



Certainty where it matters most

Capnostream™ 35 portable respiratory
monitor now available with Nellcor™
respiration rate technology

Medtronic
Further. Together

A monitor that takes the journey with patients during their hospital stay.

From a patient under sedation during a procedure to monitoring a patient in the medical-surgical unit, clinicians can count on the Capnostream™ 35 portable respiratory monitor to deliver continuous monitoring in virtually any clinical setting. Quick, easy, and reliable access to respiratory status provides key insights for safe and effective care.

- Portable, rugged, lightweight, ergonomic design — helps facilitate moving a patient between areas of care
- Smart algorithms — engineered to give an early indication of changes in respiratory status that may need intervention
- Connectivity to web-enabled devices on a secured hospital WiFi network for advanced data management and remote patient monitoring



Now available with Nellcor™ respiration rate technology

Measurements of respiratory rate, pulse rate and SpO₂ are attainable with a single Nellcor™ pulse oximetry sensor.

Flexible options to help clinicians detect respiratory compromise early and fast.

The Capnostream™ 35 portable respiratory monitor provides options, so clinicians can choose what and how to monitor a patient's respiratory status.

Access continuous, noninvasive, real-time respiratory status monitoring of etCO₂ and capnography-derived respiration rate using a Microstream™ Advance filter line. Or use a Nellcor™ respiratory rate sensor alone to measure SpO₂, pulse rate and pulse oximetry-derived respiration rate (RRPleth).

In addition to respiratory rate status monitoring, Nellcor™ Saturation Pattern Detection (SPD) algorithm identifies evolving SpO₂ patterns in real-time, which can indicate repetitive reduction in airflow.

How Nellcor™ respiration rate technology works

Using a single sensor, the Capnostream™ 35 portable respiratory monitor provides a continuous, noninvasive measurement of SpO₂, pulse rate and respiratory rate. Nellcor™ respiration rate software analyzes variations in the pulse oximetry signal and the plethysmographic waveform[†]. These variations are indicative of respiratory activity.

Nellcor™ respiration rate software measures changes to the pleth waveform caused by inhalation and exhalation. The respiration rate measurement is calculated based on changes to the baseline, amplitude and frequency components of the pleth signal. The accuracy is very robust, ±1 breath per minute when compared to a capnography waveform reference measurement.²

[†]Pleth-based Nellcor™ respiration rate is not approved for use in EMS or intra-hospital transport.



One sensor, three measurements

For patients who do not require capnography monitoring, a single sensor offers clinicians continuous access to oxygenation, pulse rate, and respiration rate, providing a more accurate measurement than manual spot check methods.

Respiration rate is a standard of care measurement.

However it's often read **intermittently** and **manually** by clinicians, which may result in infrequent and inaccurate measurements.

By implementing **automated, continuous** respiratory rate monitoring to patient management protocols, clinicians will be alerted to early signs of changes in respiratory status.

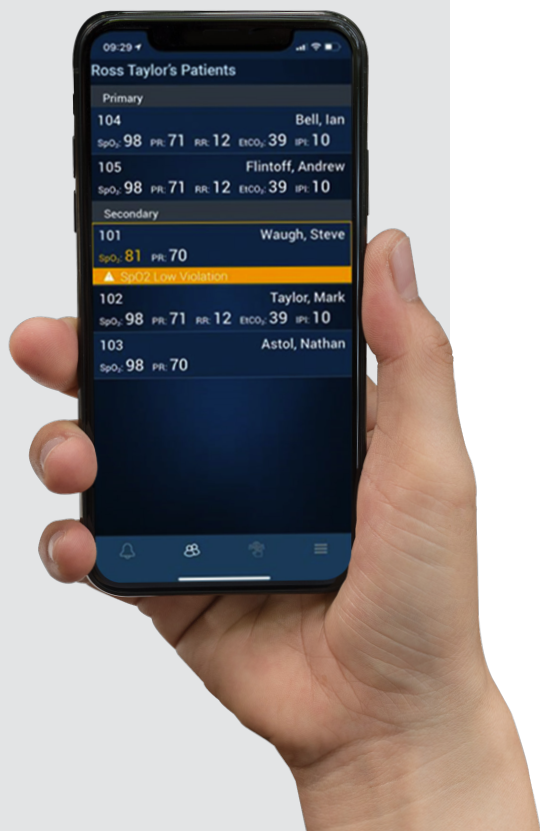
Nellcor™ respiration rate technology is now available on the Capnostream™ 35 portable respiratory monitor from the same single-use sensor used to measure oxygen saturation.





View patient data wirelessly

Patient data can be sent wirelessly to the Vital Sync™ monitoring and clinical decision support solution. View patient information on any web-enabled device, on a secured hospital WiFi network. Patient data can also be stored on a USB drive or micro SD card, printed, and transferred to other data systems.



Insights that lead to action

Providing insights on respiratory status that clinicians can use to intervene early and fast is the foundation of Microstream™ capnography and Nellcor™ pulse oximetry technology. Combined with integrated algorithms and data management, the Capnostream™ 35 portable respiratory monitor is a step ahead of conventional monitors.

Molecular Correlation Spectroscopy™ Technology

Microstream™ technology uses a CO₂ specific infrared (IR) wavelength that is highly accurate and unaffected by the presence other gases (e.g. O₂, N₂O, He or inhaled anesthetics).²

Smart Capnography™ Algorithms

Our suite of algorithms is engineered to provide a complete picture of respiratory status. And these proprietary algorithms are engineered to reduce nonactionable alarms to help mitigate alarm fatigue.

- **Smart Breath Detection™ algorithm (SBD)** — proprietary filter and pattern recognition screens out low-amplitude "nonbreath" etCO₂ excursions like snoring, talking, or crying
- **Smart Alarm for Respiratory Analysis™ algorithm (SARA)** — combined with the SBD algorithm, manages breath-to-breath variability and is engineered to reduce nuisance alarms. SARA reduces 53% of clinically insignificant, unactionable nuisance alarms²
- **Apnea-Sat Alert™ algorithm (ASA)** — provides key insights through summary reports of recurring apnea events per hour as well as oxygen desaturations
- **Integrated Pulmonary Index™ algorithm** — combines four real-time measurements in a single number: etCO₂, SpO₂, pulse rate, respiratory rate^{††}

Continuous Oxygenation Monitoring

Nellcor™ respiration rate software uses one sensor, pulse oximetry technology, and workflows to derive respiration rate based on the changes in the waveform.

Continuous monitoring of respiration rate, including pleth-based respiratory rate, offers an early indication of respiratory compromise compared to continuous SpO₂ monitoring alone.³

The Saturation Pattern Detection (SPD) alert adds automated, real-time detection of specific patterns within the second-by-second SpO₂ trend data. This indicates the presence of repetitive reductions in airflow (RRiA) through an adult patient's upper airway and into the lungs. One of the more well-known examples of RRiA is obstructive sleep apnea.



Help reduce alarm fatigue

Alarm fatigue is common. An estimated 85 percent to 99 percent of alarms at healthcare facilities don't require intervention.^{4,5} Alarm fatigue can lead to missed interventions — with potentially catastrophic events. Microstream™ capnography and Nellcor™ pulse oximetry alarm management algorithms are engineered to help enhance patient safety and improve workflow by reducing nuisance alarms.

Preserve caregiver alarm vigilance

The Smart Alarm for Respiratory Analysis™ algorithm (SARA) manages breath-to-breath variability. It's designed to reduce the number of nuisance respiratory rate alarms while providing an accurate picture of the patient's respiratory status.²

The Smart Breath Detection™ algorithm (SBD) is engineered to reject shallow, non-breath CO₂ excursions from being counted as breaths. Together, SARA and SBD reflect patient condition and help mitigate clinically insignificant alarms.

Differentiate minor from major incidents

Nellcor™ SatSeconds alarm management calculates duration and severity of events. And it can give clinicians insight to help distinguish between minor or brief desaturations and serious hypoxemia.

Capnostream™ 35 respiratory monitor

product specifications

Order Number	Description
PM35MN	Capnostream™ 35 portable respiratory monitor
PM35MN-RR	Capnostream™ 35 portable respiratory monitor with Nellcor™ respiratory rate configuration
General characteristics	
Unit dimensions	<ul style="list-style-type: none"> 213 mm (h) x 137 mm (w) x 55 mm (d) (8.38 in (h) x 5.39 in (w) x 2.16 in (d))
Unit weight	1 kg, 2.2 lb.
Power supply	
Input power	100–240 VAC, 50/60 Hz, ± 10%
Battery	
Battery type	Lithium ion
Battery pack nominal voltage and energy	7.2V; 18.72Wh
Battery operation	Three hours for removable battery pack; 20 minutes for internal battery pack
Battery charging time	Up to five hours when the monitor is off and up to eight hours when the monitor is on, for both batteries
Display	
Screen	<ul style="list-style-type: none"> 109 mm (4.3 inch) Color TFT display Pixel Pitch: 0.198 (horizontal) x 0.198 (vertical) mm Active display area: 95.04 (horizontal) x 53.856 (vertical) mm Resolution: 480 x 272 pixels Viewing angle: (vertical) 125° Viewing angle: (horizontal) 140°
Trace speed	3.0, 6.3, 12.5 and 25 mm/second
Waveform sampling rate	<ul style="list-style-type: none"> 77.82 samples/second for SpO₂ (fixed) 20 samples/second for capnography (fixed)
Trend storage	48 hours with one second resolution
Trend display	<ul style="list-style-type: none"> Graphical display: 1 hour, 2 hour, 4 hour, 8 hour, 12 hour views Tabular display intervals: 1 second, 5 seconds, 15 seconds, 30 seconds, 1 minute, 5 minutes, 15 minutes, 30 minutes, 1 hour

Algorithms and Software	
<p>Microstream™ technology: Saturation Pattern Detection™ algorithm, Integrated Pulmonary Index™ algorithm, Saturation Pattern Detection™ algorithm, Nellcor™ Saturation Pattern Detection alert, Nellcor™ SatSeconds Technology, Apnea-Sat Alert™ algorithm, Smart Alarm for Respiratory Analysis™ algorithm.</p> <p>Nellcor™ pulse oximetry technology: Saturation Pattern Detection alert, SatSeconds alarm management, respiration rate software.</p>	
Communication interface	
Wi-Fi (Vital Sync™ virtual patient monitoring platform connectivity option) and file transfer via USB flash drive	
Connectivity on a secured hospital WiFi network	
Microstream™ capnography	
CO ₂ units	mmHg or kPa or Vol%
CO ₂ etCO ₂ range	0–150 mmHg
CO ₂ waveform resolution	0.1 mmHg
etCO ₂ resolution	1 mmHg
CO ₂ accuracy	<ul style="list-style-type: none"> 0–38 mmHg: ± 2 mmHg 39–150 mmHg: ± (5% of reading + 0.08 for every 1 mmHg above 38 mmHg)
etCO ₂ alarms	No breath, etCO ₂ High, etCO ₂ Low, RR High, RR Low, Integrated Pulmonary Index™ algorithm (IPI). IPI also requires pulse oximetry information.
Flow rate	50 (42.5 ≤ flow ≤ 65) ml/minute, flow measured by volume
Waveform sampling	50 millisecond intervals
Response time	2.95 seconds (typical); with use with sampling lines with long tubing, ~5.0 seconds
Initialization time	60 seconds (typical)
Calibration interval	Initially calibrate after 1,200 operating hours, then once a year or after 4,000 operating hours, whichever comes first.
Capnography-derived respiration rate range	0–150 bpm
Capnography-derived respiration rate accuracy	<ul style="list-style-type: none"> 0–70 bpm ± 1 bpm 71–120 bpm ± 2 bpm 120–150 bpm ± 3 bpm

Nellcor™ pulse oximetry performance

Respiration rate range	4–40 bpm \pm 1 bpm
SpO ₂ measurement range	1–100%
Pulse rate range	20 to 250 beats per minute Pulse rate values of < 20 beats per minute shall be displayed as zero beats per minute Pulse rate values of > 250 beats per minute shall be displayed as 250 beats per minute
Pulse amplitude	0.03% to 20%
Standard and LoSat SpO ₂ accuracy range, using Nellcor™ pulse oximetry sensors: MAXA, MAXAL, MAXP, MAXI, MAXN	\pm 2% in the standard range of 70% to 100% saturation and LoSat SpO ₂ accuracy of \pm 3% in the range of 60% to 80% saturation, enabling clinicians to accurately assess patients' oxygen saturation.
Pulse rate accuracy	\pm 3 digits over the range of 20 to 250 beats per minute inclusive, including under low perfusion; with motion, 48 to 127 bpm \pm 5 digits
Alarms	SpO ₂ High, SpO ₂ Low, PR High, PR Low
Nellcor™ SatSeconds Alarm Management	Settings: 10, 25, 50, and 100 or OFF
Nellcor™ SPD algorithm	Sensitivity setting: 1, 2, 3 or OFF
Pulse rate delay	Settings: 5, 10 or OFF

Monitor Alarms

Item	Audible alarm	Visual alarm
High priority alarm	Beep pattern repeated every five seconds	Flashing red LED
Medium priority alarm	Triple beep repeated every 10 seconds	Flashing yellow LED
Advisories alarm	No audible alarm	No LED

Nellcor™ respiration rate sensor

Respiration Rate sensor – Adult



- Measures SpO₂, pulse rate and respiration rate
- For patients with low perfusion
- Suitable for long-term monitoring
- Use with Nellcor™ Respiration Rate enabled monitor
- Single-patient use

Ordering information

Part number	Weight range	Units per case	Accuracy 70–100%	Accuracy 60–80%	Accuracy 4–40 breaths per minute
10068119	>30 kg	24	\pm 2	\pm 3	\pm 1 breath per minute

Visit www.medtronic.com/comfortishealing and see the full portfolio of intubated and nonintubated Microstream™ Advance sampling lines.



Visit [capnostream35.com](https://www.capnostream35.com) for more information, or contact your local Medtronic sales representative.

The Microstream™ capnography monitoring system and the Nellcor™ pulse oximetry monitoring system should not be used as the sole basis for diagnosis or therapy and are intended only as an adjunct in patient assessment.

1. Mecca R MD, Batchelder K, Chen B, Mannheimer PD. Development and validation of Nellcor™ pulse oximetry with OxiMax™ technology SPD™ Alert. 2016 [Medtronic Internal White Paper]
2. Internal test data on file.
3. Bergese SD. Multicenter Study Validating Accuracy of a Continuous Respiratory Rate Measurement Derived from Pulse Oximetry: A Comparison with Capnography. *Anesth Anal.* 2017; 124 (2): 1153-1159.
4. The Joint Commission. Sentinel Event Alert Issue 50: Medical device alarm safety in hospitals. https://www.jointcommission.org/sea_issue_50/. Published Apr. 8, 2013.
5. Graham KC, Cvach M. Monitor alarm fatigue: standardizing use of physiological monitors and decreasing nuisance alarms. *Am J Crit Care.* 2010;19(1):28-35.

© 2021 Medtronic. All rights reserved. Medtronic, Medtronic logo and Further, Together are trademarks of Medtronic. All other brands are trademarks of a Medtronic company. 09/2021-US-PM-210070-[WF#5087064]