



Water Jacket CO₂ Microscope Stage Incubator

The ultimate solution for live cell imaging

WJ CO ₂ Microscope Stage Incubator - Technical specifications	
Temperature range	BASIC: from 3°C above ambient T to 50°C CRYO: 5 - 50 °C
Temperature control accuracy	±0.1°C
Heating Technology	Water Jacket
Type of temperature controller	Software
Temperature feedback	Specimen temperature feedback
Humidification module	Heated
CO ₂ range (Manual or digital)	0 to 20%

The Water Jacket CO₂ Microscope Stage Incubator is designed to maintain all the required environmental conditions for cell cultures right on the microscope stage, thus allowing prolonged observations of cell events.

Temperature is controlled by circulating water from a thermostatic bath into the incubating chamber. An accompanying software reads the temperature in a reference well and updates the set point temperature of the water bath, ensuring a specimen temperature stability of ± 0.1°C.

The Basic version allows to incubate in the temperature range from 3°C above ambient temperature to 50°C. The Cryo version allows to incubate in the temperature range 5 - 50°C and to perform temperature cycles and ramps.

A humidifying and a pre-heating module prevent medium evaporation and avoid water condensation on glass and plastic surfaces.

Compatible with manual and digital CO₂ / O₂ controllers from OKO-Gas Controllers series.

A wide choice of interchangeable inserts adds flexibility to the equipment and allows to accept any cell culture support (petri-dishes, glass slides, multiwell plates, etc.).

SUPERIOR
PERFORMANCE

OIL IMMERSION
COMPENSATION

HEATING AND
COOLING





TEMPERATURE AND HUMIDITY MODULES

Temperature Control Module

In this type of incubator, the chamber is a water jacket and temperature is controlled by circulating water in the base and in the lid of the incubating chamber. This guarantees superior temperature uniformity and stability, both required for long lasting experiments.

Temperature accuracy $\pm 0.1^\circ\text{C}$: A meter equipped with an external small gauge temperature sensor is used to measure the temperature of a reference well, placed into the incubating chamber, near the specimen.

Temperature uniformity: The most challenging task in incubation technology is to maintain a highly humid atmosphere without having water condensation in the chamber. The only way to prevent water condensation from a nearly saturated atmosphere is to achieve superior temperature uniformity throughout the incubator. In the Water Jacket CO₂ stage incubator, this is obtained by fluxing temperature controlled water into a precision-engineered channeling system embedded in the chamber.

Temperature stability: Temperature stability in time is essential to avoid temperature-driven focus drift. The Water Jacket CO₂ stage incubators have excellent temperature stability thanks to the thermal inertia of the water circulating in the system (4 liters), which shields the specimen from ambient temperature fluctuations.

The **Basic model** is equipped with a heating thermostat and operates in the temperature range 3°C above ambient to 50°C.

The **Cryo model** is equipped with a heating-cooling thermostat and operates in the temperature range 5 - 50°C.



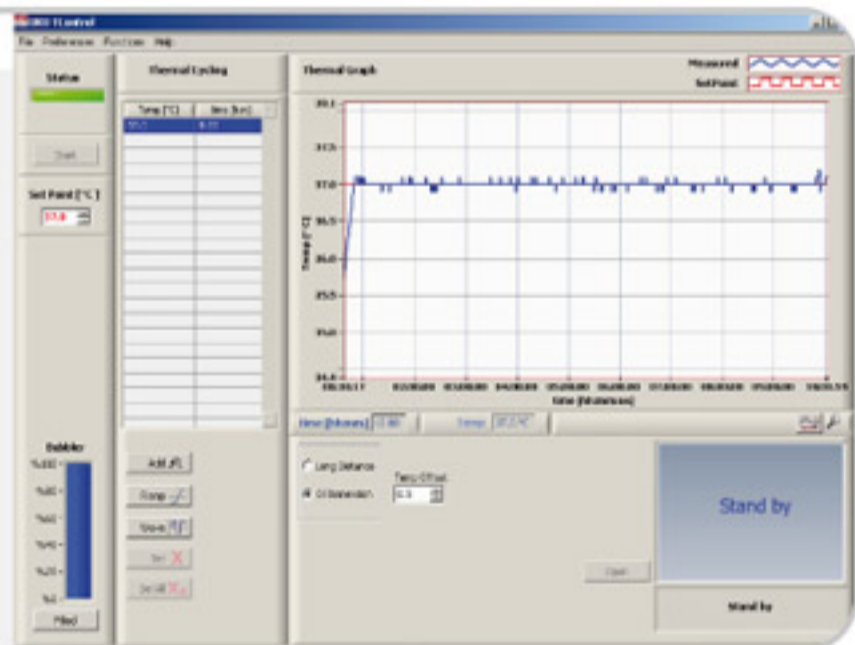
Software

The Temperature Control Software ensures a temperature stability of $\pm 0.1^\circ\text{C}$ by periodically acquiring incubator temperature and giving feedback to the water bath to update water temperature. Data of temperature profile are stored in computer memory and displayed in a plot.

Thermal shock prevention: an intelligent software algorithm avoids thermal shock to the specimen when the CO₂ Microscope Stage Incubator is opened.

Oil immersion compensation: a software temperature offset compensates the heat sink caused by oil immersion objectives.

Thermal cycle module: this software module allows to perform thermal cycles, ramps, waves, etc. (Available for the Cryo model, only).



Humidity module

A **humidifying** and a pre-heating module prevent medium evaporation and avoid water condensation in the incubating chamber.

The gas stream is warmed up by flowing into a copper coil immersed into the water bath and then it is humidified by bubbling into a glass column filled with distilled water and immersed into the water bath.

To reach a nearly saturated atmosphere in the incubating chamber, without causing water condensation, the humid gas is equilibrated with the chamber by flowing into a tube embedded into the water jacket.





The Water Jacket Chamber is available in two models: Universal and Slim. They both require at least one plate adapter, chosen according to the type of cell culture support (Petri Dish, glass slide, multiwell plates, etc.). A one screw mechanism allows to change the plate adapters very easily, so that the same chamber can be conveniently used with different cell culture supports.

A variety of custom chambers is available (please, visit www.oko-lab.com).

UNIVERSAL



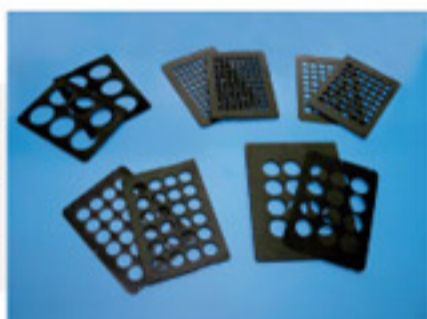
This chamber can accommodate any kind of cell culture support. It can be used both with Long Working Distance and oil-immersion objectives.

Typical applications: time-lapse observations of more than one field of view. To fully benefit from the multi accommodation design, this chamber should be mounted on a microscope equipped with motorized focus and motorized XY stage.

Perfusion: two holes on the chamber body allow the insertion of perfusion tubings.

It fits any 160x110mm sized stage (i.e. Ludl BioPrecision and BioPoint, Marzhauser SCAN IM 120x100, Prior H107 and H117) and all mechanical flat stages. It also fits into the Nikon TI-S-E motorised XY stage with stage insert TIPA.

A dedicated model is available for A.S.I. stages.



Interchangeable adapters allow to use any kind of multiwell plate (6-12-24-48-96), 35/60 mm Petri-dishes and chamber slides. This model is designed to increase reproducibility and versatility thus improving experimental efficiency.

SLIM PROFILE

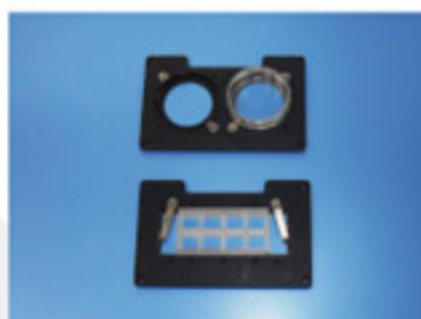


The slim model has been especially designed for high-magnification microscopy. Indeed, thanks to the slim profile, it can be used with high N.A. condensers (minimum working distance 24 mm), thus allowing to use the best optical condition necessary for 63x and 100x objectives. The use of glass-bottom metal dishes is recommended to minimize heat sink phenomena while using oil-immersion objectives.

Typical applications: time-lapse observations of a single field of view with high magnification.

Perfusion: Eight holes on the chamber body allow the insertion of perfusion tubings.

It fits any 160x110mm sized stage (i.e. Ludl BioPrecision and BioPoint, Marzhauser SCAN IM 120x100, Prior H107 and H117) and all mechanical flat stages. It also fits into the Nikon TI-S-E motorised XY stage with stage insert TIPA.



Interchangeable plate adapters allow to use two 35mm Petri-dishes or one chamber slide.

System Performance

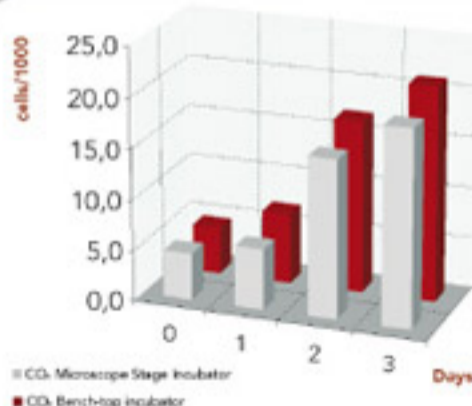


Figure 1. Cell proliferation vs. time.

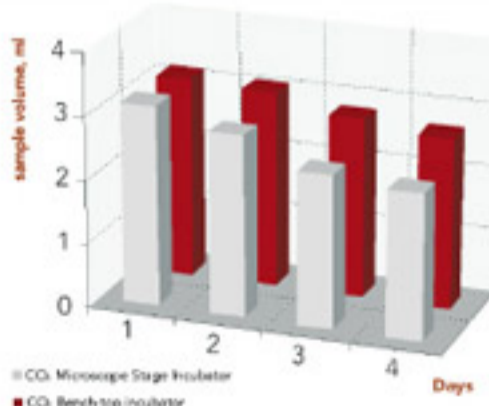


Figure 2. Medium evaporation vs. time.

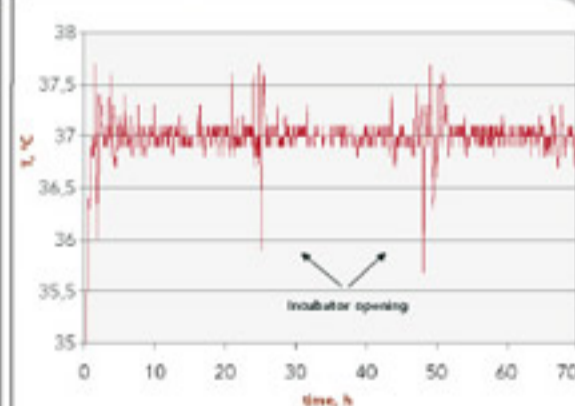


Figure 3. Sample temperature vs. time.

Data of cell proliferation in the CO₂ Microscope Stage Incubator and in a CO₂ bench-top incubator were compared for a period of three days. Cell line: Jurkat. As shown in figure 1, cells proliferate as well as in the CO₂ bench-top incubator.

As shown in figure 2, the combined action of the humidifying module and of the water reservoirs in the micro-environmental chamber allow to minimize medium evaporation. System design guarantees similar evaporation in all the wells. Low evaporation allows to perform long lasting experiments.

Figure 3 reports data of sample temperature as a function of time. Temperature stability and uniformity is guaranteed by water circulation in the lid and in the base of the incubating chamber. Temperature accuracy is obtained by controlling the temperature very close to the sample.

Okolab Microscope Incubators can be equipped with Manual or Digital CO₂ / O₂ controllers.

MANUAL 2 or 3 GAS MIXERS

The 2-Gas Manual Mixer allows to generate CO₂-Air mixtures with an adjustable CO₂ concentration in the range 0-15%. Air and CO₂ flows are regulated by two floating ball flow meters in the range 0.2 - 1.7 and 0.013 - 0.13 NL/min, respectively. A table allows to easily define the air and CO₂ flow values necessary to achieve the desired CO₂ concentration.



The 3 Gas Manual Mixer mixes three gas streams, for instance N₂/CO₂/O₂, by means of floating ball flowmeters. The first gas can be regulated in the range 70 -100%, the second and third gas can be regulated in the range 0-15%.



DIGITAL CO₂ CONTROLLER

It allows to generate a CO₂-Air mixture with an adjustable CO₂ concentration in the range 0-20%, with an accuracy of $\pm 5\%$ of CO₂ concentration. For instance, if CO₂ set point is 5%, accuracy is $\pm 0.25\%$. The air flow is regulated by a floating ball air flow meter in the range 0.2-0.8 NL/min.



Sensing Technology

A CO₂ infrared sensor continuously measures CO₂ concentration in the mixed gas stream and a PID closed loop controller gives feedback to a fine valve regulating CO₂ flow. The measured value of CO₂ concentration is displayed in real time.

Data Storage

The serial RS-232 interface and the CO₂ Control Software allow the user to control the unit with a personal computer and to acquire and store concentration data in computer memory.

OKO AIR PUMP

Air pump. Plug and play solution for Air inlet. Convenient alternative to 100% Air tanks/compressed Air lines. Directly connects to the Air input of Okolab gas mixers/controllers. Built-in foam filter. Low noise. It lasts up to 10,000 hrs. Maximum outlet pressure 300 mbar. Operating voltage: 110/220V AC.



DIGITAL O₂ CONTROLLER

The DGTO2BX is a O₂ controller capable of measuring O₂ concentration in the range 1-19% with a resolution of 0.1%. It controls O₂ concentration by mixing Air with Nitrogen, O₂ oxygen. Air flow is set to 0.1 liter per minute by means of a floating ball flowmeter. Nitrogen consumption at 5% of Oxygen is 0.32 liter per minute.



Therefore, a 200 liters Nitrogen tank will last approximately 3 months. Repeatability 0.05% of oxygen level.

Sensing Technology

Long life zirconium oxide sensor lasting up to 10 years if used continuously and considerably longer if used intermittently.

Data Storage

The serial RS-232 interface and the O₂ Control Software allow the user to control the unit with a personal computer and to acquire and store concentration data in computer memory.

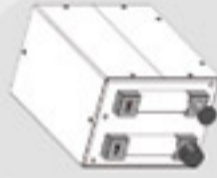


TEMPERATURE CONTROLLER



H101-BASIC

Heating unit. From 3°C above ambient to 50°C. It comprises: water bath, temperature sensor, temperature meter, temperature control software.



H101-CRYO

Heating / Cooling unit. From 0° to 50 °C. It comprises: cryostatic water bath, temperature sensor, temperature meter, cryo-control temperature software.



H101-CRYO-S

Temperature cycles software. It provides computer control of temperature cycles and ramp rates.



O₂/CO₂ CONTROLLER

2GF-MIXER

2 Gas Manual Mixer. It mixes two gas streams by means of floating ball flowmeters. One gas can be regulated in the range 85÷100%, the other in the range 0÷15%



DGT-CO2BX-PLUS

Digital CO₂ Controller Plus. CO₂ can be regulated in the range 0-20%. Accuracy at 5% CO₂ is 0.25%.



DGT-O₂/CO₂BX-PLUS-S

DGT-O₂BX-PLUS

Digital O₂ Controller Plus. Oxygen can be regulated in the range 1-19%. Accuracy at 5% O₂ is ± 0.0025%.

WATER JACKET CHAMBERS



H101-WJC

Universal water jacket chamber. Fits any motorized XY stage (except ASI). It requires at least one plate adapter.



H101-WJC-SLIM

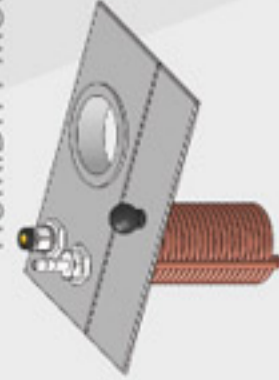
Slim water jacket chamber. Fits mechanical and motorized XY stages. Suitable for high N.A. condensers. It requires at least one plate adapter.



H101-WJC-ASI

Water jacket chamber for A.S.I. XY stage. It requires at least one plate adapter.

HUMIDITY MODULE



H101-HM

Humidity module. It comprises: gas preheating system and bubbling column.



H101-WJC-AB

Water jacket chamber for Applied BioPhysics. Fits on Ludl, Marzhauser, Nikon and Prior motorized XY stages.

- Overview
- Description
- CO₂ / O₂ Controllers
- Schematic chart
- Available chambers