

SpO2 Instruction Supplement

This supplement should be used in conjunction with the petMAP+ Operator's Manual.

Theory of Operation

The pulse oximetry function of petMAP+ determines both pulse rate and SpO2 % (percent oxygen saturation) by passing two different wavelengths of low intensity light (one is a visible red and the other is an invisible infrared) through body tissue which has good blood flow to a photodetector. The sensor is divided into two halves: the emitter is the part of the sensor that glows red when powered on; the detector is the opposite part of the sensor and does not emit any light. SpO2 values are based on calculations of the ratios of the differences in absorbance of red and infra-red light between blood saturated with oxygen and oxygen-depleted blood at each heartbeat. The variation of the absorbance of the infrared light during each heart beat is displayed as the O2 pleth trace.

Requirements for Obtaining Reliable SpO2 Readings

Proper Sensor Placement: The user must place the sensor clip on a relatively thin tissue that has good circulation, such as the tongue, lip, deep in the ear, paw, toe, toe webbing, arm or leg just above the paw, vulva, or Achilles tendon. The tissue being used must be of a thickness and color that allows proper light penetration of the tissue between the two halves of the sensor clip. Darkly pigmented skin or dark fur can prevent proper light penetration and thus prevent O2 measurement. Note that the sensor should NOT be placed on an extremity that has a blood pressure cuff, arterial catheter or intravascular line proximal to the O2 sensor site.

Proper Sensor clamping pressure: If needed, the sensor's clamping pressure adjustment should be used to reduce sensor clamping pressure so that the pressure of the sensor does not compress the tissue and prevent good circulation in the tissue between the sensor's two arms. This pressure reduction adjustment is made by using the grey pressure reduction slider (details below) and is often needed when measuring on the ear and tongue of small animals. Specifically, the pressure can be relieved by moving the gray strain relieve slider towards the sensor so that clamping tension is placed on the rear portion of the clip by the two sensor wires. This pressure on the rear portion of the sensor reduces the pressure on the sensor jaws which will prevent the sensor pressure from cutting off the circulation in the tissue between the sensor jaws. However, care should be taken to maintain just enough pressure to hold the sensor in place. (see lower left photo below which shows the slider snugged up close to the sensor to relieve pressure on the ear)

No subject motion: The animal must be motionless. Any motion will affect the stability and accuracy of the readings, and continuous motion such as shivering will prevent accurate measurement. Generally, SpO2 readings are best taken on anesthetized patients or patients that are not moving.

Reset O2 electronics: After any change in the sensor positioning, the O2sat ON/OFF button should be cycled OFF and then back to ON. This allows the O2 electronics to restart using the new sensor/tissue setup. It will typically take 15-20 seconds to get a first reading and up to 30 seconds for the readings to stabilize. During monitoring, disregard the SpO2 readings if the pleth trace is not stable and/or if the patient's heart rate is not reasonably correct. Either of these conditions requires sensor adjustment and resetting the O2 switch to OFF, then ON.

Causes of Inaccurate SpO2 Measurements

Incorrect application of the sensor: move to alternate site; reduce pressure using gray slider; make sure to place the sensor on an extremity that does not have a blood pressure cuff, arterial catheter or intravascular line proximal to the O2 sensor.

Tissue too thick or too dark (i.e., not enough signal): move to thinner site; wet fur and part to allow better light transmission; clip fur.

Tissue too thin (ie, too much signal): apply one or two cloth tape wraps (see Helpful Hints, below) to both the emitter and the detector halves of the sensor if the tissue is very thin like a cat's ear and tongue (see lower left photo below); move to a thicker tissue site.

Excessive amount of ambient light: shield the sensor by covering it with a lightweight opaque material.

Subject motion: reduce motion by appropriate means.

Some Helpful Hints

The primary application site is the tongue for most anesthetized animals, though on the cat, the ear and the leg and the paw are good sites, too. Depending on the size of the tongue of a cat or a dog, it may be necessary to apply 1 or 2 tape wraps to both halves of the sensor. Alternatively, it may be helpful to fold the tongue like a taco to increase thickness, or use wet gauze of single thickness folded over the tongue, and then placing the sensor over the gauze (this simulates the tape wrap). When measuring on the tongue, the measurement site should be kept moist. Reduction of sensor pressure will likely be needed on small animals (cats and small dogs).

If you have experienced difficulty obtaining a stable pleth or stable readings, it is sometimes helpful to turn SpO2 OFF and back ON to reset the O2 electronics. Any time the sensor is repositioned or adjusted, the SpO2 should be cycled OFF then back ON to allow the electronics to start fresh with the new sensor positioning.

As described above, on thinner, lighter tissues (eg., cat ears, tongues) it is possible that the sensor's light source will overwhelm the detector, i.e., the light coming through the very thin tissue is too strong to be properly interpreted by the detector half of the sensor. If this happens, the effect will be that no reading is displayed, even though there is potentially a good pleth tracing. In this situation, to reduce the intensity of the light hitting the detector, try wrapping a single layer of ½ inch cloth tape (Johnson & Johnson or 3M Durapore) over the detector and over the emitter halves of the sensor and then reapply the sensor to the patient. And, as suggested above, reset the SpO2 function by turning it OFF and then back ON. In cases of very thin tissue (like the cat's ear), it may be advantageous to apply a second layer of cloth tape to both halves of the sensor. This tape wrapping technique with two layers of tape on both halves of the sensor has been found useful when measuring SpO2 using the cat's ear specifically. For the dog's tongue, a single wrap of tape on both halves has been helpful.

Some clinicians have found the rubber jackets are not useful and do not use them on the sensors. With the jackets removed, the sensor can more easily be placed on an individual toe of either a cat or a dog. (see photos below)

