The only way to continuously and noninvasively monitor methemoglobin, carboxyhemoglobin, perfusion index and pleth variability index, as well as oxygen saturation and pulse rate during challenging conditions including motion and low perfusion.
Introducing Masimo Rainbow SET

*The second revolution in noninvasive oxygenation monitoring*

Transcend the limitations of conventional pulse oximetry with Masimo Rainbow SET, the first and only technology capable of continuously and noninvasively measuring methemoglobin (SpMet) and carboxyhemoglobin (SpCO), in addition to oxygen saturation, perfusion index, pleth variability index and pulse rate. Incorporating Masimo’s revolutionary Read-Through Motion and Low Perfusion pulse oximetry technology, Masimo Rainbow SET technology gives you:

- accurate readings during patient motion and low perfusion
- unprecedented specificity, virtually eliminating false alarms
- improved sensitivity, dramatically improving true alarm detection
- detection of life-threatening dyshemoglobins: methemoglobin and carboxyhemoglobin
- unprecedented probe-off detection with Rainbow APOD
- upgradable platform for future planned parameters
- unprecedented accuracy range: \( \text{SpO}_2 \) 60-100%, SpCO 0-40%, SpMet 0-15%
- proven accurate on cyanotic patients
Masimo Signal Extraction Technology Makes it All Possible

The Masimo Rainbow SET Pulse CO-Oximetry platform is based on Masimo’s revolutionary and industry pioneering Signal Extraction Technology (Masimo SET)—the world’s first and highest performance pulse oximetry technology clinically proven to work during periods of patient motion and low peripheral perfusion.

Since its introduction, more than 100 independent and objective clinical studies have documented that Masimo SET is the most accurate and reliable SpO₂ technology, improving patient outcomes even in the most difficult clinical conditions.

RAINBOW TECHNOLOGY—THE SECOND REVOLUTION

Masimo Rainbow SET is a breakthrough noninvasive blood constituent monitoring platform that has the promise of measuring many blood constituents that previously required invasive procedures. Masimo Rainbow SET’s first application is Pulse CO-Oximetry, the first and only technology platform capable of continuously and noninvasively measuring carboxyhemoglobin (SpCO) and methemoglobin (SpMet), in addition to oxyhemoglobin (SpO₂), perfusion index (PI), pleth variability index (PVI) and pulse rate.

A PLATFORM FOR GROWTH—WHY SETTLE FOR LESS?

In addition to the current ability to monitor the level of SpMet and SpCO, Masimo scientists are currently at work using the data delivered by the multiple wavelengths of light in the sensor to qualify additional noninvasive parameters, such as total hemoglobin (SpHb). When these new parameters become available, they can be field installed on your Rainbow-ready monitoring devices through a simple software upgrade, so you can easily purchase and add them when you need them.

Available in either full color or monochromatic blue screen, only the Masimo Radical-7 provides you with a more accurate assessment of the oxygenation and dyshemoglobin status of your patients.
Both color and monochrome versions of the Radical-7 feature Masimo’s unique rotational screen for maximum clinical flexibility.

Now you can monitor carboxyhemoglobin, methemoglobin, oxygen saturation, perfusion index, pleth variability index and pulse rate continuously, noninvasively and at the point of care.
Masimo Radical-7 Lets You Complete the Oxygenation Picture with Masimo Rainbow SET

Elevate confidence in your SpO₂ readings with the Masimo Radical-7 equipped with optional Rainbow parameters—delivering you a fuller oxygenation picture by framing the SpO₂ measurements with the dyshemoglobins, SpCO & SpMet.

» Gold-standard SpO₂, pulse rate and perfusion index, proven to be the most accurate technology during motion and low perfusion in more than 100 independent and objective studies.
» Breakthrough continuous and noninvasive monitoring of methemoglobin (SpMet) and carboxyhemoglobin (SpCO).
» Allows for continuous monitoring and trending of patients on methemoglobin-inducing drugs or therapies.
» Minimizes the risk of misdiagnosing carbon monoxide poisoning as flu or fatigue.
» Only technology to measure Pleth Variability Index (PVI), capturing vital thoracic pressure changes that may compromise normal cardiac function affecting systemic circulation.
» Provides unprecedented probe-off detection with Rainbow APOD.
» Patented 3D Alarms provide thresholds for desaturations and perfusion index based on clinician-specified severity and frequency.

Choose the Clinical Connectivity Option that Works for You

With a choice of docking stations for your Radical-7, you can select the connectivity configuration that works best for your clinical needs. Whether you need a serial port to connect to your Masimo RadNet central monitoring system, a SatShare port to interface your Rainbow-enabled Radical-7 to another manufacturer’s multiparameter monitor, an analog port to connect to your nurse call system, we’ve got the right solution for you.

Available docking stations:

- **RDS-1**: Serial, analog, nurse call and SatShare connectivity. Optional extended battery provides battery life up to 10 hours. (RDS-1B)
- **RDS-2**: Power Only.
- **RDS-3**: Serial, analog and nurse call connectivity.
Three-in-One Flexibility to Meet Your Specific Needs

Whether you need a bedside or handheld monitor, a standalone or networked SpO₂ monitor, or a cost-effective way to put Masimo Rainbow SET to work with your existing multi-parameter monitors, Masimo has a solution for you.
Rainbow Sensors—Part of the Industry’s Most Complete Line of Sensors

Masimo Radical-7 monitors use a revolutionary sensor that emits multiple (7+) wavelengths of light to capture SpCO and SpMet together with Masimo SET SpO₂, perfusion index, pleth variability index and pulse rate.

All Radical-7 monitors are designed to accept both Masimo Rainbow 7+ wavelength sensors and Masimo SpO₂ two-wavelength sensors. With a Masimo two wavelength sensor connected to a Rainbow empowered device you can monitor SpO₂, perfusion index, pleth variability index and pulse rate—but with a Masimo Rainbow 7+ wavelength sensor you get the added functionality of being able to measure SpMet and SpCO continuously and noninvasively.
Because both methemoglobin and carboxyhemoglobin are dysfunctional forms of hemoglobin that are incapable of transporting oxygen, they reduce blood oxygenation and can induce tissue hypoxemia. Numerous peer-reviewed clinical studies have shown the prevalence and significance of both these dyshemoglobins. Yet, because the flu-like symptoms of carboxyhemoglobinemia and methemoglobinemia are difficult to isolate, increases in SpCO and SpMet often go undetected until dangerous levels are reached.

**Methemoglobinemia and Carboxyhemoglobinemia Prevalence in the Acute Care Setting**

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**Methemoglobinemia**

Elevated levels of methemoglobin can lead to methemoglobinemia and hypoxemia. While low levels normally occur without clinical consequence, morbidity increases at moderate to high levels. High SpMet levels in the blood, unchecked, can result in the loss of life.

The Institute for Safe Medication Practices believes “methemoglobinemia is unlikely to be a rare occurrence,” while authors of a 2004 Johns Hopkins University School of Medicine study concluded “drugs that cause acquired methemoglobinemia are ubiquitous in both the hospital and the outpatient setting.”1 The Hopkins study found:

- Acquired methemoglobinemia occurs everywhere from the OR to the general ward and is independent of age—from four days to 86 years.
- More than 20 frequently used drugs cause acquired methemoglobinemia, including ‘caine’ anesthetics such as Benzocaine and Lidocaine; nitroglycerin; inhaled nitric oxide; and Dapsone, an anti-infective used in organ transplant, AIDS, and dermatoses patients.
- Nearly 20% of tested patients had elevated SpMet levels and 25% of cases were found accidentally. There were three near-deaths and one death.

Two recent studies suggest that increases in SpMet levels may occur prior to the onset of sepsis, implying that continuously monitoring SpMet levels of at-risk patients may provide a potential predictor of sepsis.2, 3

“Methemoglobinemia does not discriminate significantly throughout areas of hospital care, with the operating room, outpatient clinics, and the intensive care units receiving similar distributions. One quarter of the methemoglobinemia cases in this study were discovered incidentally.”

Reference: “Acquired Methemoglobinemia” Ash-Bernal, et.al., Johns Hopkins Bayview Medical Center, John Hopkins University School of Medicine, Baltimore, MD Medicine 2004; 83:265-273
“Until Masimo Rainbow SET, testing carbon monoxide levels in the blood was invasive and painful and resulted in delays in diagnosis, particularly when carbon monoxide poisoning was not suspected. Now we triage ED patients immediately and speed treatment to those affected.”

Mary Russell EdD MSN
Research & Organizational Preparedness Specialist
Boca Raton Community Hospital

CARBOXYHEMOGLOBINEMIA:

More people present to the emergency department with carbon monoxide (CO) poisoning (carboxyhemoglobinemia) than for any other type of poisoning, resulting in at least 40,000 visits and as many as 5,000 deaths per year in the United States alone.4

The need to quickly recognize CO poisoning in a patient who presents with ambiguous, flu-like symptoms is critical to prevent long-term clinical consequences. It has been demonstrated that even one moderate to severe exposure of CO can lead to long term cardiac and neuropsychiatric sequelae.

Even when the current method for detecting CO in the blood—invasive CO-Oximetry—is used, the average delay in diagnosis can be anywhere from minutes to 15 hours—leading to critical time lost in the proper evaluation and treatment of this silent killer.5

Pooled scatter plot for SpCO from Masimo Rainbow SET vs. COHb from invasive CO-Oximeter

Seventy years ago, Karl Matthes, M.D. envisioned a device that would noninvasively, continuously and accurately monitor arterial oxygenation. In 1998, after nearly 300 man years of engineering, over 200 patents, and 5 years of clinical testing, Masimo delivered the first pulse oximeter reliable even during periods of motion and low perfusion.

Now, with the launch of Masimo Rainbow SET less than a decade later, we’ve taken another leap forward with the ability to monitor SpMet & SpCO—not only providing these critical measurements, but completing the oxygenation picture.

The revolution continues . . .

1949
Wood adds pressure capsule to squeeze blood out of ear to obtain zero setting in an effort to obtain absolute $O_2$ saturation value when blood was readmitted. Concept similar to today’s conventional pulse oximetry but suffered due to unstable photocells and light sources. Not used clinically.

1964
Shaw assembles first absolute reading ear oximeter by using eight wavelengths. Commercialized by Hewlett Packard, use was limited to pulmonary function and sleep laboratories due to cost and size.

1942
Millikan develops optical blood oxygen saturation method because Air Force fighter pilots were blacking out at high “G” forces. Arterialized blood in ear by heating, coined the term “oximeter”.

1935
Matthes develops first 2-wavelength ear $O_2$ saturation meter with red and green filters, later switched to red and infrared filters. First device to measure $O_2$ saturation.
1981
In 1972, Aoyagi at Nihon Kohden invents conventional pulse oximetry using the ratio of red to infrared light absorption of pulsating components at the measuring site. It was commercialized by BIOX/Ohmeda in 1981 and Nellcor in 1983.

1996
In 1989, Diab and Kiani at Masimo invent Signal Extraction Pulse Oximetry using many breakthrough technologies, including parallel engines, adaptive filters, Discrete Saturation Transform, and Fast Saturation Transform to separate the arterial signal from the non-arterial noise (e.g., venous blood movement during motion). The result was the first and only pulse oximetry technology scientifically and clinically proven to be accurate during challenging conditions of patient motion and low perfusion.

2005
In 2005, Masimo launches another significant advance in noninvasive patient monitoring technology called Masimo Rainbow SET—the first and only way to continuously and non-invasively measure carboxyhemoglobin, methemoglobin, oxygen saturation, pulse rate, pleth variability index, and perfusion index. This revolutionary new technology uses multiple (7+) wavelengths of light and sophisticated signal processing including parallel engines and adaptive filters to calculate dyshemoglobin saturation values, allowing clinicians to detect and treat potentially life threatening conditions earlier than ever before. Coined Pulse CO-Oximetry™.
Instruments and sensors that contain Masimo SET and Masimo Rainbow SET technologies are identified with these logos. Always look for the Masimo SET and Rainbow SET designation for accurate monitoring when you need it most.