



# ProOx P360

Versatile High Infusion Rate O<sub>2</sub> Controller

## WORKS IN LARGE VOLUME:

- Incubators
- Gloveboxes
- Refrigerators
- Animal cages
- Plant chambers
- Plastic bags
- Ice boxes
- Tents
- Etc.



0.1-99.9% O<sub>2</sub> in Any Semi-Sealable Chamber

### NEW TOOL

The new ProOx P360 is a handy little tool for people who do oxygen sensitive work. It makes oxygen control easy.

### PHYSIOLOGIC CONTROL

Control setpoint can be anywhere from 0.1-99.9% oxygen.

The ProOx P360 senses oxygen inside the chamber and infuses either nitrogen to lower the concentration or oxygen to raise it.

### WORKS IN ANY CHAMBER

The ProOx P360 fits and controls oxygen within any semi-sealed enclosure. Its high output makes it ideal for larger chambers, and most chambers can be fitted in minutes.

### CONTROL IS EFFICIENT

Feedback from sensor tells the ProOx P360 exactly when and exactly how much gas to infuse. No gas is ever wasted!

### OPERATION IS SIMPLE

Oxygen is quickly taken to setpoint and held there indefinitely. Any disturbances are immediately detected and corrected.

Check calibration once in a while and don't run out of gas. Otherwise it's all automatic!

### HANDLES ANY JOB

...Where ambient air oxygen (21%) is too high or too low, the ProOx P360 can provide any other level you need.

...Where ambient atmosphere is not air, the ProOx P360 can restore and maintain air-equivalent oxygen.

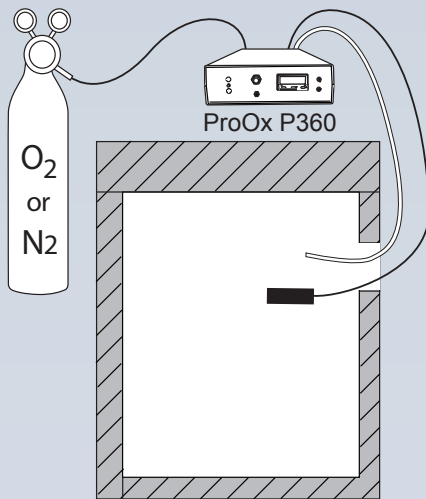
...Where oxygen consumptive or generative processes need to be countered, the ProOx P360 can hold oxygen stable against destabilizing loads.

It can work continuously year round or on occasion as needed. No other oxygen tool offers so much value!

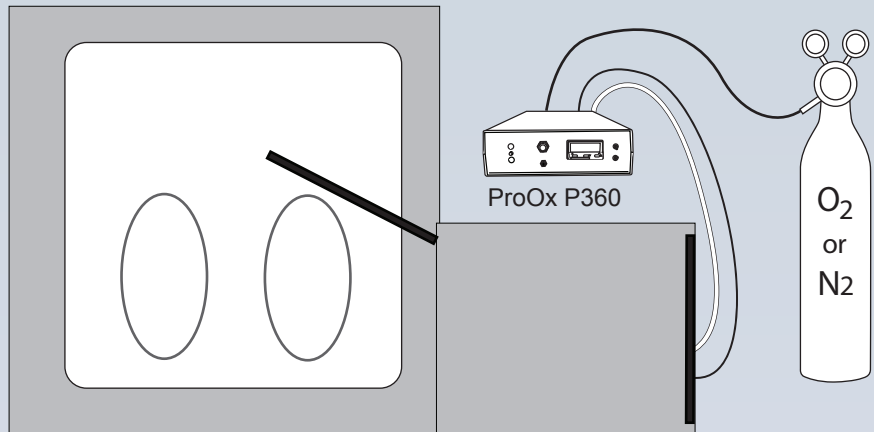


The ProOx P360 is capable of accurately controlling O<sub>2</sub> in large incubators, glove boxes, refrigerators, etc.

## Installation Schematics



Direct insertion of sensor/tubing  
(shown on incubator)



Control via Adapter Plate  
(shown on BioSpherix C-Shuttle)

ProOx P360 can control any large semi-sealable chamber by one of the methods shown above, installation may vary based on chamber.

## Installation

1. Set ProOx P360 on or near host chamber and plug it in.
2. Hook up sensor and gas infusion tube and insert both into the chamber.
3. Hook up gas supply.

## How It Works

From outside the host chamber, the ProOx P360 works by remotely sensing the oxygen concentration inside the chamber and infusing either nitrogen to lower it or oxygen to raise it.

Installation is easy. Simply insert sensor and nozzle of infusion tube into chamber through any convenient passageway. Doors, windows, sample ports, access ports, holes (built-in or custom-drilled) all work.

## Operation



### FRONT PANEL INTERFACE

All operations are conveniently located at the front of the panel and all connections are located at the back and out of the way allowing for less interference and increasing usability for cell culture research and development.

O<sub>2</sub> concentration sensor readings are displayed in bright green numbers to be continuously and easily monitored from across the lab. Manual switch for gas provides a convenient shut off thus saving gas when chamber door is opened. An alarm buzzer, also manual, will remind you if you have forgotten to turn the gas back on.

Bleed valve on front panel for easy calibration (top right).



## Gas

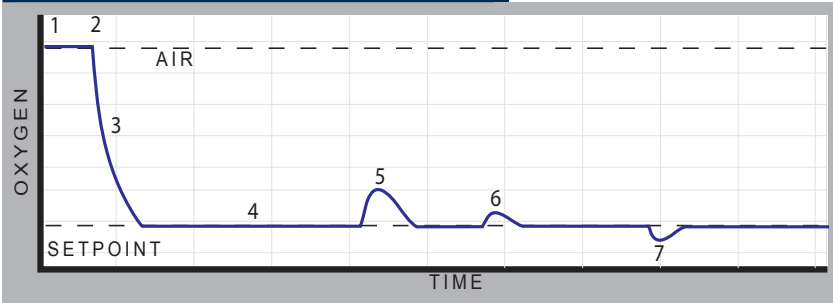
### USE ANY GAS SUPPLY

Conveniently utilizes gas from any source. Best supply depends on consumption. Compressed gas is best in low consumption applications. Generator is best in high consumption applications. Liquid is best in between.

### SAVES GAS AND MONEY

Chamber gas consumption varies widely, but in every case the ProOx P360 always and absolutely minimizes gas consumption. It's maximally efficient! Gas costs are reduced to absolute minimum.

### Hypoxia Control Scenario



1. No control yet. Chamber oxygen is ambient air oxygen (21%).
2. Control starts. Control gas is nitrogen. Infusion immediately starts to push oxygen down.
3. Oxygen is taken to setpoint. How fast depends on infusion rate. Infusion rate is adjustable. The higher the infusion rate, the faster to setpoint. Gas consumption in this phase is mostly a function of chamber size. The larger the chamber, the more gas it takes.
4. Steady-state control at setpoint is established. Infusion of control gas exactly matches chamber leakage to hold oxygen level constant. Gas consumption here is mostly a function of chamber leakage. The leakier the chamber, the more gas it takes.

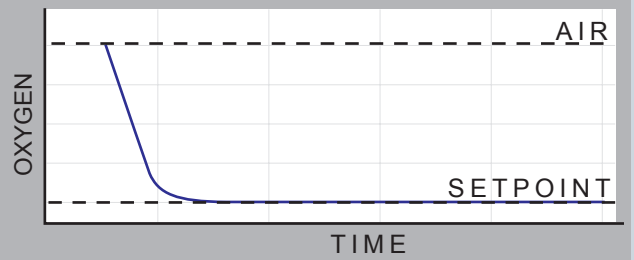
5. Door of chamber is suddenly opened and closed. Steady-state is disrupted. Inrush of air is immediately detected and chamber oxygen is promptly returned to setpoint. Gas consumption depends on how wide and how long the door was opened. The more it's disrupted, the more gas it takes to get back to setpoint.
6. Door suddenly unlatches. Leakage goes up but ProOx P360 compensates and immediately re-establishes steady state at setpoint. Gas consumption goes up dramatically, but oxygen is kept at setpoint. Consumption increases in proportion to leakage.
7. Door gets shut tight. Leakage goes back down to normal. ProOx P360 compensates by drifting back to setpoint and reestablishes steady-state at setpoint. Gas consumption goes back down to normal levels, while oxygen stays put.

### NORMOBARIC OXYGEN FEEDBACK CONTROL

ProOx P360 works in semi-sealable chambers. It controls chamber oxygen by forced displacement of gas inside chamber via dilution with either oxygen-rich or oxygen-poor control gas. Pressure inside the chamber stays the same as pressure outside.

Dilution is a logarithmic process. The further away from ambient, the slower it goes. But closed-loop control is efficient. By constantly monitoring chamber oxygen, it promptly gets to setpoint. It responds immediately to correct any disturbance. It automatically adjusts to different loads. And in the process, it uses the least amount of gas possible!

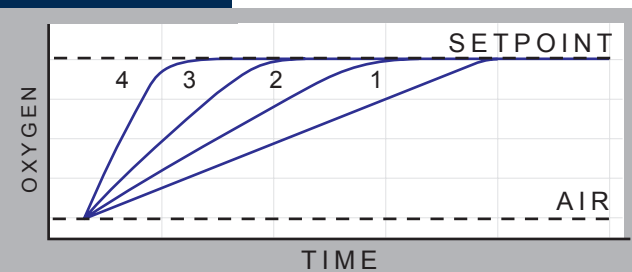
### Hypoxia



#### CONTROL GAS IS NITROGEN

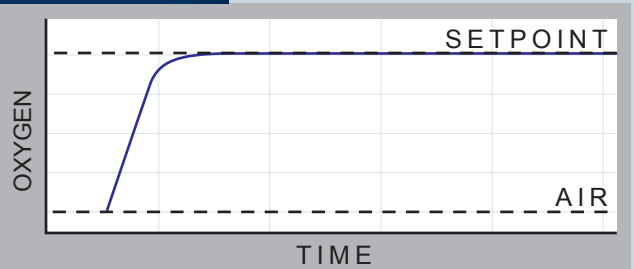
Setpoints are 0.1-20.7% oxygen. The lower the set point, the more time and nitrogen it takes to reach and hold the setpoint.

### Power



Power is a function of infusion rate of control gas. The higher the infusion rate, the faster to setpoint. Above: infusion rate  $\#4 > \#3 > \#2 > \#1$ . Infusion rate is a function of control gas supply pressure. The higher the pressure, the higher the infusion rate. Maximum 40 PSIG provides up to 140 SCFH.

### Hyperoxia



#### CONTROL GAS IS OXYGEN

Setpoints are 20.9-99.9% oxygen. The higher the set point, the more time and oxygen it takes to reach and hold the setpoint.

## Specs

<b>ELECTRICAL POWER:</b> 12 VDC at 2.5A
<b>CONTROL RANGE:</b> 0.1-99.9% oxygen
<b>ACCURACY:</b> O <sub>2</sub> : ±1% at constant temperature/pressure ±2% over entire temperature range.
<b>RESOLUTION:</b> 0.1%
<b>OXYGEN SENSOR:</b> Various application specific sensors available.
<b>GAS SOURCE:</b> compressed gas tanks, liquid carboys (from headspace), or generators.
<b>GAS SUPPLY:</b> pressurized O <sub>2</sub> and/or N <sub>2</sub>
<b>GAS SUPPLY LINE:</b> 1/4" I.D. hose, pressure rated to 40 PSIG.
<b>GAS SUPPLY LINE PRESSURE:</b> 1-40 PSIG
<b>GAS INFUSION RATE:</b> 1-140 S.C.F.H.
<b>GAS CONSUMPTION:</b> depends on (1) size and leakiness of host chamber, (2) frequency and duration of opening chamber doors, and (3) oxygen level controlled.
<b>GAS SUPPLY HOSE FITTING:</b> 1/4" hose barb.
<b>UMBILICAL LENGTH:</b> 12 Ft. (custom lengths available).
<b>SENSOR CABLE LENGTH:</b> 12 Ft.
<b>SENSOR CABLE DIAMETER:</b> 6mm.
<b>ALARM OUTPUT:</b> audible 40dB and visible flashing indicator.
<b>ALARM MODES:</b> process high, process low, deviation high, deviation low, deviation band.
<b>WEIGHT:</b> 2.2lbs (Controller Only)
<b>DIMENSIONS:</b> 2.5"H x 8"W x 7"D (Controller Only)

## Sensor Operational Parameters

<b>HOST CHAMBER TEMPERATURE:</b> 5-40°C (depending on sensor)
<b>HOST CHAMBER CO<sub>2</sub>:</b> 0.1-20% (depending on sensor)
<b>HOST CHAMBER HUMIDITY:</b> 0-95% RH. Non-Condensing

**ProOx P360 Redundancy option:** Two ProOx P360s can be "daisy chained" to one another to act as a failsafe in applications. This runs the gases being infused past two oxygen sensors, and any deviation between the two readings will indicate an issue needing to be addressed.

**Optional:** Windows® based software package that provides trend plotting, data logging, and remote operation via RS connection to your PC. Multiple ProOx P360s can be daisy chained via optional RS-485 interface.

## Front Panel



- 1. Needle Valve:** Sets infusion rate of control gases in each chamber to accommodate different dynamics. Can manually override controller to shut off gas.
- 2. Bleed Valve:** Bleeds gas (nitrogen or oxygen) out of gas supply line. Used for calibrating sensor and de-pressurizing gas supply.
- 3. Controller:** Bright green 0.4 inch digits. Continuously displays oxygen concentration at sensor, unless pre-empted by other operations. Displays menu items and settings during programming.
- 4. Gas Switch:** Manually overrides controller to shut off gas.
- 5. Alarm Switch:** Manually overrides controller to shut off alarm.
- 6. Bleed Barb:** 1/8" hose barb where gas bleeds out from bleed valve. Calibration cup for sensor attaches here.

## Back Panel



- 7. Sensor Input Jack:** Sensor cable connects here. Finger tightened locking nut on cable plug secures it.
- 8. 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).
- 9. Control Gas Outlet Hose Barb:** Brass 1/4" hose barb where infusion tubing into host chamber connects.
- 10. Supply Gas Hose Barb:** Barb for 1/4 inch I.D. hose from gas sources. Handles pressure up to 40 PSIG.
- 11. Power Receptacle:** 12VDC power supply connects here.



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