Image EM / Orca R2 / Flash 4.0 / Andor iXon3 | ● | ● | ● |
| **Double Adapter Duolink 60N – 2× 60N man. (426143-9000-000) at sideport right:** | | | | |
| | Axiocam, e.g. 503 / 506 / 512 / 702 / 705 / 712 (Axiocam 202 / 208 **NOT** compatible) | – | – | ● |
| 000000-1964-944 | EMCCD Camera evolve 512 | – | – | ● |
| 000000-2034-186 | EMCCD Camera evolve 512 delta | – | – | ● |
| | Hamamatsu Image EM / Orca R2 / Flash 4.0 / Andor iXon3 | – | – | ● |
| **Camera with camera adapter 1.0× or 0.63× at sideport left:** | | | | |
| | Axiocam, e.g. 503 / 506 / 512 / 702 / 705 / 712 | ● | ● | ● |
| | Axiocam 202 / 208 (only with camera adapter 1×) | ● | ● | ● |
| 000000-1964-944 | EMCCD Camera evolve 512 | ● | ● | ● |
| 000000-2034-186 | EMCCD Camera evolve 512 delta | ● | ● | ● |
| | Hamamatsu Image EM / Orca R2 / Flash 4.0 | ● | ● | ● |
| **Camera with camera adapter 1.0× or 0.63× at sideport right:** | | | | |
| | Axiocam, e.g. 503 / 506 / 512 / 702 / 705 / 712 (Axiocam 202 / 208 **NOT** compatible) | ●* | ● | ● |
| 000000-1964-944 | EMCCD Camera evolve 512 | – | – | ● |
| 000000-2034-186 | EMCCD Camera evolve 512 delta | – | – | ● |
| | Hamamatsu Image EM / Orca R2 / Flash 4.0 | – | – | ● |
| **Other accessories:** | | | | |
| 425535-0000-000 | Binocular ergotube 25°/23 | – | – | – |
| 432047-9902-000* | Mechanical stage 130 × 85 R/L, short drive | – | – | – |
| 432017-9901-000 | Specimen stage 250 × 230 | ● | ● | ● |
| 000000-1005-833 | Object guide 130 × 85 mm right | ● | ● | ● |
| 428400-9000-000<br>428400-9900-000 | LD condenser 0.55 mot.; AI Sample Finder | ● | ● | ● |
| 452358-9011-000* | Dual filter wheel mot. for beam splitting and emission; CAN | ● | ● | – |
| all versions | Slider systems ApoTome / ApoTome.2 / Apotome 3 | ● | ● | ● |

● = compatible    – = incompatible    * = incl. predecessors    ●* = compatible if Axiocam is mounted horizontally

› In Brief

› The Advantages

› The Applications

› The System

› Technology and Details

› **Service**


# ZEISS Service – Your Partner at All Times

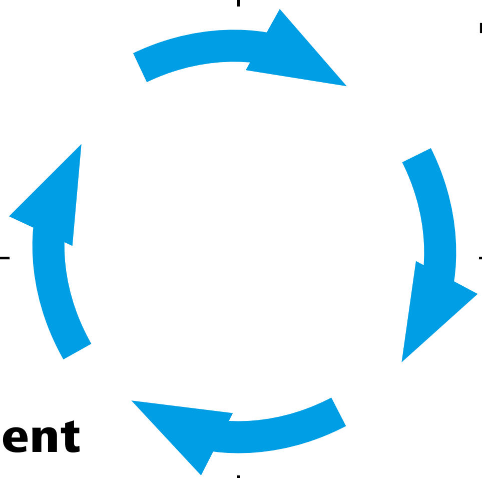
Your microscope system from ZEISS is one of your most important tools. For over 170 years, the ZEISS brand and our experience have stood for reliable equipment with a long life in the field of microscopy. You can count on superior service and support - before and after installation. Our skilled ZEISS service team makes sure that your microscope is always ready for use.

## Procurement

- Lab Planning & Construction Site Management
- Site Inspection & Environmental Analysis
- GMP-Qualification IQ/OQ
- Installation & Handover
- IT Integration Support
- Startup Training

## Operation

- Predictive Service Remote Monitoring
- Inspection & Preventive Maintenance
- Software Maintenance Agreements
- Operation & Application Training
- Expert Phone & Remote Support
- Protect Service Agreements
- Metrological Calibration
- Instrument Relocation
- Consumables
- Repairs



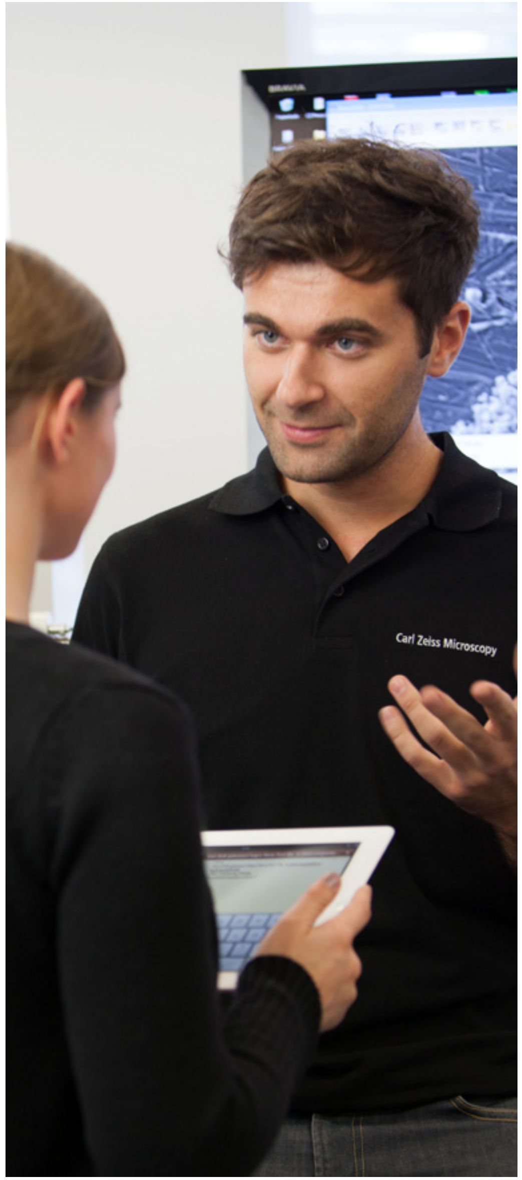
## New Investment

- Decommissioning
- Trade In

## Retrofit

- Customized Engineering
- Upgrades & Modernization
- Customized Workflows via APEER

Please note: Availability of services depends on product line and location




>> **www.zeiss.com/microservice**

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