Capnostream® 20p Bedside Capnography Monitor

The only integrated, complete picture of oxygenation and ventilation[1]

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positive results for life™

Smart Capnography™ and Pulse Oximetry Technology

Smart Capnography is a suite of algorithms proven to reduce alarms and simplify the use of capnography monitoring. It includes Smart Breath Detection™, Smart Alarm for Respiratory Analysis™ (SARA) and Nellcor™ SatSeconds to support alarm management. Additionally, Smart Capnography offers algorithms that provide workflow solutions, including the Integrated Pulmonary Index™ (IPI) and the new Apnea Sat-Alert algorithm. With all features combined, clinicians have access to a broader range of respiratory status information and alarm management technology to help enhance patient safety and improve clinical efficiency.[2-3]

The Capnostream® 20p patient monitor is built on a legacy of proven performance. For nearly two decades, clinicians have relied on Microstream®-enabled capnography monitoring for an accurate, continuous view of ventilation adequacy on intubated and non-intubated patients, from neonate to adult.

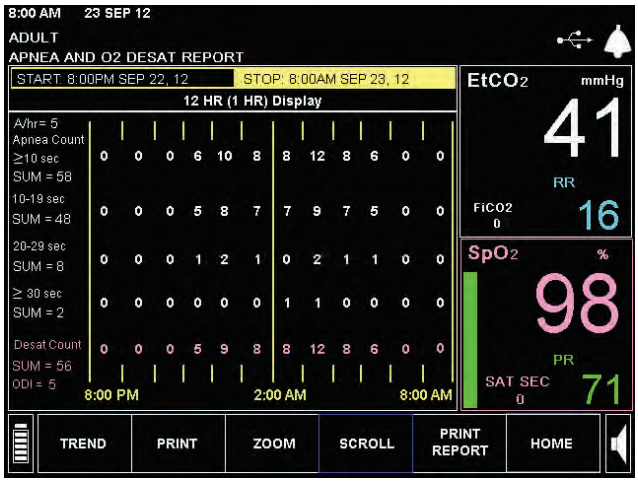
The 'p' in Capnostream® 20p stands for 'plus', and integrates an expanded electronics platform for enhanced Smart Capnography algorithms. Apnea Sat-Alert, the first algorithm to be supported on the new 'plus' platform, is designed to alert caregivers to repetitive patterns of apneas and oxygen desaturation.

The platform also supports the integration of the microMediCO$_2$™ Module, the core component of Microstream etCO$_2$ measurement technology. Smaller and requiring less power to operate than previous modules, the microMediCO$_2$ Module can be integrated into an even wider range of OEM host monitor configurations.

Patient Information + Analysis + Efficiency = Smart

Apnea-Sat Alert (ASA)*

ASA tracks and reports apneas per hour (A/hr), and the oxygen desaturation index (ODI) indicates the 'dips' in SpO_2 (number of times the SpO_2 value dropped 4 percent or more from baseline and returned to baseline in 240 seconds or less). A visual alert appears if the A/hr exceed a preset threshold over user selectable time periods of 2, 4, 8 or 12 hours. A/hr and ODI are displayed in real time on the monitor home screen, and the data is available in trend reports, in print outs and through data export.



ASA trend screen displays an analysis of A/hr by length of the apneas.

*Apnea-Sat Alert is FDA cleared for adults 22 years of age or older.

Smart Breath Detection™ (SBD)

Proprietary filter and pattern recognition algorithm screens out low-amplitude "non-breath" $etCO_2$ excursions like snoring, talking or crying, to provide a more accurate respiratory rate.

Smart Alarm for Respiratory Analysis™ (SARA)

Reducing distractions from clinically insignificant alarms helps preserve caregiver alarm vigilance, leading to improved patient safety.[4] Functioning in combination with the SBD algorithm, the SARA algorithm is proven to reduce clinically insignificant respiratory rate alarms by dynamically adjusting the respiratory rate averaging algorithm during periods of breath-to-breath cycle variability.[5]

Integrated Pulmonary Index™ (IPI)

IPI incorporates four real-time respiratory measurements into a single number, displayed on a scale from 1 to 10, representing an inclusive respiratory profile. Helpful in busy clinical environments, IPI provides a simple and comprehensive indication of respiratory status and trends, promoting early awareness of changes to a patient's breathing.

IPI	Patient Status
10	Normal
8-9	Within normal range
7	Close to normal range; requires attention
5-6	Requires attention and may require intervention
3-4	Requires intervention
1-2	Requires immediate intervention

Nellcor™ SatSeconds

SatSeconds analyzes desaturation events by multiplying their duration, in seconds, by the number of percentage points the patient drops below the SpO_2 alarm limit. As a safety precaution, when three or more SpO_2 alarm violations occur within 60 seconds, an alarm will sound even if the SatSeconds limit has not been reached.

LoSat Expanded Accuracy

Nellcor™ adhesive sensors with OxiMax™ technology and LoSat Expanded Accuracy range give clinicians the ability to assess patients with critically low saturation readings (60%-80%), such as infants with congenital heart disease. Accurate readings at low saturation levels expand options for clinicians to effectively monitor pulse oximetry.[6]

Remote Alarm Management Connectivity Capabilities

The Capnostream® 20p patient monitor platform supports a range of remote alarm annunciation connectivity options to help clinicians monitor patients through nurse call systems, stand-alone central stations, wireless phones and pagers.

Nurse Call System Alarm Annunciation

By attaching a cable to an auxiliary nurse call panel in the patient's room, the Capnostream 20p patient monitor alarm will be sent to the institution's nurse call system. In more advanced nurse call systems, alarms can be annotated on pagers and wireless phones.

Vital Sync™ Virtual Patient Monitoring Platform 2.4 (VPMP)

Vital Sync VPMP by Covidien offers Electronic Medical Record (EMR) connectivity and remote continuous patient monitoring. Clinicians can remotely view patient information from ventilators, capnography monitors and pulse oximeters on any web-enabled devices. Patient information is sent to the EMR, Clinical Information System, and alarm forwarding systems.

Nuvon VEGA™*, iSirona™* and Philips VueLink Systems

The Caponstream 20p patient monitor sends all measured patient information, including IPI data, to Nuvon VEGA™* systems and iSirona™* systems for electronic charting. Physiologic data automatically flows to the clinical information system, at the desired interval. When connected to Philips VueLink interfacing module†, parameter information and alarm status of the Capnostream 20p is automatically integrated. Alarms are annunciated on the Philips patient monitor and connected information center.

†Visual only

Summary of Capnostream® 20p Patient Monitor Remote Alarm Management and Connectivity Options

	OPTIONS					
	Basic Nurse Call	Advanced Nurse Call	Nuvon VEGA™* System	iSirona™*	Philips VueLink	Vital Sync™ VPMP
	Capnostream 20p Patient Monitor Connection					
FUNCTIONALITY	Nurse Call Cable	Nurse Call Cable	Wireless or Ethernet Adapter	Ethernet Adapter	Capnostream 20 Monitor/Philips VueLink Cable	Wireless or Ethernet
Basic alarm annunciation on nurse call system	●	●				
Alarm annunciation on existing hospital wireless pagers and phones		●				
IPI display					●	●
Alarm differentiation by type of alarm					●	●
Central station view with parameters and alarms					●†	●
Wireless paging (stand-alone, departmental system)						●
Paging to existing hospital paging system					●	●
Vitals and ADT HL7 connectivity			●	●	●	●

†Visual only

Specifications

POWER SUPPLY	
Input Voltage	100-240VAC, 50/60Hz
Fuses	Two F3.15A 250 Volt
Input Power	90 VA
BATTERY	
Battery Type	14.8V, 4Ah Lithium-Ion
Battery Operation	2.5h (without thermal recorder)
Battery Charging Time	100% in 12h
CONTROLS	
Front Panel	1 Switch for monitor On/Off control 4 specific function keys 1 optical encoder with switch
DISPLAY	
Screen	162mm (6.4in) Color TFT Display Pixel Pitch: 0.204 (H) x 0.204(V) mm (0.008in) Active Display Area: 130.56 (H) x 97.92 (V) mm (5.14in x 3.86in) Resolution 640 x 480 pixels Viewing angle (vertical) 110° Viewing angle (horizontal) 140°
Trace Speed	3.0, 6.3, 12.5 and 25 mm/sec
Waveform sampling rate	75.7 samples/sec for SpO_2 (fixed) 20 samples/sec for Capnography (fixed)
Trend Storage	8640 point storage • 2h at 5s resolution • 24h at 10s resolution • 72h at 30s resolution
Trend Display	Graphical Display: 2h, 6h, 12h views Tabular Display: 60 min, 15 min, 3 min, 1.5 min, and minimum resolution (minimum resolution settable to 5, 10, or 30 seconds)
MICROSTREAM® CAPNOGRAPHY	
CO_2 Units	mmHg or kPa or Vol%
CO_2, $etCO_2$, $FiCO_2$ Range	0-150 mmHg
CO_2 Waveform Resolution	0.1 mmHg
$EtCO_2$, $FiCO_2$ Resolution	1 mmHg
CO_2 Accuracy	0-38 mmHg: ± 2 mmHg 39-150 mmHg: ± (5% of reading + 0.08% for every 1 mmHg above 38 mmHg)
Respiration Rate Range	0-150 bpm
Respiration Rate Accuracy	0-70 bpm: ±1 bpm 71-120 bpm: ±2 bpm 121-150 bpm: ±3 bpm
CO_2 Alarms	No breath, $EtCO_2$ high, $EtCO_2$ low, RR high, RR low, IPI low (IPI also requires pulse oximetry information)
Flow Rate	50 (42.5 ≤ flow ≤ 65) ml/min, flow measured by volume
Waveform Sampling	20 samples/s
Response Time	2.95 s (typical)
Initialization Time	40 s (typical)
Calibration Interval	Initially calibrate after 1,200 operating hours, then once a year or after 4,000 operating hours, whichever comes first
NELLCOR™ OXIMAX™ PULSE OXIMETRY	
SpO_2 Measurement Range	1% to 100%
SpO_2 Accuracy: Adult - Neonate	
Saturation (% SpO_2 ± 1 SD)	
70% to 100% ± 2 digits; ± 3 digits (Motion)	
60% to 80% ± 3 digits	
Low perfusion	70% to 100% ± 2 digits
Pulse Rate	20 to 250 bpm ± 3 digits
Low perfusion	20 to 250 bpm ± 3 digits
Alarms	Adjustable Alarm Limits SpO_2 high, SpO_2 low, Pulse Rate high, Pulse Rate low
Sat Sec Range	10, 25, 50, 100
ALARMS	
High Priority Patient Warning Alarms	Flashing Red LED Flashing Red Numeric High Priority Alarm beep pattern Alarm Indication on Screen Nurse Call
Patient Caution Alarms	Flashing Yellow LED Flashing Yellow Numeric
Medium Priority Alarm	Flashing Yellow LED Triple beep every thirty seconds Alarm Indication on Screen Nurse Call
Advisories	Beep once Advisory Indication on Screen
Silent Advisories	Advisory Indication on Screen
Alarm Volume Control	5 steps
Temporary Alarm Silence	All audible alarms silenced for 2 minutes

Summary of Capnostream® 20p Patient Monitor Features and Enhancements

NEW FEATURES	INTENDED BENEFITS
Apnea-Sat Alert	Provides summary screens and USB/printer reports that indicate when apnea and oxygenation events occur. Offers apnea and oxygenation indexes for selected monitoring epochs.
Alarm limit default settings	The factory default alarm limit levels were adjusted in response to findings from a clinical user survey.
Alarm limit electronic export and printout	Urgent alarm limits can be exported to a USB Flash Memory Drive or printed out for documentation purposes.
Instant demo mode	Immediate activation facilitates sales demonstrations.
"Parameter Standby" mode	Suspends monitoring until a valid physiological signal is detected. Designed to improve workflow by allowing the caregiver to suspend monitoring and alarms because a FilterLine® sampling line or SpO_2 sensor disconnection as been acknowledged and authorized.
"FilterLine® Disconnected" and "SpO_2 Sensor Disconnected" alarms	Using the "nurse call" output, the alarm alerts remote caregivers that a patient is no longer being monitored.

ENHANCED FEATURE	INTENDED BENEFITS
"Trend Printout" updated to include full memory and resolution as displayed on "Tab Trend" screen	All trend data is printed in the display interval format, permitting complete documentation of procedural sedation cases.
Permanent alarm silence on/off toggle	If Permanent Alarm Silence Mode is enabled under institutional defaults, the user can now activate alarms by pressing the Alarm Silence Key. This mode may be desirable for highly supervised procedural sedation cases.

1. Maddox RR, Oglesby H, Williams CK, Fields M, Danello S., Continuous respiratory monitoring and a "smart" infusion system improve safety of patient-controlled analgesia in the postoperative period. http://www.ahrq.gov/downloads/pub/advances2/vol4/Advances-Maddox_111.pdf
2. ECRI Institute. The Hazards of Alarm Overload: Keeping Excessive Physiologic Monitoring Alarms from Impeding Care. ECRI Guidance Article, March 2007.
3. Hockman S, Glembot T, Niebel K. Comparison of capnography derived respiratory rate alarm frequency using the SARA algorithm versus an established nonadaptive respiratory rate alarm management algorithm in bariatric surgical patients. *Resp Care* (Open Forum Abstracts). 2009;12.
4. The hazards of alarm overload. Keeping excessive physiologic monitoring alarms from impeding care. *Health Devices.* 2007;36(3):73-83.
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6. Bebout DE, Mannheimer PD, Wun C-C. Site-dependent differences in the time to detect changes in saturation during low perfusion. *Crit Care Med.* 2001;29(12):A115. [Abstract]

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