



CytoCentric Products

Oxycycler GT4181C

CO Subchamber Cell Culture System

- **First CO Gasotransmitter Cell Culture System**
- **Precise Automated Exposures of CO**
- **Dynamic or Static Exposures**
- **Simulate Physiologic and Pathophysiologic conditions**
- **Unprecedented CO Induced Phenotypes**



Single Chamber 0-400 PPM CO Control

ADVANCED GASOTRANSMITTER INCUBATION

Carbon monoxide (CO) is now known to be an exciting gasotransmitter involved in cell signaling, with powerful and interesting effects on cell phenotype. Until now, CO was difficult to study in cell culture because the only available method for applying CO *in vitro* used to be chemical donors. This method made it messy and difficult to control, and CO exposures were hard to reproduce. Now, with the Oxycycler GT4181C controller, cell culture in subchamber culture systems makes CO research easy, precise and very reproducible.

GT4181C is the most advanced and reliable method for CO culture. Any dose and duration to cells in culture can be simply programmed. With the click of a mouse, any exposure can be precisely reproduced.

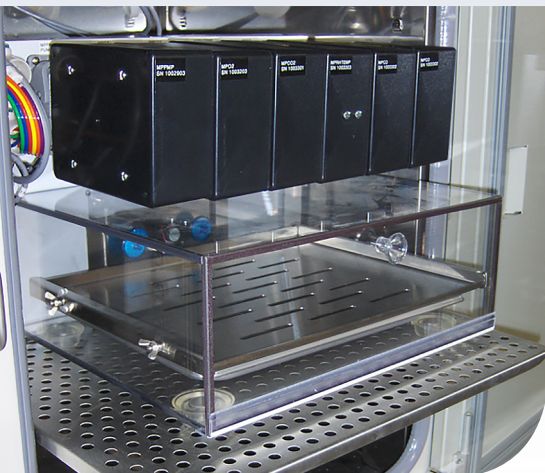
Inside the culture chamber, all critical conditions are controlled by the Oxycycler GT4181C. Interface between the cells in culture and the GT4181C is completely protected by a microbial barrier. In addition, none of the sensors are directly exposed to the cells. This way, if the culture chamber gets contaminated, the sensors will not. Likewise, if the sensors ever get contaminated, they cannot contaminate your cells.

UNLIMITED PROGRAMMED, DYNAMIC EXPOSURES

Consisting of a GT41 which provides the common O₂, CO₂, and RH control, and the modular GT81C piggyback controller, which provides the CO, a subchamber culture system controlled by the Oxycycler

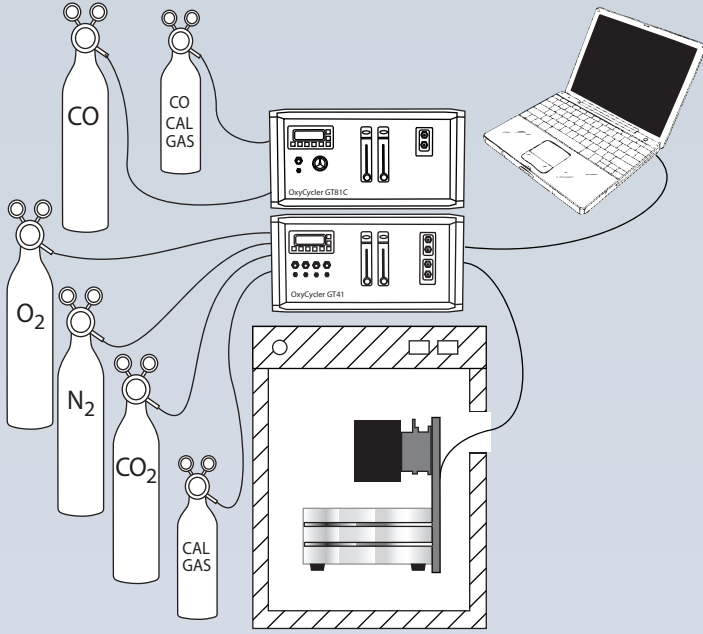
MODULAR FLEXIBILITY

The controller is compatible and will fit any standard size C-Chamber. The entire system will fit any existing incubator.



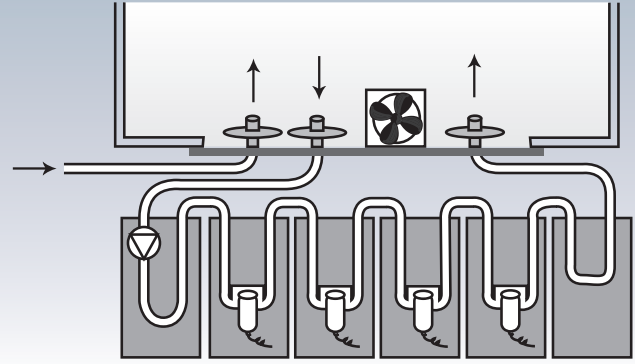
The GT series all use the same multipod adapter plate. This attaches to a C-Chamber and sits within your incubator.

Installation Schematic



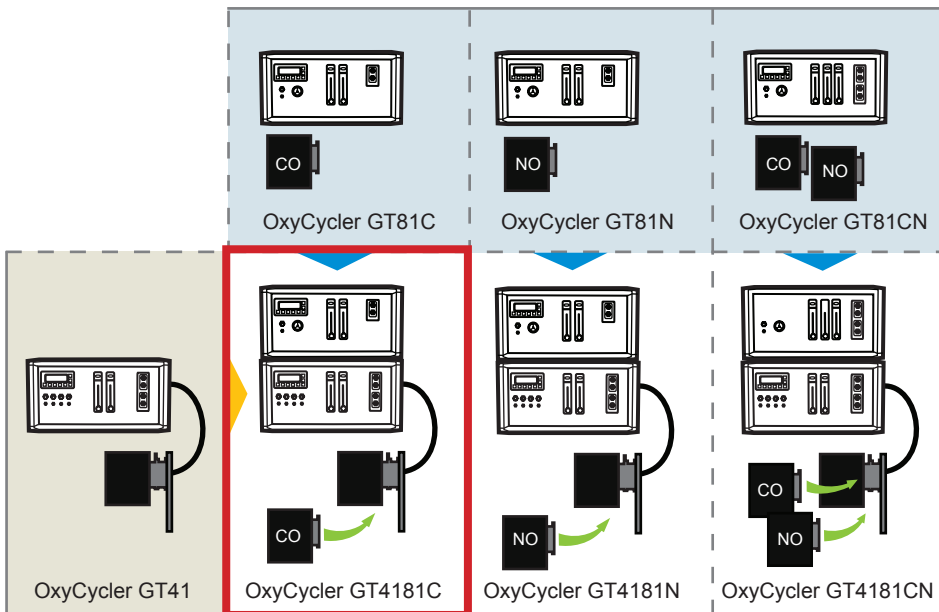
OxyCycler GT4181C Culture System. Controls dynamic or static O₂, CO₂, and CO, and limits RH in subchamber. Supply gases to GT41 required: Oxygen, Nitrogen, Carbon Dioxide. Calibration gas to GT41 required: certified pre-mix of 10% CO₂ in balance oxygen. Supply gases to GT81C: non-certified pre-mix of 10000ppm CO in balance nitrogen. Calibration gas to GT81C required: certified pre-mix of 300ppm CO in balance nitrogen.

How It Works



Hot swap multipod adapter plate provides microbial barrier filters between cells culturing in the subchamber and all of the sensors and mechanisms that control O₂, CO₂, RH, CO and temperature. Hot swap multipods provide upgrade flexibility and immediate, easy maintenance. A pump draws a sample from the controlled atmosphere and passes by all sensors and returns to chamber through disposable microbial barrier filters. Appropriate gases are infused as necessary by controllers through terminal, microbial barrier filters. Small fan homogenizes gases throughout chamber and can be easily removed, sterilized and replaced. A loop pod (depicted to the far right) keeps a continuous flow of the sample draw in the absence of the NO/NO₂ multipod. If the system is upgraded at a later date, the loop pod is easily removed and replaced with a NO/NO₂ multipod.

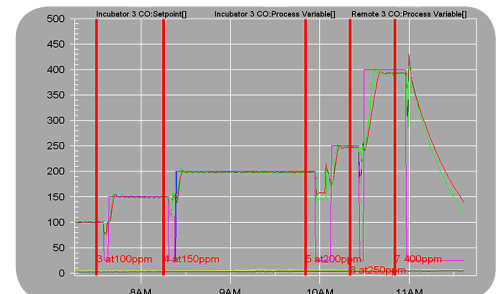
Configuration



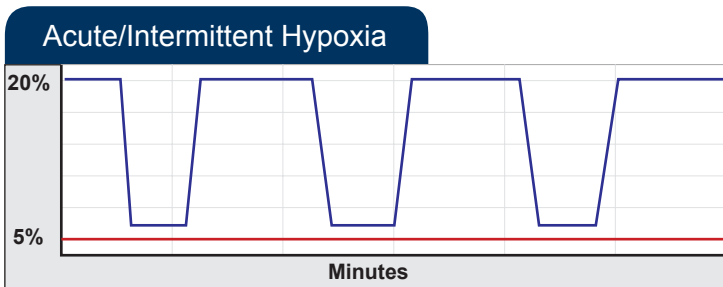
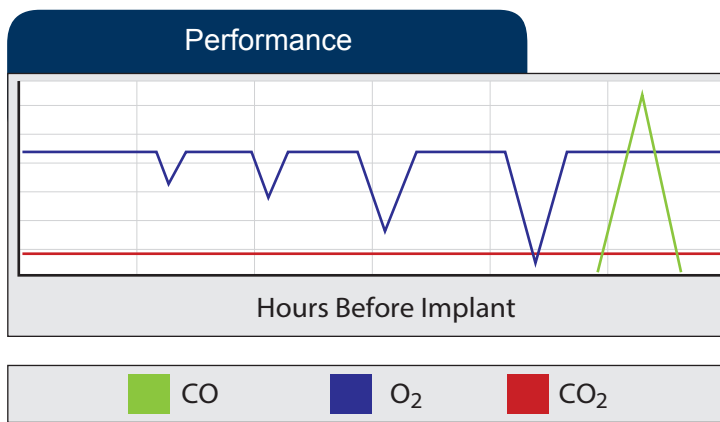
The OxyCycler GT4181C is a combination controller consisting of a GT41 mother controller and the GT81C piggyback controller working in tandem. It makes CO gasotransmitter research easy and reproducible. The GT41 controls core O₂ and CO₂ levels in dynamic or static states and limits RH, while in conjunction the GT81C controls 0-400 ppm CO in dynamic or static exposures. Optionally, the GT81C can be removed and substituted with the GT81N for NO control with NO₂ limiting, or the GT81CN for simultaneous CO and NO control with NO₂ limiting.



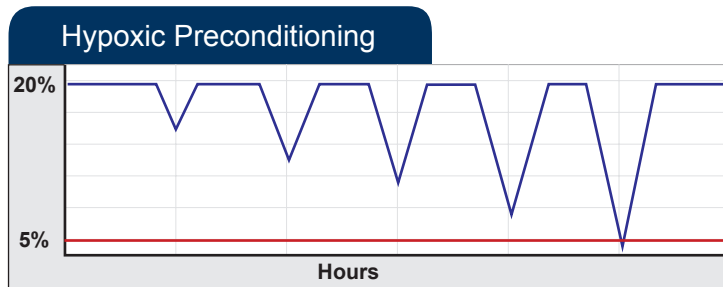
Controller sits outside the incubator and umbilicals extend through port hole on the incubator and connect to Hot Swap Minipod Assembly inside the incubator.



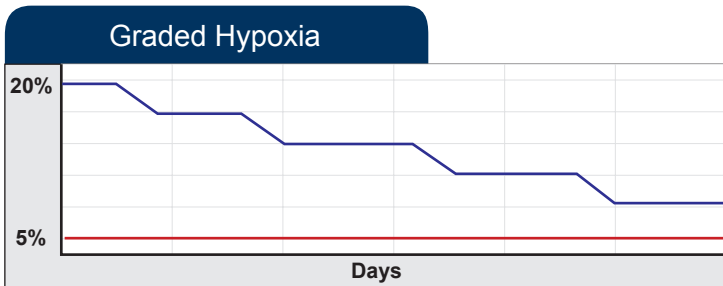
Operated by a computer and powerful software allows user to program any type of exposure with all variables and repeat those exposures with the click of a mouse. Profiles can be created, stored and recorded 24 hrs a day/7 days a week.



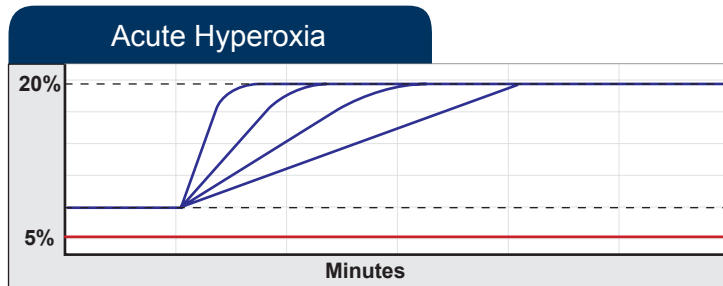
Hypoxic stress can model components of many severe diseases such as heart attacks, strokes, asthma, or epilepsy. Frequency, duration and degree of drops are all adjustable.



Cells destined for implantation will experience hypoxia and may be better prepared if they are conditioned to it before implantation. Ischemia may also be protected by conditioning. The OxyCycler GT4181C can easily run any preconditioning profile.



Model step reduction in oxygen, similar to altitude acclimation, to gradually condition cells for hypoxic upregulation of gene expression. The rate of change between any two levels is adjustable and repeatable. The duration at any given level is adjustable and repeatable.



Sudden increases in oxygen can cause cell damage. The OxyCycler GT4181C allows modeling toxicity of oxygen in any cell culture, similar to toxicity from recreational oxygen inhalation by athletes, therapeutic oxygen administration in critical care units, and other sudden exposures to high oxygen. The rate of oxygen increase can be adjusted to change faster to overwhelm antioxidants, or change slower to condition for antioxidants.

Safety



SAFETY: Gasotransmitter culture systems can release small amounts of CO, NO, and NO₂. Safety procedures must be followed on multiple levels. First, gas tanks should be located in a well-ventilated room. Second, gas mixtures should be ordered that will not exceed OSHA danger levels (PEL) under worst case scenario (full tank release into the room). Third, all hoses and connections should be double checked for leak-free operation. Fourth, minimize gasotransmitter control setpoints and duration. Fifth, before opening gasotransmitter culture chamber (sub chamber) set gasotransmitter control level to zero and wait until setpoint is reached. Under these conditions, only a small amount of gasotransmitter will leak out of subchamber into host incubator. Subsequently, an even smaller amount will leak out of incubator into the room. Dilution in room should never approach danger levels. OxyCycler GT4181 controllers all have ambient room safety sensors. Optional I-Hood incubator safety hood can sweep any gasotransmitter exhausted from incubator directly to a fume hood (shown in picture to left).



Ambient gasotransmitter sensors can be placed in the room to monitor room levels of gasotransmitter exposures. Alarms can be set to notify of unexpected high gasotransmitter concentrations. These safety sensors are not certified gas safety equipment. In addition, third party certified gas safety monitors may be desired. This picture shows ambient room monitor sensors for the OxyCycler GT4181CN and monitors and logs CO, NO and NO₂.

Specs

ELECTRICAL POWER: 12VDC at 6.66a (power supply specifications), expected current draw around 3.7a.

CONTROL RANGE: O₂: 0.1-99.9%, CO₂: 0.1-20.0%, CO: 0-400PPM

ACCURACY: O₂: ±1% at constant temperature/pressure, ±2% over entire temperature range. CO₂: ±5% of measurement or 0.1% CO₂. Temperature: ±0.6°C. Relative Humidity: ±3% RH between 0-40°C. CO: varies based on calibration for customer protocol

OXYGEN SENSOR: Electro-galvanic fuel cell

CARBON DIOXIDE SENSOR: Infrared sensing

CARBON MONOXIDE SENSOR: Electro-galvanic fuel cell

GAS SOURCE: Compressed gas tanks, liquid carboys (from headspace) or generators

GAS SUPPLY: Pressurized O₂, CO₂, N₂, O₂/CO₂ SPAN mix, CO, CO SPAN mix. Customer should consider protocol when ordering SPAN gases. Appropriate CO volume and concentration to be determined by lab safety officer.

GAS SUPPLY LINE PRESSURE: 0-25 PSIG

GAS INFUSION RATE:

GAS CONSUMPTION: Depends on (1) size and leakiness of host chamber, (2) frequency and duration of opening chamber doors and (3) gas level

GAS SUPPLY HOSE FITTING: 1/4" ID

UMBILICAL LENGTH: 12 ft

UMBILICAL DIAMETER: 1/16" ID

SENSOR CABLE LENGTH: 12 ft

SENSOR CABLE DIAMETER: 6mm

ALARM OUTPUT: Global Alarm Output and Audible, External Alarm system

ALARM MODES: Process High, Process Low, Deviation High, Deviation Low, Deviation Band

WEIGHT: 22 Lbs

CONTROLLER DIMENSIONS: 9"H, 17"W, 15"D

REMOTE MONITOR POD DIMENSIONS: 4.25"H, 7.0625"W, 4.25"D

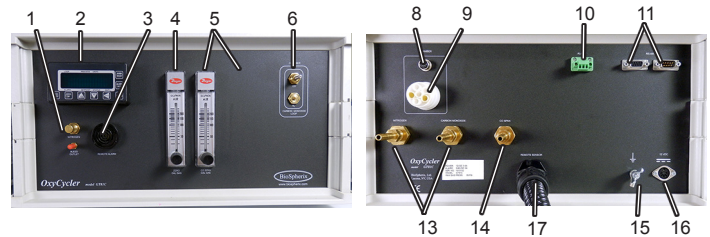
Sensor Operational Parameters

HOST CHAMBER TEMPERATURE: 5-40°C

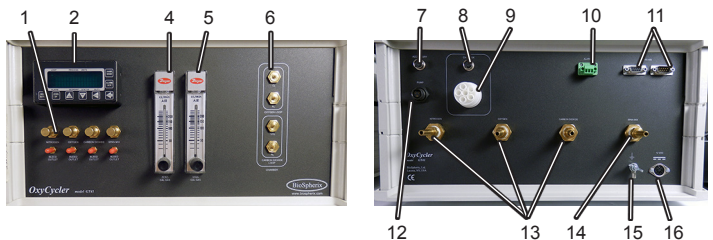
HOST CHAMBER HUMIDITY: 15-90%, Non-Condensing

Front and Back Panels

GT81C



GT41



1. **Bleed Valves and Barbs:** Bleeds gases out of gas supply lines. Calibration cup for sensor attaches here.
2. **Controller:** Bright blue digits on black back ground. Continuously displays current control gas level, control status, and alarm status in all chambers. Displays menu items and settings during programming.
3. **Alarm:** Will sound if Ambient CO monitor detects unsafe levels
4. **ZERO Calibration Gas Flowmeter:** Used for calibration.
5. **SPAN Calibration Gas Flowmeter:** Used for calibration.
6. **Needle Valves:** Sets infusion rate of control gases in each chamber to accommodate different dynamics. Can manually override controller to shut off gas.
7. **Accessory Receptacle:** 10 Pin Receptacle is for connecting optional accessory units.
8. **Communications Cable Jack:** This cable relays information for the sensors.
9. **Actuator Pod Umbilical:** Flexible umbilicals connect remote actuator pods to back panel.
10. **Alarm Receptacle:** Connect an appropriate alarm to this jack.
11. **RS 485 Connections:** One cable attaches to a computer and the other cable attaches to another unit, to allow communication with the computer (if applicable).
12. **Pump Connection:** This 3 pin receptacle supplies power to the Mini Pod Pump.
13. **Supply Gas Hose Barb:** Barbs for 1/4 inch I.D. hose from gas sources. Handles pressure up to 40 PSIG.
14. **Span Mix Barb:** Barb for 1/4 inch I.D. hose from gas source.
15. **Ground Stud:** For grounding the unit to protect from electric damage.
16. **Power Receptacle:** 12VDC power supply connects here.
17. **Monitor Pod Umbilical:** Flexible umbilical connects remote monitor pod to back panel. Semi-swivel connectors at both ends allow 360° orientation. Some models are hard welded; function is the same.



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cell incubation and processing
systems

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