



# Acoustic Respiration Rate

# RRa

Acoustic Respiration Rate (RRa™) is a breakthrough measurement that allows clinicians to noninvasively and continuously assess patients' breathing—facilitating earlier detection of respiratory compromise and patient distress.

Accurate > Easy-to-Use > Patient-Tolerant

## HOW IT WORKS

rainbow Acoustic Monitoring™ noninvasively and continuously measures respiration rate using an innovative adhesive sensor with an integrated acoustic transducer that is easily and comfortably applied to the patient's neck.

Using acoustic signal processing that leverages Masimo's patented revolutionary Signal Extraction Technology (SET®), the respiratory signal is separated and processed to display continuous respiration rate.



Cloth rainbow Acoustic Sensor™

Breathable cloth allows air to penetrate tape for enhanced patient comfort



Acoustic Signal

“Breathing adequately is what matters most. Masimo Acoustic Respiration Rate provides clinicians with the ability to automatically and continuously monitor the breathing status of post-surgical patients in general care or post-anaesthesia settings—alerting them to the first sign of an abnormal or compromised breathing pattern that may be indicative of airway obstruction or respiratory distress.”

MICHAEL RAMSAY, MD

Chief of the Department of Anaesthesiology and Pain Management  
Baylor University Medical Center, Dallas, TX

**Masimo SET**  
rainbow

## CLINICAL BENEFITS

### Respiration rate is a critical vital sign that provides early detection of respiratory compromise and patient distress

- > Continuous monitoring of respiration rate is especially important for post-surgical patients receiving patient-controlled analgesia (PCA) for pain management as the sedation can induce respiratory depression and place patients at considerable risk of serious injury or death.<sup>1-4</sup>
- > Although the Anaesthesia Patient Safety Foundation (APSF) guidelines include oxygenation and ventilation monitoring in all patients receiving opioids,<sup>5</sup> current methods for respiration rate monitoring can be limited by reliability or patient tolerance.<sup>6</sup>
- > Masimo rainbow SET® Pulse CO-Oximeters with rainbow Acoustic Monitoring™ help you meet APSF guidelines for monitoring post-operative patients.

## CLINICAL ACCURACY

### Masimo rainbow Acoustic Monitoring™ provides similar respiration rate accuracy as capnography respiration rate monitoring<sup>7</sup>

Dataset	Number of Samples	Bias (bpm)	Standard Deviation (bpm)	ARMS (bpm)
Masimo RRa	21,369	0.18	1.31	1.33
Capnography Respiration Rate	21,405	0.22	1.62	1.63

- > Both methods were compared to a control respiration rate obtained by a trained observer counting inspirations and expirations visually and by listening (as done during auscultation).
- > Respiration rate accuracy is validated in the range of 4 to 70 breaths per minute  $\pm$  1 bpm.<sup>8</sup>

## TECHNOLOGY PLATFORM



Masimo rainbow SET® is a noninvasive monitoring platform enabling the assessment of multiple blood constituents and physiologic parameters that previously required invasive or complicated procedures, in addition to providing Masimo SET® Measure-through Motion and Low Perfusion pulse oximetry.

- > Acoustic Respiration Rate (RRa™)
- > Carboxyhaemoglobin (SpCO®)
- > Methaemoglobin (SpMet®)
- > Oxygen Content (SpOC™)
- > Pleth Variability Index (PVI®)
- > Total Haemoglobin (SpHb®)
- > Oxygen Saturation (SpO2)
- > Pulse Rate (PR)
- > Perfusion Index (PI)

The upgradeable rainbow SET® platform lets you choose the rainbow® measurements that are right for you now and be confident that your investment in patient safety won't become obsolete tomorrow.

## REFERENCES

- <sup>1</sup> Joint Commission on Accreditation of Healthcare Organizations. Sentinel event alert: patient controlled analgesia by proxy; *JCAHO*. 2004.
- <sup>2</sup> Institute for Safe Medication Practices. Safety issues with patient-controlled analgesia: Part I – How errors occur; *ISMP*. 2003.
- <sup>3</sup> Institute for Safe Medication Practices. Safety issues with patient-controlled analgesia: Part II – How to prevent errors; *ISMP*. 2003.
- <sup>4</sup> Bird M. Acute pain management: a new area of liability for anesthesiologists; *ASA Newsletter*. 2007; 71:8.
- <sup>5</sup> Weinger MB et al. *APSF Newsletter*. 2011; 26(2):21-40.
- <sup>6</sup> Macknet MR, et al. Accuracy and tolerance of a novel bioacoustic respiratory sensor in pediatric patients; *Anesthesiology*. 2007; A84.
- <sup>7</sup> Masimo FDA Submission Data.
- <sup>8</sup> Respiration rate accuracy has been validated for the range of 4 to 70 breaths per minute in bench toptesting. Clinical validation for up to 30 breaths per minute was also performed with the Masimo Acoustic Monitoring sensor and instrument. The variation in accuracy specifications equals plus or minus 1 standard deviation which encompasses 68% of the population. Contact Masimo for testing specifications.