Patient Monitor Range

A comprehensive range of patient monitors that combine high levels of sophistication with ease of use

◆ Powerful monitoring tools for every clinical department

◆ Low life costs

◆ Adult, paediatric and neonate monitoring on all models

◆ Affordable, multi-department, Central Monitoring System

◆ Battery backup

◆ Optional Masimo SET™ or Nellcor OxiMax™ SpO2

◆ All models share the same intuitive user interface

◆ Full Penlon Service Support

Partnership for Life

SP M8 and M5 Patient Monitors

Power, Sensitivity and Flexibility

The SP Range is Penlon's next generation of monitor for the most advanced applications

SP M8 Patient Monitor

- ◆ 17" TFT colour display with up to 12 waveforms
- ◆ Up to three additional displays
- ◆ Parameters:
  ECG, Respiration, NIBP, SpO2, Temperature, IBP, CO, EtCO2, Multi-Gas/O2, BIS, ICG, and RM
- ◆ Rechargeable Li-ion battery
- ◆ Up to 13 module slots available when used with the Satellite Module Rack
- ◆ Networkable as standard
- ◆ Optional wireless networking also available
- ◆ Prompt knob or optional touchscreen control
- ◆ Intelligent cooling system keeps the unit running quietly during use
- ◆ Separate indicator lights for technical and physiological alarms
- ◆ Optional memory card for increased data storage
- ◆ Rolling stand or wall mounted units available

SP M5 Patient Monitor

- ◆ 12.1" TFT colour display with up to 12 waveforms
- ◆ Lighter, more compact, with the same features

ECG
3/5-lead selectable or optional 12-lead ECG with eight hour data storage, ST Segment and Arrhythmia Analysis

IBP
Up to eight channels of Invasive Blood Pressure measurement

ICG
Impedance Cardiography for the management of patients with congestive heart failure, hypertension and pacemakers

Alarm Indicators
Separate indicator lights for technical and physiological alarms

Prompt Knob
Convenient interface control via prompt knob or optional touchscreen control

SP M8 and M5 Patient Monitors

Power, Sensitivity and Flexibility

The SP Range is Penlon's next generation of
monitor for the most advanced applications

Choose the parameters and modules to match your patient monitoring requirements

1. Select the MPM option from the table below

2. Select the Multi-Gas/O_2 Module option from the table below (if required)

3. Select individual plug-in modules* (if required)

4. Calculate the number of slots required to mount your modules

NOTE Specify a Satellite Module Rack if the number of slots required is greater than five
*IBP can be incorporated into a MPM Module
*BIS can be incorporated into a Multi-Gas/O_2 Module

Configuration and Options

Main Unit	Integrated 17" (SP M8) or 12.1" (SP M5) colour TFT display and prompt knob with optional touchscreen control
MPM Module	See table opposite [1]
Multi-Gas/O_2 Module	See table opposite [2]
Parameter Modules	See below [3]
Satellite Module Rack	Eight slots
Navigation	USB compatible mouse, keyboard, Bluetooth presenter
Printing	Three channel thermal recorder module, printer
Mounting	Rolling stand, wall mount
Calculations	Drug, haemodynamic, oxygen, ventilation, nephritic
Other Options	External displays, wireless LAN, power-off storage and Compact Flash memory card

[1] MPM Module Options

	P1	P2	P3	P4	P5	P6
3/5-lead ECG	✓	✓	✓	✓	✓	✓
12-lead ECG				✓	✓	✓
Respiration	✓	✓	✓	✓	✓	✓
Dual-Channel Temperature	✓	✓	✓	✓	✓	✓
NIBP	✓	✓	✓	✓	✓	✓
Dual-Channel IBP	✓	✓	✓	✓	✓	✓
Standard SpO_2	✓			✓		
Masimo SET™ SpO_2		✓			✓	
Nellcor™ OxiMax SpO_2			✓			✓

[2] Multi-Gas/O_2/BIS Module Options

	P1	P2	P3	P4	P5	P6	P7	P8
Automatic Agent ID	✓	✓	✓	✓				
Manual Agent ID					✓	✓	✓	✓
Oxygen	✓	✓			✓	✓		
Bispectral Index (BIS)	✓		✓		✓		✓	

[3] Parameter Modules

Multi-Gas/O_2 (TRIPLE WIDTH)

Sidestream CO_2 (DOUBLE WIDTH)

BIS

Microstream CO_2

Mainstream CO_2

Dual Channel IBP

Multi-Gas/O_2/BIS (TRIPLE WIDTH)

MPM (DOUBLE WIDTH)

CO

RM

ICG

Satellite Module Rack

PM-8000 Express

Portable Patient Monitor
High specification, lightweight monitor with TFT colour display

◆ 8.4" TFT colour display with five waveforms
◆ Standard Parameters:
  • ECG (3 or 5 lead)
  • Respiration
  • Dual Temperature
  • NIBP
  • Standard SpO_2
◆ Optional Parameters:
  • Masimo SET™ or Nellcor OxiMax™ SpO_2
  • IBP
  • $EtCO_2$
◆ OxyCRG
◆ Arrhythmia and ST Segment analysis
◆ Haemodynamic calculations
◆ Up to two hours battery use
◆ Optional two channel strip chart recorder
◆ Optional wireless networking
◆ Optional trolley

PM-8000 Portable Patient Monitor

Colour Display
8.4" TFT display with five waveforms and clear, easy to read numeric values

OxyCRG
Displays the relationship between heart rate, respiration and oxygen parameter for neonates and paediatrics

User-friendly Menu
Simple and clear, easy to learn and use

Carry Handle
Convenient handle for moving the unit around

Rotary Knob
Ensures accurate and prompt selection

Quality Products • Flexible Specification • Customer Care • Partner

PM-9000 Express

Portable Patient Monitor

State of the art, compact, portable monitor with a large TFT colour display

◆ 12.1" TFT colour display with eight waveforms

◆ Up to 96 hour graphic and tabular trends of all parameters

◆ Large font display

◆ SpO_2 pulse-tone modulation

◆ 12-lead ECG analysis

◆ Multi-Gas/O_2 with agent identification

◆ Optional Masimo SET™ or Nellcor OxiMax™ SpO_2

◆ Optional Li-ion rechargeable battery available

◆ Fixed compact flash for memory card or wireless LAN card

◆ Standard Configuration:
ECG, NIBP, Respiration, SpO_2, Dual Temperature, Lead Acid Battery

◆ Options:
12-lead ECG, Dual IBP, Cardiac Output, $EtCO_2$, Multi-Gas/O_2, Thermal Recorder, Li-ion Battery, CF Card (for Wireless LAN or Power Off Storage)

PM-9000 Express Portable Patient Monitor
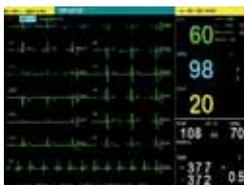
12-lead ECG
Conventional 12-lead ECG technique to analyse I, II, III, aVR, aVF, V1-V6 and display these waveforms on the same screen

Multi-Gas/O_2 Waveforms
Adopting infrared absorption techniques to measure the concentration of $EtCO_2$, N_2O, O_2 and five anaesthetic gases (Des, Iso, Enf, Sevo, Hal)

$EtCO_2$ Waveform
Adopting infrared absorption technique to measure the concentration of $EtCO_2$, $InsCO_2$ and AWRR

Strip Chart Recorder
Provides high resolution hard copy print-out of waveforms, trends and other patient data. Two channel output, real time, alarm and review recording

Rotary Knob
Ensures accurate and prompt selection

ship for Life

VS-800

Vital Signs Patient Monitor

The VS-800 Vital Signs Monitor is suitable for adult, paediatric and neonatal patients

◆ Large colour display

◆ Integrated handle

◆ Up to 10 hours battery use

◆ High resolution LCD display

◆ Optional Masimo SET™ or Nellcor OxiMax™ SpO$_2$

◆ Adjustable alarms

◆ Storage and review of up to 1200 measured data parameters

◆ Data export facility for PC storage and printing

◆ Networkable via central monitoring station

VS-800 Vital Signs Monitor

Hypervisor VI

Central Monitoring System

Operates as a centralised viewing station for a single or multiple departments

◆ Network to Telemetry, VS-800, PM-8000 Express, PM-9000 Express, SP M8 and SP M5

◆ Dual-screen display as standard

◆ Three types of real-time reports:
  • Four user-selectable waveforms and all parameters
  • Multi-lead ECG waveforms and parameters
  • 12-lead ECG waveforms and parameters

◆ Up to 64 bedside monitors are connectable

◆ Display up to four waveforms and automatically save two waveforms for each patient

◆ Review the previous 720 alarm events for each bedside monitor

◆ Review a four hour dynamic short trend and 240 hours trend for each bedside monitor

◆ Multi-lead ECG waveforms and ST segment display

◆ 72-hour full-disclosure waveform store and review

◆ Patient database information can be viewed on screen or printed out

◆ Optional thermal recorder and A4 printer

Hypervisor VI Central Monitoring System

Quality Products • Flexible Specification • Customer Care • Partner

Technical Specification

SP M8 Patient Monitor

DIMENSION AND WEIGHT

Dimensions	400 x 370 x 193 mm (H x W x D)
Weight	10.5 kg

OPERATIONAL ENVIRONMENT

Power	100 – 240 VAC (±10%), 50/60 Hz (±3 Hz), 2.8 – 1.6 A
Temperature	5 – 40°C
Humidity	15 – 95% non-condensing
Patient Range	Adult, Paediatric, and Neonatal

PERFORMANCE SPECIFICATIONS

Display	17" Colour SXGA, supports up to three additional displays Multi-slave displays selectable
Trace	12 waveform channels per display (Up to 48 waveforms with additional displays)
Sweep Speed	6.25, 12.5, 25, 50 mm/s
Indicators	• Dual alarm lights • Power light • Battery light • QRS beep and alarm sound • Operating key sound
Interface	• Parameter Module Frame and Interface • AC power input socket • Network interface • External display interface (DVI) • Auxiliary output interface • Defibrillator synchronisation interface • Peripheral USB devices interface (mouse, keyboard, Bluetooth Presenter, etc.)
Battery Backup	Rechargeable Li-ion battery, with two hours working time
Trend Time	120 hours. Up to 24 hours full disclosure
Alarm	User-adjustable High and Low Limits Prioritized Audible and Visual Alarm
Networking	Connected to central monitoring system by hardwire/wireless Bedside Device Connection
Recorder	Built-in, Thermal Array Waveform: 3 channels
Printer	External printer supported

ELECTROCARDIOGRAM (ECG)

5-lead and 3-lead Selectable, Optional 12-lead

Input	10-leadwire cable: RA; LA; RL; LL; V1-V6 5-leadwire cable: RA; LA; RL; LL; V 3-leadwire cable: RA; LA; LL
Lead Selection	12-lead: I; II; III; avR; avL; avF; V1-V6 5-lead: I; II; III; avR; avL; avF; V(n) 3-lead: I; II; III
ECG Waveform	Up to 8 channels, 12-lead display
Gain Selection	x0.125; x0.25; x0.5; x1; x2; Automatic
Sweep Speed	12.5, 25, 50 mm/s
Heart Rate Range	Adult: 15 – 300 bpm Neonate: 15 – 350 bpm Paediatric: 15 – 350 bpm
Accuracy	±1 bpm or ±1%, whichever is greater
Resolution	1 bpm
Filter	Diagnostic Mode: 0.05 – 100 Hz or 0.05 – 150 Hz (12-lead) Monitoring Mode: 0.50 – 55 Hz Surgical Mode: 1.00 – 20 Hz
Protection	Electrosurgical interference and defibrillation input isolation 4000 VAC, 50 Hz
Scaling Signal	1 mV ±5%
Alarm Range	15 – 350 bpm
S-T Segment Detection	Measurement Range: -2.0 to 2.0 mV Alarm Range: -2.0 to 2.0 mV
Arrhythmia Analysis	Yes
Alarm	Audible and Visual, Alarm events recallable
12-lead ECG Analysis	Yes

RESPIRATION

Method	Thoracic Impedance
Modes	Automatic / Manual
Range	Adult: 0 – 120 BrPM Neonate: 0 – 150 BrPM Paediatric: 0 – 150 BrPM
Apnoea Alarm	Yes
Accuracy	7 – 150 BrPM: ±2 BrPM or ±2%, whichever is greater 0 – 6 BrPM: Unspecified
Alarm	Audible and Visual, Alarm events recallable

TEMPERATURE

Range	0 – 50°C
Resolution	0.1°C
Accuracy	±0.1°C
Channel	Dual-channel, provides T1; T2; ΔT

NON-INVASIVE BLOOD PRESSURE (NIBP)

Method	Automatic Oscillometric
Modes	Manual / Automatic / Continuous
Automatic Measure Time	Adjustable
Unit	mmHg / kPa selectable
Types	Systolic, Diastolic, Mean

Measurement Range

Systolic Pressure	Adult Mode	40 – 270 mmHg
	Paediatric Mode	40 – 200 mmHg
	Neonatal Mode	40 – 135 mmHg
Diastolic Pressure	Adult Mode	10 – 210 mmHg
	Paediatric Mode	10 – 150 mmHg
	Neonatal Mode	10 – 100 mmHg
Mean Pressure	Adult Mode	20 – 230 mmHg
	Paediatric Mode	20 – 165 mmHg
	Neonatal Mode	20 – 110 mmHg

Accuracy of Blood Pressure Measurement	Mean error: less than ±5 mmHg Standard deviation: less than 8 mmHg
Over-Pressure Protection	Double safety protection
Resolution	1 mmHg
Alarm	Systolic, Diastolic, Mean

STANDARD SPO2

Range	1 – 100%	
Resolution	1%	
Accuracy (Static)	Adult / Paediatric	70 – 100% ±2%
	Neonate	70 – 100% ±3% 0 – 69% Unspecified
Accuracy (Motion)		70 – 100% ±3% 0 – 69% Unspecified
Alarm Range	0 – 100%	
Pulse Rate	Range:	20 – 254 bpm
	Resolution:	1 bpm
	Accuracy:	±3 bpm (static) ±5 bpm (motion)
	Alarm Range:	20 – 254 bpm

MASIMO SET™ SPO2

Range	1 – 100%	
Resolution	1%	
Accuracy (Static)	Adult / Paediatric	70 – 100% ±2%
	Neonate	70 – 100% ±3% 0 – 69% Unspecified
Accuracy (Motion)		70 – 100% ±3% 0 – 69% Unspecified
Alarm Range	0 – 100%	
Pulse Rate	Range:	25 – 240 bpm
	Resolution:	1 bpm
	Accuracy:	±3 bpm (static) ±5 bpm (motion)
	Alarm Range:	25 – 240 bpm

NELLCOR OXIMAX SPO2

Range	0 – 100%	
Resolution	1%	

Sensor Accuracy

MAX-A, MAX-AL, MAX-N, MAX-P, MAX-I and MAX-FAST		70 – 100% ±2.0% 0 – 69% Unspecified
OxiCliq A, OxiCliq N, OxiCliq P and OxiCliq I		70 – 100% ±2.5% 0 – 69% Unspecified
D-YS, DS-100A, OXI-A/N and OXI-P/I		70 – 100% ±3.0% 0 – 69% Unspecified
MAX-R, D-YSE and D-YSPD		0 – 100% ±3.5% 0 – 69% Unspecified
Alarm Range	0 – 100%	
Pulse Rate	Range:	20 – 300 bpm
	Resolution:	1 bpm
	Accuracy:	20 – 250 bpm ±3 bpm 251 – 300 bpm Unspecified
	Alarm Range:	20 – 250 bpm

CARDIAC OUTPUT (CO)

Method	Thermodilution	
Range	CO:	0.1 – 20 L/min
	TB:	23 – 43°C
	TI:	0 – 27°C
Resolution	CO:	0.1 L/min
	TI:	0.1°C
	TB:	0.1°C
Accuracy	CO:	±5%
	TB:	±0.1°C
	TI:	±0.1°C
Parameter Output	Cardiac Output, Haemodynamics Calculation	

INVASIVE BLOOD PRESSURE (IBP)

Range	-50 to 300 mmHg	
Channel	2 Channels	
Pressure Transducer	Sensitivity:	5 μV/V/mmHg
	Impedance Range:	300 – 3000 W
Pressure Names	ART, PA, CVP, RAP, LAP, ICP, CPP	
Resolution	1 mmHg	
Accuracy	±2% or ±1 mmHg, whichever is greater (exclusive of transducer)	
Alarm Range	-50 to 300 mmHg	

EtCO2

Method	Infrared Absorption
Displayed Numerics	EtCO2, FiCO2, AwRR
Waveforms	Capnography

MICROSTREAM CO2

Range	0 – 99 mmHg	
Accuracy	0 – 38 mmHg	±2 mmHg
	39 – 99 mmHg	±5% of reading + 0.08% for every 1 mmHg (above 38 mmHg)
Resolution	Waveform:	0.1 mmHg
	Value:	1 mmHg
Sampling Rate	50 ml/min -7.5 + 15 ml/min	
Initialisation Time	30 seconds (typical value), reaches ±5% steady-state accuracy within 3 minutes	
Response Time	2.9 seconds (typical value) including the rising time and the delay time (using standard length filter line)	
Rising Time	< 190 ms (rising from 10% to 90%)	
Delay Time	2.7 seconds (typical value)	
Respiration	Rate:	0 – 150 BrPM
	Accuracy:	0 – 70 BrPM ±1 BrPM 71 – 120 BrPM ±2 BrPM 121 – 150 BrPM ±3 BrPM
Mode	Adult, Neonate	

SIDESTREAM CO2

Range	0 – 99 mmHg	
Accuracy	0 – 40 mmHg	±2 mmHg
	41 – 76 mmHg	±5% of reading
	77 – 99 mmHg	±10% of reading
Sampling Rate	Rate:	100 or 150 ml/min
	Accuracy:	15%
Start-up Time	< 1 minute (typical value), reaches steady state accuracy within ten minutes	
Respiration	Rate:	0 – 120 BrPM
	Accuracy:	0 – 70 BrPM ±2 BrPM > 70 BrPM ±5 BrPM
Response Time	< 240 ms (10 to 90%)	
Delay Time	< 2 seconds Sampling line length: 7 inches Internal diameter: 0.055 Inches Sampling gas flow rate: 150 ml/min	

MAINSTREAM CO2

Measuring Mode	Mainstream	
Range	CO2:	0 – 150 mmHg
	AwRR:	0 – 150 rpm
Resolution	CO2:	0 – 69 mmHg: 0.10 mmHg 70 - 150 mmHg:0.25 mmHg
	AwRR:	1 rpm
CO2 Concentration Accuracy	0 – 40 mmHg	±2 mmHg
	41 – 70 mmHg	±5% of reading
	71 – 100 mmHg	±8% of reading
	101 – 150 mmHg	±10% of reading
Alarm Range	Same as measurement range	

BISPECTRAL INDEX (BIS)

Method	EEG Bispectral Analysis, DSA
BIS Range	0 – 100
SQI Range	0 – 100%
Other Calculated Parameters	Signal Quality Index (SQI), EMG, Suppression Ratio (SR)
Impedance Measurement Range	0 – 999 k
BIS Smooth Rate	15 seconds or 30 seconds
EEG Specifications	EEG Scales: 6.25/12.5/25/50/100 uV Sweep Speeds: 12.5, 25, 50 mm/sec Input Impedance: > 50 MΩ Noise (RTI): < 0.3 uV RMS 0.25 – 50 Hz Input Range: ±1 mV EEG Bandwidth: 0.25 – 110 Hz A/D Conversion: Noise shaped Sigma-Delta Sample Rate: 16,384 samples/second Patient Leakage: < 10 uA

MULTI-GAS/O2

Method	Infrared Absorption / Paramagnetic	
Gases	CO2, N2O, Des, Iso, Enf, Sev, Hal, O2 (optional paramagnetic sensor)	
Range	CO2:	0 – 30%
	N2O:	0 – 105%
	O2:	0 – 105%
	Enf, Iso, Hal:	0 – 30%
	Sev:	0 – 30%
	Des:	0 – 30%
Accuracy	CO2:	0 – 1% ±0.1% 1 – 5% ±0.2% 5 – 7% ±0.3% 7 – 10% ±0.5% > 10% Unspecified
	N2O:	0 – 20% ±2% 20 – 100% ±3%
	Des:	0 – 1% ±0.15% 1 – 5% ±0.20% 5 – 10% ±0.40% 10 – 15% ±0.60% 15 – 18% ±1.00% > 18% Unspecified
	Sev:	0 – 1% ±0.15% 1 – 5% ±0.20% 5 – 8% ±0.40% > 8% Unspecified
	Enf, Iso, Hal:	0 – 1% ±0.15% 1 – 5% ±0.20% > 5% Unspecified
	O2:	0 – 25% ±1% 25 – 80% ±2% 80 – 100% ±3%
Data Output	Fi and Et values	
Respiration Rate	2 – 60 BrPM ±1 BrPM 61 – 100 BrPM Unspecified	
Alarm	User selectable limits for all measurements	
Other	• Up to 5 waveforms displayed • Agent mixture detection • MAC value displayed	

IMPEDANCE CARDIOGRAPHY (ICG)

Method	• Thoracic bioimpedance measurement • DISQ™ (digital impedance signal quantifier) Technology • Z MARC (impedance modulating AoRtic compliance) algorithm	
Waveforms	Thoracic Bioimpedance, iECG	
Stroke Volume (SV)	Range:	5 – 250 ml/b
Heart Rate (HR)	Range:	44 – 185 bpm
Cardiac Output (CO)	Range:	1.4 – 15 L/min
Other Measured Parameters	Flow, Resistance, Contractility, Fluid Status and Cardiac Work Parameters: SI, CI, BSA, SVR/SVRI, PVR/PVRI, LCW/LCWI, LVSW/LVSWI, RCW/RCWI, RVSW/RVSWI, EF, ACI, VI, TFC, TFI, STR, PEP, LVET, VEPT	
Alarm	User Selectable Alarm Limits for TFC, CI	

RESPIRATORY MECHANICS (RM)

Method	Flow measurement based on micro differential pressure sensing	
Waveforms	Airway Pressure, Volume, Loops (P-V, P-F, V-F)	
Flow	Range:	Adult: ±(2 – 120) L/min Paediatric: ±(2 – 120) L/min Neonate: ±(0.5 – 30) L/min
	Accuracy:	25 ml/s or ±10% of reading, whichever is greater
	Resolution:	0.1 L/min
Pressure Unit	User Selectable: cmH2O, kPa or mmHg	
Airway Pressure	Range:	-20.0 to 120 cmH2O
	Accuracy:	±3% of reading
	Resolution:	0.1 cmH2O
Minute Volume	Range:	Adult: 2.0 – 60 L/min Paediatric: 2.0 – 60 L/min Neonate: 0.5 – 15 L/min
	Accuracy:	±5% of reading
Tidal Volume	Range:	Adult: 100 – 1500 ml Paediatric: 100 – 1500 ml Neonate: 20 – 500 ml
	Resolution:	1 ml
	Accuracy:	±5% of reading
Respiration Rate	Range:	Adult: 4 – 99 BrPM Paediatric: 4 – 99 BrPM Neonate: 10 – 99 BrPM
	Accuracy:	±2 BrPM
I:E Ratio	Range:	12.0:1 – 1:12.0
	Accuracy:	±5% of reading
Dead Space	< 11 ml	
Other Measured Parameters	Respiratory Mechanics Parameters: I:E Ratio, FEV 1.0, MAP, TVi/TVe, MVi/MVe, PEEP, PEF, PIF, PIP, C, Compliance, RAW, RSBI, NIP, WOB	
Alarm	User selectable alarm limits for Respiration Rate, PEEP, PIP, Mve	

Technical Specification

SP M5 Patient Monitor

DIMENSION AND WEIGHT

Dimensions	297 x 336 x 187 mm (H x W x D)
Weight	9.0 kg

OPERATIONAL ENVIRONMENT

Power	100 – 240 VAC (±10%), 50/60 Hz (±3 Hz), 2.5 – 1.4 A
Temperature	5 – 40°C
Humidity	15 – 95% non-condensing
Patient Range	Adult, Paediatric, and Neonatal

PERFORMANCE SPECIFICATIONS

Display	12.1" Colour SVGA, supports one additional display Multi-slave displays selectable
Trace	12 waveform channels per display
Sweep Speed	6.25, 12.5, 25, 50 mm/s
Indicators	• Dual alarm lights • Power light • Battery light • QRS beep and alarm sound • Operating key sound
Interface	• Parameter Module Frame and Interface • AC power input socket • Network interface • External display interface (DVI) • Auxiliary output interface • Defibrillator synchronisation interface • Peripheral USB devices interface (mouse, keyboard, Bluetooth Presenter, etc.)
Battery Backup	Rechargeable Li-ion battery, with three hours, working time
Trend Time	120 hours. Up to 24 hours full disclosure
Alarm	User-adjustable High and Low Limits Prioritized Audible and Visual Alarm
Networking	Connected to central monitoring system by hardwire/wireless Bedside Device Connection
Recorder	Built-in, Thermal Array Waveform: 3 channels
Printer	External printer supported

ELECTROCARDIOGRAM (ECG)

5-lead and 3-lead Selectable, Optional 12-lead

Input	10-leadwire cable: RA; LA; RL; LL; V1-V6 5-leadwire cable: RA; LA; RL; LL; V 3-leadwire cable: RA; LA; LL
Lead Selection	12-lead: I; II; III; avR; avL; avF; V1-V6 5-lead: I; II; III; avR; avL; avF; V(n) 3-lead: I; II; III
ECG Waveform	Up to 8 channels, 12-lead display
Gain Selection	x0.125; x0.25; x0.5; x1; x2; Automatic
Sweep Speed	12.5, 25, 50 mm/s
Heart Rate Range	Adult: 15 – 300 bpm Neonate: 15 – 350 bpm Paediatric: 15 – 350 bpm
Accuracy	±1 bpm or ±1%, whichever is greater
Resolution	1 bpm
Filter	Diagnostic Mode: 0.05 – 100 Hz or 0.05 – 150 Hz (12-lead) Monitoring Mode: 0.50 – 55 Hz Surgical Mode: 1.00 – 20 Hz
Protection	Electrosurgical interference and defibrillation input isolation 4000 VAC, 50 Hz
Scaling Signal	1 mV ±5%
Alarm Range	15 – 350 bpm
S-T Segment Detection	Measurement Range: -2.0 to 2.0 mV Alarm Range: -2.0 to 2.0 mV
Arrhythmia Analysis	Yes
Alarm	Audible and Visual, Alarm events recallable
12-lead ECG Analysis	Yes

RESPIRATION

Method	Thoracic Impedance
Modes	Automatic / Manual
Range	Adult: 0 – 120 BrPM Neonate: 0 – 150 BrPM Paediatric: 0 – 150 BrPM
Apnoea Alarm	Yes
Accuracy	7 – 150 BrPM: ±2 BrPM or ±2%, whichever is greater 0 – 6 BrPM: Unspecified
Alarm	Audible and Visual, Alarm events recallable

TEMPERATURE

Range	0 – 50°C
Resolution	0.1°C
Accuracy	±0.1°C
Channel	Dual-channel, provides T1; T2; ΔT

NON-INVASIVE BLOOD PRESSURE (NIBP)

Method	Automatic Oscillometric
Modes	Manual / Automatic / Continuous
Automatic Measure Time	Adjustable
Unit	mmHg / kPa selectable
Types	Systolic, Diastolic, Mean

Measurement Range

Systolic Pressure	Adult Mode	40 – 270 mmHg
	Paediatric Mode	40 – 200 mmHg
	Neonatal Mode	40 – 135 mmHg
Diastolic Pressure	Adult Mode	10 – 210 mmHg
	Paediatric Mode	10 – 150 mmHg
	Neonatal Mode	10 – 100 mmHg
Mean Pressure	Adult Mode	20 – 230 mmHg
	Paediatric Mode	20 – 165 mmHg
	Neonatal Mode	20 – 110 mmHg

Accuracy of Blood Pressure Measurement	Mean error: less than ±5 mmHg Standard deviation: less than 8 mmHg
Over-Pressure Protection	Double safety protection
Resolution	1 mmHg
Alarm	Systolic, Diastolic, Mean

STANDARD SPO2

Range	1 – 100%	
Resolution	1%	
Accuracy (Static)	Adult / Paediatric 70 – 100% ±2% Neonate 70 – 100% ±3%	0 – 69% Unspecified
Accuracy (Motion)	70 – 100% ±3%	0 – 69% Unspecified
Alarm Range	0 – 100%	
Pulse Rate	Range: 20 – 254 bpm Resolution: 1 bpm Accuracy: ±3 bpm (static) ±5 bpm (motion) Alarm Range: 20 – 254 bpm	

MASIMO SET™ SPO2

Range	1 – 100%	
Resolution	1%	
Accuracy (Static)	Adult / Paediatric 70 – 100% ±2% Neonate 70 – 100% ±3%	0 – 69% Unspecified
Accuracy (Motion)	70 – 100% ±3%	0 – 69% Unspecified
Alarm Range	0 – 100%	
Pulse Rate	Range: 25 – 240 bpm Resolution: 1 bpm Accuracy: ±3 bpm (static) ±5 bpm (motion) Alarm Range: 25 – 240 bpm	

NELLCOR OXIMAX SPO2

Range	0 – 100%	
Resolution	1%	
Sensor Accuracy		
MAX-A, MAX-AL, MAX-N, MAX-P, MAX-I and MAX-FAST	70 – 100% ±2.0%	0 – 69% Unspecified
OxiCliq A, OxiCliq N, OxiCliq P and OxiCliq I	70 – 100% ±2.5%	0 – 69% Unspecified
D-YS, DS-100A, OXI-A/N and OXI-P/I	70 – 100% ±3.0%	0 – 69% Unspecified
MAX-R, D-YSE and D-YSPD	0 – 100% ±3.5%	0 – 69% Unspecified
Alarm Range	0 – 100%	
Pulse Rate	Range: 20 – 300 bpm Resolution: 1 bpm Accuracy: 20 – 250 bpm ±3 bpm 251 – 300 bpm Unspecified Alarm Range: 20 – 250 bpm	

CARDIAC OUTPUT (CO)

Method	Thermodilution	
Range	CO: 0.1 – 20 L/min TB: 23 – 43°C TI: 0 – 27°C	
Resolution	CO: 0.1 L/min TI: 0.1°C TB: 0.1°C	
Accuracy	CO: ±5% TB: ±0.1°C TI: ±0.1°C	
Parameter Output	Cardiac Output, Haemodynamics Calculation	

INVASIVE BLOOD PRESSURE (IBP)

Range	-50 to 300 mmHg
Channel	2 Channels
Pressure Transducer	Sensitivity: 5 µV/V/mmHg Impedance Range: 300 – 3000 W
Pressure Names	ART, PA, CVP, RAP, LAP, ICP, CPP
Resolution	1 mmHg
Accuracy	±2% or ±1 mmHg, whichever is greater (exclusive of transducer)
Alarm Range	-50 to 300 mmHg

EtCO2

Method	Infrared Absorption
Displayed Numerics	EtCO2, FiCO2, AwRR
Waveforms	Capnography

MICROSTREAM CO2

Range	0 – 99 mmHg
Accuracy	0 – 38 mmHg ±2 mmHg 39 – 99 mmHg ±5% of reading + 0.08% for every 1 mmHg (above 38 mmHg)
Resolution	Waveform: 0.1 mmHg Value: 1 mmHg
Sampling Rate	50 ml/min -7.5 + 15 ml/min
Initialisation Time	30 seconds (typical value), reaches ±5% steady-state accuracy within 3 minutes
Response Time	2.9 seconds (typical value) including the rising time and the delay time (using standard length filter line)
Rising Time	< 190 ms (rising from 10% to 90%)
Delay Time	2.7 seconds (typical value)
Respiration	Rate: 0 – 150 BrPM Accuracy: 0 – 70 BrPM ±1 BrPM 71 – 120 BrPM ±2 BrPM 121 – 150 BrPM ±3 BrPM
Mode	Adult, Neonate

SIDESTREAM CO2

Range	0 – 99 mmHg
Accuracy	0 – 40 mmHg ±2 mmHg 41 – 76 mmHg ±5% of reading 77 – 99 mmHg ±10% of reading
Sampling Rate	Rate: 100 or 150 ml/min Accuracy: 15%
Start-up Time	< 1 minute (typical value), reaches steady state accuracy within ten minutes
Respiration	Rate: 0 – 120 BrPM Accuracy: 0 – 70 BrPM ±2 BrPM > 70 BrPM ±5 BrPM
Response Time	< 240 ms (10 to 90%)
Delay Time	< 2 seconds Sampling line length: 7 inches Internal diameter: 0.055 Inches Sampling gas flow rate: 150 ml/min

MAINSTREAM CO2

Measuring Mode	Mainstream
Range	CO2: 0 – 150 mmHg AwRR: 0 – 150 rpm
Resolution	CO2: 0 – 69 mmHg 0.10 mmHg 70 - 150 mmHg 0.25 mmHg AwRR: 1 rpm
CO2 Concentration Accuracy	0 – 40 mmHg ±2 mmHg 41 – 70 mmHg ±5% of reading 71 – 100 mmHg ±8% of reading 101 – 150 mmHg ±10% of reading
Alarm Range	Same as measurement range

BISPECTRAL INDEX (BIS)

Method	EEG Bispectral Analysis, DSA
BIS Range	0 – 100
SQI Range	0 – 100%
Other Calculated Parameters	Signal Quality Index (SQI), EMG, Suppression Ratio (SR)
Impedance Measurement Range	0 – 999 k
BIS Smooth Rate	15 seconds or 30 seconds
EEG Specifications	EEG Scales: 6.25/12.5/25/50/100 uV Sweep Speeds: 12.5, 25, 50 mm/sec Input Impedance: > 50 MΩ Noise (RTI): < 0.3 uV RMS 0.25 – 50 Hz Input Range: ±1 mV EEG Bandwidth: 0.25 – 110 Hz A/D Conversion: Noise shaped Sigma-Delta Sample Rate: 16,384 samples/second Patient Leakage: < 10 uA

MULTI-GAS/O2

Method	Infrared Absorption / Paramagnetic	
Gases	CO2, N2O, Des, Iso, Enf, Sev, Hal, O2 (optional paramagnetic sensor)	
Range	CO2: 0 – 30% N2O: 0 – 105% O2: 0 – 105% Enf, Iso, Hal: 0 – 30% Sev: 0 – 30% Des: 0 – 30%	
Accuracy	CO2: 0 – 1% ±0.1% 1 – 5% ±0.2% 5 – 7% ±0.3% 7 – 10% ±0.5% > 10% Unspecified	
	N2O: 0 – 20% ±2% 20 – 100% ±3%	
	Des: 0 – 1% ±0.15% 1 – 5% ±0.20% 5 – 10% ±0.40% 10 – 15% ±0.60% 15 – 18% ±1.00% > 18% Unspecified	
	Sev: 0 – 1% ±0.15% 1 – 5% ±0.20% 5 – 8% ±0.40% > 8% Unspecified	
	Enf, Iso, Hal: 0 – 1% ±0.15% 1 – 5% ±0.20% > 5% Unspecified	
	O2: 0 – 25% ±1% 25 – 80% ±2% 80 – 100% ±3%	
Data Output	Fi and Et values	
Respiration Rate	2 – 60 BrPM ±1 BrPM 61 – 100 BrPM Unspecified	
Alarm	User selectable limits for all measurements	
Other	• Up to 5 waveforms displayed • Agent mixture detection • MAC value displayed	

IMPEDANCE CARDIOGRAPHY (ICG)

Method	• Thoracic bioimpedance measurement • DISQ™ (digital impedance signal quantifier) Technology • Z MARC (impedance modulating AoRtic compliance) algorithm
Waveforms	Thoracic Bioimpedance, iECG
Stroke Volume (SV)	Range: 5 – 250 ml/b
Heart Rate (HR)	Range: 44 – 185 bpm
Cardiac Output (CO)	Range: 1.4 – 15 L/min
Other Measured Parameters	Flow, Resistance, Contractility, Fluid Status and Cardiac Work Parameters: SI, CI, BSA, SVR/SVRI, PVR/PVRI, LCW/LCWI, LVSW/LVSWI, RCW/RCWI, RVSW/RVSWI, EF, ACI, VI, TFC, TFI, STR, PEP, LVET, VEPT
Alarm	User Selectable Alarm Limits for TFC, CI

RESPIRATORY MECHANICS (RM)

Method	Flow measurement based on micro differential pressure sensing
Waveforms	Airway Pressure, Volume, Loops (P-V, P-F, V-F)
Flow	Range: Adult: ±(2 – 120) L/min Paediatric: ±(2 – 120) L/min Neonate: ±(0.5 – 30) L/min Accuracy: 25 ml/s or ±10% of reading, whichever is greater Resolution: 0.1 L/min
Pressure Unit	User Selectable: cmH2O, kPa or mmHg
Airway Pressure	Range: -20.0 to 120 cmH2O Accuracy: ±3% of reading Resolution: 0.1 cmH2O
Minute Volume	Range: Adult: 2.0 – 60 L/min Paediatric: 2.0 – 60 L/min Neonate: 0.5 – 15 L/min Accuracy: ±5% of reading
Tidal Volume	Range: Adult: 100 – 1500 ml Paediatric: 100 – 1500 ml Neonate: 20 – 500 ml Resolution: 1 ml Accuracy: ±5% of reading
Respiration Rate	Range: Adult: 4 – 99 BrPM Paediatric: 4 – 99 BrPM Neonate: 10 – 99 BrPM Accuracy: ±2 BrPM
I:E Ratio	Range: 12.0:1 – 1:12.0 Accuracy: ±5% of reading
Dead Space	< 11 ml
Other Measured Parameters	Respiratory Mechanics Parameters: I:E Ratio, FEV 1.0, MAP, TVi/TVe, MVi/MVe, PEEP, PEF, PIP, C, Compliance, RAW, RSBI, NIP, WOB
Alarm	User selectable alarm limits for Respiration Rate, PEEP, PIP, Mve

Technical Specification

PM-8000 Express Patient Monitor

DIMENSION AND WEIGHT

Dimension	240 x 261 x 171 mm (H x W x D)
Weight	< 5 kg (including battery)

OPERATION ENVIRONMENT

AC Power	100 – 240 VAC (±10%), 50/60 Hz (±3 Hz), 110 VA
DC Power	12 VDC (Rated), 10 – 16 VDC 70W
Temperature	0 – 40°C
Humidity	15 – 95%, non-condensing
Patient Range	Adult, Paediatric and Neonate

PERFORMANCE SPECIFICATIONS

Display	8.4" colour TFT Rolling and refreshing waveform display Resolution: 800 x 600 Multi displays selectable, including: • Standard display • Large-font display • Trend coexist display • Freeze display • Alarm limit • Multi-lead ECG simultaneous • Bed-to-bed view • OxyCRG dynamic view
Trace	8 waveforms
Sweep Speed	6.25, 12.5, 25, 50 mm/s
Indicator	• Alarm indicator light • Power indicator light • Battery indicator light • QRS beep and alarm sound
Interface	• Parameter cable interface • AC and DC power input socket • Software upgrade via networking port • External VGA interface for connection of an alternate display • Auxiliary output (Analog / Defib-synch / Nurse Call)
Rechargeable Lead Acid Battery	Charging Time: 6 hours (maximum) Working Time: 75 minutes (continuous)
Rechargeable Li-ion Battery	Charging Time: 6.5 hours (maximum) Working Time: 3 hours (continuous)
Trend Time	1 – 96 hours
Alarm	User-adjustable High and Low limits 3-Level Audible and Visual Alarm
Networking	Connected to central monitoring system
Recorder	Built-in, Thermal Array Plethysmogram Waveform: 2 channels Record Mode: Manual, On alarm, Time-defined, etc Record Width: 50 mm Print Speeds: 25, 50 mm/s

ECG

3-lead or 5-lead selectable

Input	5-lead: RA; LA; RL; LL; V
Lead Selection	I; II; III; avR; avL; avF; V(n)
ECG Waveform	2 channels
Gain Selection	x0.125; x0.25; x0.5; x1; x2; Automatic
Sweep Speed	12.5, 25, 50 mm/s
Heart Rate Range	Adult: 15 – 300 bpm Neonate/Paediatric: 15 – 350 bpm
Accuracy	±1 bpm or ±1%, whichever is greater
Resolution	1 bpm
Filter	Diagnostic Mode: 0.05 – 100 Hz Monitoring Mode: 0.50 – 40 Hz Surgical Mode: 1.00 – 20 Hz
Protection	Electrosurgical interference and defibrillation. Input isolation 4000 VAC, 50 Hz
Scaling Signal	1mV ±5%
Alarm Range	15 – 350 bpm
S-T Segment Detection	Measurement Range: -2.0 to 2.0 mV Alarm Range: -2.0 to 2.0 mV
Arrhythmia Analysis	Yes
Alarm	Yes, Audible and Visual Alarm, Alarm Events recallable

RESPIRATION

Method	Thoracic Impedance
Sensing Leads	Lead I and lead II are optional (Default: lead II)
Modes	Automatic / Manual
Range	Adult: 0 – 120 BrPM Neonate/Child: 0 – 150 BrPM
Apnoea Alarm	Yes

NIBP

Method	Automatic Oscillometric
Modes	Manual / Automatic / Continuous
Auto Measure Time	Adjustable
Unit	mmHg / kPa selectable
Types	Systolic, Diastolic, Mean

Measurement Range

Systolic Pressure	Adult Mode:	40 – 270 mmHg
	Paediatric Mode:	40 – 200 mmHg
	Neonate Mode:	40 – 135 mmHg
Diastolic Pressure	Adult Mode:	0 – 210 mmHg
	Paediatric Mode:	10 – 150 mmHg
	Neonate Mode	10 – 95 mmHg
Mean Pressure	Adult Mode:	20 – 230 mmHg
	Paediatric Mode:	20 – 165 mmHg
	Neonate Mode:	20 – 110 mmHg

Accuracy of Blood Pressure Measurement	The mean error shall be less than ±5 mmHg. The standard deviation shall be less than 8 mmHg
Over-pressure Protection	Double safety protection
Resolution	1 mmHg
Alarm	Systolic, Diastolic, Mean
Accuracy	Mean error ±5 mmHg Standard deviation 8 mmHg

STANDARD SPO2

Range	0 – 100%	
Resolution	1%	
Accuracy (Static)	Adult/Paediatric 70 – 100% ±2% Neonate	70 – 100% ±3% 0 – 69% Unspecified
Accuracy (Motion)		70 – 100% ±3% 0 – 69% Unspecified
Alarm Range	0 – 100%	
Pulse Rate	Range:	20 – 254 bpm
	Resolution:	1 bpm
	Accuracy:	±3 bpm (static) ±5 bpm (motion)
	Alarm Range:	20 – 254 bpm

MASIMO SET™ SPO2

Range	0 – 100%	
Resolution	1%	
Accuracy (Static)	Adult/Paediatric 70 – 100% ±2% Neonate	70 – 100% ±3% 0 – 69% Unspecified
Accuracy (Motion)		70 – 100% ±3% 0 – 69% Unspecified
Alarm Range	0 – 100%	
Pulse Rate	Range:	25 – 240 bpm
	Resolution:	1 bpm
	Accuracy:	±3 bpm (static) ±5 bpm (motion)
	Alarm Range:	25 – 240 bpm

NELLCOR OXIMAX™ SPO2

Range	0 – 100%	
Resolution	1%	
Sensor Accuracy		
MAX-A, MAX-AL, MAX-N, MAX-P, MAX-I and MAX-FAST		70 – 100% ±2.0% 0 – 69% Unspecified
OxiCliq A, OxiCliq N, OxiCliq P and OxiCliq I		70 – 100% ±2.5% 0 – 69% Unspecified
D-YS, DS-100A, OXI-A/N and OXI-P/I		70 – 100% ±3% 0 – 69% Unspecified
MAX-R, D-YSE and D-YSPD		70 – 100% ±3.5% 0 – 69% Unspecified
Alarm Range	0 – 100%	
Pulse Rate	Range:	20 – 300 bpm
	Resolution:	1 bpm
	Accuracy:	20 – 250 bpm ±3 bpm 251 – 300 bpm Unspecified
	Alarm Range:	20 – 250 bpm

TEMPERATURE

Range	0 – 50°C
Resolution	0.1°C
Accuracy	±0.1°C
Channel	Dual channel, provides T1; T2; ΔT

IBP

Range	-50 to 300 mmHg
Channel	2 channels
Pressure Transducer	Sensitivity: 5m V/V/mmHg Impedance Range: 300 – 3000 W
Pressure Names	ART, PA, CVP, RAP, LAP, ICP, CPP
Resolution	1 mmHg
Accuracy	±2% or ±1 mmHg, whichever is greater (exclusive of transducer)
Alarm Range	-50 to 300 mmHg

MICROSTREAM CO2

Range	0 – 99 mmHg	
Accuracy	0 – 38 mmHg ±2 mmHg 39 – 99 mmHg ±5% of reading +0.08% for every 1 mmHg (above 38 mmHg)	
Resolution	Waveform: 0.1 mmHg Value: 1.0 mmHg	
Sampling Rate	50 ml/min -7.5 + 15 ml/min	
Initialisation Time	30 seconds (typical value), reaches 5% steady-state accuracy within three minutes	
Response Time	2.9 seconds (typical value) including the rising time and the delay time (using standard length filter line)	
Rising Time	< 190 ms (rising from 10% to 90%)	
Delay Time	2.7 seconds (typical value)	
Respiration	Rate:	0 – 150 BrPM
	Accuracy:	0 – 70 BrPM ±1 BrPM 71 – 120 BrPM ±2 BrPM 121 – 150 BrPM ±3 BrPM
Mode	Adult, Neonate, Paediatric	

SIDESTREAM CO2

Range	0 – 99 mmHg	
Accuracy	0 – 40 mmHg ±2 mmHg 41 – 76 mmHg ±5% of reading 77 – 99 mmHg ±10% of reading	
Sampling Rate	Rate: 100 ml/min Accuracy: 15%	
Start-up Time	< 1 minute (typical value) reaches steady state accuracy within ten minutes	
Respiration	Rate:	0 – 120 BrPM
	Accuracy:	0 – 70 BrPM ±2 BrPM > 70 BrPM ±5 BrPM
Response Time	< 240 mSeconds (10% to 90%)	
Delay Time	< 2 seconds Sampling Line Length: 7 inches Internal Diameter: 0.055 inches Sampling Gas Flow Rate: 150 ml/min)	

Standard Configurations	ECG, Respiration, Dual Temperature • SpO2 • NIBP • Lead Acid battery
Optional Configurations	Recorder • Dual IBP • EtCO2, Li-ion battery • CF Card (Wireless LAN or Power off storage)

Technical Specification

PM-9000 Express Patient Monitor

DIMENSION AND WEIGHT

Dimensions	270 x 318 x 137 mm (H x W x D)
Weight	< 7.5 kg

OPERATION ENVIRONMENT

Power	100 – 240 VAC (±10%), 50/60 Hz (±3Hz), 140 VA
Temperature	0 – 40°C
Humidity	15 – 95%, non-condensing
Patient Range	Adult, Paediatric and Neonate

PERFORMANCE SPECIFICATIONS

Display	12.1" Colour TFT. Rolling and refreshing waveform display. Resolution: 800 x 600. Multi displays selectable, including: • Standard • Large-font • Trend coexist • Freeze • Alarm limit • Multi-lead and ECG simultaneous • Bed-to-bed View • OxyCRG dynamic view
Trace	8 waveforms
Sweep Speed	6.25, 12.5, 25, 50 mm/s
Indicator	• Alarm indicator light • Power indicator light • Battery indicator light • Working indicator light • QRS beep and alarm sound
Interface	• Parameter cable interface • AC power input socket • Network interface • External VGA interface for connection of an alternate display • Auxiliary output interface (Analog/Defib-synch/Nurse Call)
Rechargeable Lead Acid Battery (For 2 Pieces)	Charging Time: 12.0 hours (maximum). Working Time: 2.0 hours (continuous)
Rechargeable Li-ion Battery (For 2 Pieces)	Charging Time: 6.5 hours (maximum). Working Time: 5.0 hours (continuous)
Trend Time	1 – 96 hours
Alarm	User-adjustable High and Low Limits. 3-Level Audible and Visual Alarm
Networking	Connected to central monitoring system (available in US market in the middle of 2006)
Recorder	Built-in, Thermal Array. Plethysmogram Waveform: 2 channels. Record Mode: Manual, On alarm, Time-defined, etc. Paper Width: 50 mm. Print Speeds: 25, 50 mm/s

ECG

3-lead or 5-lead selectable
Optional 12-lead (including 3/5-lead)

Input	10-leadwire Cable: RA; LA; RL; LL; V1-V6 or R; L; N; F; C1-C6. 5-leadwire Cable: RA; LA; RL; LL; V or R; L; N; F; C. 3-leadwire Cable: RA; LA; LL or R; L; F
Lead Selection	12-lead: I; II; III; avR; avL; avF; V1-V6. 5-lead: I; II; III; avR; avL; avF; V(n). 3-lead: I; II; III
ECG Waveform	2 channels
Gain Selection	x0.125; x0.25; x0.5; x1; x2; Automatic
Sweep Speeds	12.5, 25, 50 mm/s
Heart Rate Range	Adult: 15 – 300 bpm. Neonate/Paediatric: 15 – 350 bpm
Accuracy	±1 bpm or ±1%, whichever is greater
Resolution	1 bpm
Filter	Diagnostic Mode: 0.05 – 100 Hz or 0.05 – 150 Hz (12-lead). Monitoring Mode: 0.50 – 40 Hz. Surgical Mode: 1.00 – 20 Hz
Protection	Electrosurgical interference and defibrillation. Input isolation: 4000 VAC, 50 Hz
Scaling Signal	1 mV ±5%
Alarm Range	15 – 350 bpm
S-T Segment Detection	Measurement Range: -2.0 to 2.0 mV. Alarm Range: -2.0 to 2.0 mV
Arrhythmia Analysis	Yes
Alarm	Yes, Audible and Visual Alarm, Alarm Events Recallable
12-lead ECG Analysis	Yes

RESPIRATION

Method	Thoracic Impedance
Modes	Automatic / Manual
Range	Adult: 0 – 120 BrPM. Neonate/Paediatric: 0 – 150 BrPM
Apnoea Alarm	Yes
Alarm	Yes, Audible and Visual Alarm, Alarm Events recallable

NIBP

Method	Automatic Oscillometric
Modes	Manual / Automatic / Continuous
Auto Measure Time	Adjustable
Unit	mmHg / kPa selectable
Types	Systolic, Diastolic, Mean

Measurement Range

Range of Systolic Pressure	Adult Mode: 40 – 270 mmHg. Paediatric Mode: 40 – 200 mmHg. Neonate Mode: 40 – 135 mmHg
Range of Diastolic Pressure	Adult Mode: 10 – 210 mmHg. Paediatric Mode: 10 – 150 mmHg. Neonate Mode: 10 – 95 mmHg
Range of Mean Pressure	Adult Mode: 20 – 230 mmHg. Paediatric Mode: 20 – 165 mmHg. Neonate Mode: 20 – 110 mmHg
Accuracy of Blood Pressure Measurement	The Mean error shall be less than ±5 mmHg. The Standard deviation shall be less than 8 mmHg
Over-Pressure Protection	Double safety protection
Resolution	1 mmHg
Alarm	Systolic, Diastolic, Mean

STANDARD SPO2

Range	0 – 100%
Resolution	1%
Accuracy (Static)	Adult/Paediatric: 70 – 100% ±2%. Neonate: 70 – 100% ±3%; 0 – 69% Unspecified
Accuracy (Motion)	70 – 100% ±3%; 0 – 69% Unspecified
Alarm Range	0 – 100%
Pulse Rate	Range: 20 – 254 bpm. Resolution: 1 bpm. Accuracy: ±3 bpm (static); ±5 bpm (motion). Alarm Range: 20 – 254 bpm

MASIMO SET™ SPO2

Range	0 – 100%
Resolution	1%
Accuracy (Static)	Adult/Paediatric: 70 – 100% ±2%. Neonate: 70 – 100% ±3%; 0 – 69% Unspecified
Accuracy (Motion)	70 – 100% ±3%; 0 – 69% Unspecified
Alarm Range	0 – 100%
Pulse Rate	Range: 25 – 240 bpm. Resolution: 1 bpm. Accuracy: ±3 bpm (static); ±5 bpm (motion). Alarm Range: 20 – 240 bpm

NELLCOR OXIMAX™ SPO2

Range	0 – 100%
Resolution	1%

Sensor Accuracy

MAX-A, MAX-AL, MAX-N, MAX-P, MAX-I and MAX-FAST	70 – 100% ±2.0%; 0 – 69% Unspecified
OxiCliq A, OxiCliq N, OxiCliq P and OxiCliq I	70 – 100% ±2.5%; 0 – 69% Unspecified
D-YS, DS-100A, OXi-A/N and OXI-P/I	70 – 100% ±3.0%; 0 – 69% Unspecified
MAX-R, D-YSE and D-YSPD	70 – 100% ±3.5%; 0 – 69% Unspecified
Alarm Range	0 – 100%
Pulse Rate	Range: 20 – 300 bpm. Resolution: 1 bpm. Accuracy: 20 – 250 bpm ±3 bpm; 251 – 300 bpm Unspecified. Alarm Range: 20 – 250 bpm

TEMPERATURE

Range	0 – 50°C
Resolution	0.1°C
Accuracy	±0.1°C
Channel	Dual channel, provides T1; T2; ΔT

IBP

Range	-50 to 300 mmHg
Channel	2 channels
Pressure Transducer	Sensitivity: 5 V/V/mmHg. Impedance Range: 300 – 3000 W
Pressure Names	ART, PA, CVP, RAP, LAP, ICP, CPP
Resolution	1 mmHg
Accuracy	±2% or ±1 mmHg, whichever is greater (exclusive of transducer)
Alarm Range	-50 to 300 mmHg

CARDIAC OUTPUT

Method	Thermodulation
Range	CO: 0.1 – 20 L/min. TB: 23 – 43°C. TI: 0 – 27°C
Resolution	CO: 0.1 L/min. TI: 0.1°C. TB: 0.1°C
Accuracy	CO: ±5%. TB: ±0.1°C. TI: ±0.1°C
Parameter Output	Cardiac Output, Haemodynamics Calculation

EtCO2

MICROSTREAM CO2

Range	0 – 99 mmHg
Accuracy	0 – 38 mmHg ±2 mmHg. 39 – 99 mmHg ±5% of reading +0.08% for every 1 mmHg (above 38 mmHg)
Resolution	Waveform: 0.1 mmHg. Value: 1.0 mmHg
Sampling Rate	50 ml/min - 7.5 + 15 ml/min
Initialisation Time	30 seconds (typical value), reaches ±5% steady-state accuracy within three minutes
Response Time	2.9 seconds (typical value) including the rising time and the delay time (using standard length filter line)
Rising Time	< 190 ms (rising from 10% to 90%)
Delay Time	2.7 seconds (typical value)
Respiration	Rate: 0 – 150 BrPM. Accuracy: 0 – 70 BrPM ±1 BrPM; 71 – 120 BrPM ±2 BrPM; 121 – 150 BrPM ±3 BrPM
Mode	Adult, Neonate

SIDESTREAM CO2

Method	0 – 99 mmHg
Accuracy	0 – 40 mmHg ±2 mmHg. 41 – 76 mmHg ±5% of reading. 77 – 99 mmHg ±10% of reading
Sampling Rate	Rate: 100 ml/min. Accuracy: 15%
Start-up Time	< 1 minute (typical value), reaches steady state accuracy within ten minutes
Respiration	Rate: 0 – 120 BrPM. Accuracy: 0 – 70 BrPM ±2 BrPM; > 70 BrPM ±5 BrPM
Response Time	< 240 mSeconds (10% to 90%)
Delay Time	< 2 seconds. Sampling Line Length: 7 inches. Internal Diameter: 0.055 inches. Sampling Gas Flow Rate: 150 ml/min

MAINSTREAM CO2

Method	Infrared Absorption
Measuring Mode	Mainstream
Range	EtCO2: 0 – 99 mmHg. InsCO2: 0 – 99 mmHg. AwRR: 0 – 150 bpm
Resolution	EtCO2: 1 mmHg. InsCO2: 1 mmHg. AwRR: 1 bpm
CO2 Concentration Accuracy	0 – 40 mmHg ±2 mmHg. 41 – 76 mmHg ±5% of reading. 77 – 99 mmHg ±10% of reading
AwRR Accuracy	±2 bpm
Alarm Range	Same as measurement range

MULTI-GAS/O2

Method	Infrared Absorption
Gas Sorts	CO2, N2O, Des, Iso, Enf, Sev, Hal, O2 (optional paramagnetic sensor)
Range	CO2: 0 – 30%. N2O: 0 – 105%. O2: 0 – 105%. Enf, Iso, Hal: 0 – 30%. Sev: 0 – 30%. Des: 0 – 30%
Data Output	Fi and ET values
Respiration Rate	2 – 60 BrPM ±1 BrPM. 61 – 100 BrPM Unspecified
Other	• Up to 3 waveforms displayed • Agent mixture detection • MAC value displayed

Standard Configurations	ECG, Respiration, NIBP, Standard SpO2, Temperature, Battery
Optional Configurations	Masimo SET™ SpO2, Dual IBP, CO, EtCO2, Multi-Gas/O2, Thermal recorder

Technical Specification

VS-800 Vital Signs Monitor

DIMENSION AND WEIGHT	
Dimension	240 x 170 x 170 mm (H x W x D)
Weight	< 3.5 kg (including battery)

OPERATION ENVIRONMENT	
Power	100 – 240 VAC (±10%), 50/60 Hz (±3 Hz), 70 VA
Temperature	0 – 40°C
Humidity	15 – 95%, non-condensing
Patient Range	Adult, Paediatric and Neonate

PERFORMANCE SPECIFICATIONS	
Display	7 segment LEDs for Systolic, Diastolic, Mean pressures, SpO2 and Pulse Rate 86 mm (3.4") FSTN LCD Resolution: 320 x 160 Pitch: 0.24 x 0.24 mm Trace: Single plethysmogram waveform Sweep Speed: 25 mm/s
Indicator	Alarm indicator • Power indicator • Battery indicator • Pulse tone modulation (pitch tone) • Alarm sound
Interface	Network port, Nurse Call interface
Trend	Flexible database lists trend for review of up to 1200 measurements on up to 100 patients
Alarm	3-Level Audible and Visual Alarm
Networking	Connected to central monitoring system or data exporting system
Recorder	Built-in, Thermal Array Record Width: 48 mm Paper Width: 50 mm Print Speed: 25 mm/s
Rechargeable Lead Acid Battery	Charging Time: 8.0 hours (approx.) Working Time: 4.5 hours (approx.)
Rechargeable Li-ion Battery	Charging Time: 8.0 hours (approx.) Working Time: 10.5 hours (approx.)

NIBP	
Method	Automatic Oscillometric
Modes	Manual / Automatic / Continuous
Auto Measure Time	Adjustable
Unit	mmHg / kPa selectable
Types	Systolic, Diastolic, Mean, Pulse Rate
Range	Adult Mode: 10 – 270 mmHg Paediatric Mode: 10 – 200 mmHg Neonate Mode: 10 – 135 mmHg
Over-pressure Protection	Yes
Resolution	1 mmHg
Alarms	Systolic, Diastolic, Mean, Pulse Rate
Pulse Rate	Range: 40 – 240 bpm Resolution: 1 bpm Accuracy: ±2 bpm

STANDARD SpO2	
Range	0 – 100%
Resolution	1%
Accuracy	Adult/Paediatric: 70 – 100% ±2% 0 – 69% Unspecified Neonate: 70 – 100% ±3% 0 – 69% Unspecified
Alarm Range	0 – 100%
Pulse Rate	Range: 20 – 254 bpm Resolution: 1 bpm Accuracy: ±3 bpm Alarm Range: 20 – 254 bpm

MASIMO SET™ SpO2	
Range	1 – 100%
Accuracy (Static)	Adult/Paediatric: 70 – 100% ±2% 0 – 69% Unspecified Neonate: 70 – 100% ±3% 0 – 69% Unspecified
Accuracy (Motion)	70 – 100% ±3% 0 – 69% Unspecified
Low Perfusion Performance	Pulse Amplitude: > 0.02% Light Transmissivity: > 5% SpO2 Accuracy: ±2% PR Accuracy: ±3 bpm
Pulse Rate	Range: 25 – 250 bpm Accuracy: ±3 bpm (static) Accuracy: ±5 bpm (motion)

NELLCOR OXIMAX™ SpO2		
Range	0 – 100%	
Compatible Sensors	Nellcor sensor type: OxiMax Series MAX-A, MAX-AL, MAX-N, MAX-P, MAX-I, MAX-FAST, MAX-R, OxiCliq A, OxiCliq N, OxiCliq P, OxiCliq I, D-YS, D-YSE, D-YSPD, DS-100A, OXI-A/N and OXI-P/I	

SpO2 Accuracy		
MAX-A, MAX-AL, MAX-N, MAX-P, MAX-I and MAX-FAST Sensors	70 – 100% ±2.0% 0 – 69% Unspecified	
OxiCliq A, OxiCliq N, OxiCliq P and OxiCliq I Sensors	70 – 100% ±2.5% 0 – 69% Unspecified	
D-YS, DS-100A, OXi-A/N and OXI-P/I Sensors	70 – 100% ±3.0% 0 – 69% Unspecified	
MAX-R, D-YSE and D-YSPD Sensors	70 – 100% ±3.5% 0 – 69% Unspecified	
Pulse Rate	Range: 20 – 300 bpm Accuracy: 20 – 250 bpm ±3 bpm 251 – 300 bpm Unspecified	

Selectable Configuration (With Lead Acid Battery)	• NIBP • Standard SpO2 • NIBP + Standard SpO2 • NIBP + Masimo SET™ SpO2 • NIBP + Nellcor OxiMax™ SpO2
Options	Thermal recorder, Li-ion battery

Hypervisor VI

DIMENSION AND WEIGHT	
Dimension	206 x 455 x 469 mm (H x W x D)
Weight	13.5 kg

OPERATION ENVIRONMENT	
Power	100 – 127 / 200 – 240 VAC, 6A / 3A

CONFIGURATION	
	17" Colour TFT Display • Intel Pentium IV • 2 GHz CPU Windows® XP Professional • 256 MB RAM • 40 GB Hard Disk 1 x RJ-45 Network Interface 1 x Serial Port 1 x Parallel Port 2 x USB Ports 1 x Keyboard Interface 1 x Mouse Interface 1 x Sound Output Interface 1 x Mic Input Interface

PERFORMANCE SPECIFICATION	
Display	Size: 17" Colour TFT No. of Displays: 1 or 2 Resolution: 1280 / 2560 x 1024 Colours: 65536
Waveform	ECG (I, II, III, aVR, aVL, aVF, V1-V6), PLETH, RESP, CO2, IBP, Multi-Gas, O2, N2O
Parameter	HR, ST (I, II, III, aVR, aVL, aVF, V1-V6), RR, PVC, NIBP, IBP, SpO2, PR, TEMP, TB, EtCO2, Multi-Gas, O2, N2O

INDICATOR	
Trace	64 Waveforms
Sweep Speeds	12.5, 25, 50 mm/s (User Adjustable)
Alarm	3-Level Audible and Visual
Parameter Alarm	High / Low Limits
Arrhythmia Alarm	Yes

VIEWBED	
	• Up to 64 waveforms for 32 bedside monitors • All waveform presentation for one patient • Four hour dynamic short trend display for all parameters • Multi-leads ECG waveform display • OxyCRG display • Waveform freeze

REMOTE MONITOR CONTROL	
Type	Bi-directional Communication

NETWORK	
Type	Ethernet 802.3
Protocol	HypernetX and TCP/IP
Cabling	UTP Network Cable
Compatible Monitors	PM-8000 Express, PM-9000 Express, SP M8, SP M5, VS-800 and Telemetry
Capacity	Up to 64 bedside monitors

ACCESS POINTS	
	• Resistant to interference • 10 Base-T Ethernet • Redundant coverage

WLAN	
Protocol	IEEE 802.11b Compliant
Frequency	2.4 GHz
Channel	Direct sequence spread spectrum

DATA REVIEW	
Trend	240 hours for each bedside monitor
Alarm	720 events for each bedside monitor
CO2	720 Measurements for each bedside monitor
NIBP	720 Measurements for each bedside monitor
Data Export	Yes
Patient History	Search and review the data for up to 20,000 patients
Waveform	72 hours of 64 channels full-disclosure waveforms store and review

CALCULATIONS	
Type	• Drug Calculations and Titration Table • Haemodynamic Calculation

CHART RECORDER	
Type	External Thermal Array
Print Width	48 mm
Print Speed	25 mm/s
Trace	2 waveforms
Record Mode	8 second real-time 16 second real-time Real-time continuous waveform Freeze waveform Alarm strip Real-time alarm

InterMed Penlon

CE
0473

Penlon Limited Abingdon Science Park Barton Lane Abingdon OX14 3PH UK   www.penlon.com

PM0108