



# iM 12 & iM 15

## Technical Specifications

# Product Specifications

## 1 Safety Specifications

### 1.1 Product Classification

Components	Type of Protection Against Electric Shock	Level of Protection Against Electric Shock	Liquid Intake Protection Grade	Level of Protection Against Explosion	Operating Mode
Host	I	Non-nominal	General Equipment	Unsuitable	Continuation
ECG (Resp) Module	NA	CF(*)			
IBP Measuring Module (Optional)					
NIBP Measuring Module					
C.O. Measuring Module					
Temp Measuring Module					
SpO <sub>2</sub> Measuring Module					
CO <sub>2</sub> Measuring Module (Optional)		BF(*)			
AG Module (Optional)					

### 1.2 Environment Specifications

Equipment Environment (Host, Recorder, C.O. Module and IBP Module)			
Item	Temperature	Humidity (Non-Condensing)	Atmospheric Pressure
Operating	0℃～40℃ (32℉～104℉)	15%～80%	442.5 mmHg～805.5 mmHg (59 kPa～107.4 kPa)
Storage&Transport	-20℃～55℃ (-4℉～140℉)	10%～93%	165 mmHg～805.5 mmHg (22 kPa～107.4 kPa)
A G Module			
Item	Temperature	Humidity (Non-Condensing)	Atmospheric Pressure
Operating	0℃～40℃ (32℉～104℉)	10%～95%	393.8 mmHg～900 mmHg (52.5 kPa～120 kPa)
Storage&Transport	-40℃～75℃ (-40℉～167℉)	5%～100%	375 mmHg～900 mmHg (50 kPa～120 kPa)

### 1.3 Power Specifications

(AC) Input Voltage	100 V～240 V
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Input Power	75 VA
Frequency	50 Hz/60 Hz (Allowable frequency error $\pm 1$ Hz)
Fuse	3.15A/250V
Security Level	Category I ,Type BF, CF

## 2 Physical Specifications

Host		
	12 inches monitor	<i>15 inches monitor</i>
Weight	Approx. 4.5 kg	Approx. 5.0 kg
Size (L×W×H)	310 mm×163 mm×285 mm	370 mm×187 mm×313 mm

## 3 Hardware Specifications

Display	
Type	TFT LCD Screen
Dimensions	12.1 inches (12 inches monitor) , 15 inches ( <i>15 inches monitor</i> )
Resolution	800×600 pixels (12 inches monitor) , 1024×768 pixels ( <i>15 inches monitor</i> )
Screen Brightness	10-level, adjustable
LCD View Angle	Horizontal / vertical view angle at least 150 °/120 °
Recorder	
Type	Thermal array recorder
Horizontal Resolution	16 dots/mm (Paper Speed: 25.0 mm/s)
Vertical Resolution	8 dots/mm
Printing Paper Size	50 mm×20 m
Paper Speed	12.5 mm/s; 25.0 mm/s; 50.0 mm/s
Waveform	Max. 3 waveforms
Battery	
Dimensions	182 mm×71 mm×25.5 mm
Weight	0.3 kg
Type	Rechargeable lithium battery
Rated voltage	14.8 V
Battery Capacity	4.4 Ah
Length of Power Supply	In environment temperature ranging from 20 °C to 30 °C and under standard configuration, the continuous working time of a single battery is not less than 5 hours.
Time for recharging battery to 90% from zero power state	In environment temperature ranging from 20 °C to 30 °C and with the machine turning off, the charging time is not more than 8 hours to charge the battery to 90%.
Shutdown Delay	0 s, 0.5 s, 1 s, 1.5 s, 2 s
Host LED	
Physiological Alarm Indicator Lamp	1 (Dual color yellow & red )

Technical Alarm Indicator Lamp	1 (Blue)
Power Switch Indicator Lamp	1 (Green)
AC Power Indicator Lamp	1 (Green)
Battery Power Indicator Lamp	1 (Green)
Battery Charging Indicator Lamp	1 (Green) (Only for 12 inches monitor)
Keypad Backlight	5 (White)
Alarm Pause Key Backlight	1 (Red)
Speaker	Give out alarm sound (45 dB~85 dB), keystroke sound and QRS sound. Alarm sound complies with IEC 60601-1-8
<b>Interface</b>	
Power	1 AC power port
Network	Standard RJ45 network port, which can network with the central monitoring system and transmit all the patient monitored data to the central monitoring system.
USB	USB disk supported. For the manufacturer to upgrade and service the application software, and export data (Structurally 2 USB host interfaces supported)
VGA	Supported, for connection of external display
Analog Output Port	1 piece. It can be connected to oscilloscope for output of the analog signals.
Nurse Call System Port	1 piece. It can be connected to port of the nurse call system.
Equipotential Terminal Port	1 piece
<b>ECG Analog Signal Output</b>	
Bandwidth (-3 dB, reference 10Hz)	Surgery mode: 1 Hz~15 Hz Monitor mode: 0.5 Hz~40 Hz Diagnose mode: 0.05 Hz~150 Hz
Max. Transmission Delay	25ms (Wave filter closed under diagnose mode)
Sensitivity	1 V/mV $\pm 5\%$
Accuracy of input signal reproduction	Using the method described in 4.2.7.1 of AAMI EC11 to test the overall system error, which is within $\pm 5\%$ ; Using method A and D described in 4.2.7.1 of AAMI EC11 to test frequency response. Because of sampling characteristics and the asynchronism between sample rate and signal rate of the ECG module, digital systems may produce a noticeable modulating effect from one cycle to the next, particularly in pediatric recordings. This phenomenon, which is not physiologic, shall be clearly described in the operator's and service manuals.
<b>IBP Analog Signal Output</b>	

Bandwidth (-3 dB, reference 10Hz)	0 Hz~50 Hz
Max. Transmission Delay	30 ms (Filter closed)
Sensitivity	0.01 V/mmHg $\pm$ 5%

## 4 Data Storage

Trend Data	Short Trend (Trend Window Time 4 min, 40 min, 2 h) Resolution of Trend Chart 5 s, 30 s, 1 min, 10 min): Max. storage time: 72h. Long trend (Trend Window Time 4 h, 16 h, 32 h, 48 h) Resolution of Trend Chart 15 min, 30 min, 1 h, 2 h, 3 h): Max. storage time: 480h.
Parameter Alarm Event	700 parameter alarm events and manual events, as well as the parameter waveform related to the occurring time, wave length 10s
NIBP Measuring Result	Max. 1000 groups
Single-Channel ECG Waveform	Max. 2h
Holographic Waveform	Max. 2 min (Power cutoff storage not supported)

## 5 Wireless Network

Applicable Standard	IEEE 802.11b/g, compatible with wifi
Safe to use distance	20 cm
Frequency Range	2.412 GHz~2.472 GHz
Signal Path	1-13 (China)
Transmission Distance	30 m (Open area without obstruction)

## 6 Measuring Specifications

### 6.1 ECG Monitoring

Input Mode	3-Lead ECG input (Optional) 5-Lead ECG input (Standard) 12-Lead ECG input (Optional)
Lead Selection	I , II , III(Optional) I , II , III, aVR, aVL, aVF, V I , II , III, aVR, aVL, aVF, V1~V6 (Optional)
Lead Standard	AHA, IEC
Measuring Range of Heart Rate	Adult: 15 bpm~300 bpm Pedi: 15 bpm~350 bpm Neonate: 15 bpm~350 bpm

Heart Rate Display Tolerance	$\pm 1\%$ or $\pm 1$ bpm, whichever is higher
Sensitivity	1.25 mm/mV ( $\times 1/8$ ), 2.5 mm/mV ( $\times 1/4$ ), 5.0 mm/mV ( $\times 1/2$ ), 10.0 mm/mV ( $\times 1$ ), 20.0 mm/mV ( $\times 2$ ), 40.0 mm/mV ( $\times 4$ ), Auto. Error: $\pm 5\%$
Resolution Stability	The resolution change 1 minute after the instrument is powered on does not exceed 0.66% per minute. The total change within 1h does not exceed any available fixed gain setting by $\pm 10\%$ .
Sweep Speed	6.25 mm/s, 12.5 mm/s, 25.0 mm/s, 50.0 mm/s. Error: $\pm 10\%$
Noise Level	$\leq 30 \mu V_{p-p}$
Input Circuit Current	$\leq 0.1 \mu A$
Input Impedance	$\geq 2.5 M\Omega$
Patient Leakage Current	$< 10 \mu A$
ESU Proof	Cutting Mode: 300 W Coagulation Mode: 100 W Recovery Time: $\leq 10$ s
ESU Noise Inhibition	Tested acc. to 5.2.9.14 of ANSI/AAMI EC 13:2002: 1) The ECG signal track does not disappear; 2) Change in heart rate does not exceed 10% of the heart rate when the electrosurgical knife is not activated.
CMRR	Diagnose Mode: $\geq 89$ dB Surgery & Monitor Mode: $\geq 100$ dB
Time Constant	Monitor Mode: $\geq 0.3$ s Diagnose Mode: $\geq 3.2$ s
Frequency Response	Surgery Mode: 1 Hz-15 Hz; Monitor Mode: 0.5 Hz-40 Hz; Diagnose Mode: 0.05 Hz-150 Hz.
ECG Parameter Frequency Characteristics	Surgery Mode: Meet ( $+0.4$ dB $\sim$ $-3.0$ dB)) requirements at 15 Hz. Monitor Mode: Meet ( $+0.4$ dB $\sim$ $-3.0$ dB)) requirements at 0.5 Hz $\sim$ 40 Hz. Diagnose Mode: Meet ( $+0.4$ dB $\sim$ $-1.0$ dB)) requirements at 0.05 Hz $\sim$ 60 Hz. Meet ( $+0.4$ dB $\sim$ $-3.0$ dB)) requirements at 61 Hz $\sim$ 150 Hz.
Notch	Monitor & Surgery Mode: notch filter automatically activated at 50 Hz/60 Hz Diagnose Mode: Notch filter manually activated or deactivated at 50 Hz/60 Hz
Range of Electrode Polarized Voltage	$\pm 300$ mV d.c.
Lead Fall Testing Current	Measuring Electrode: $< 0.1 \mu A$ Drive Electrode $< 1 \mu A$
<b>Pacemaker Pulse</b>	
Pacemaker Pulse Display Capacity	Pace-making mark can be displayed for the following pacemaker pulses: Pulse Amplitude: $\pm 2$ mV $\sim$ $\pm 100$ mV Pulse Width: 0.1 ms $\sim$ 2 ms Pulse Rise Time: 10 $\mu s \sim$ 100 $\mu s$ Pacemaker pulse should be no overshoot
Pacemaker Pulse	The monitor can inhibit the pacemaker pulse that conforms to the following conditions:

Suppression Capacity	Pulse Amplitude: $\pm 2$ mV $\sim$ $\pm 100$ mV Pulse Width: 0.1 ms $\sim$ 2 ms Pulse Rise Time: 10 $\mu$ s $\sim$ 100 $\mu$ s Pacemaker pulse should be no overshoot
<b>Alarm Limit Specifications</b>	<b>Range</b>
Upper Limit of ECG Heart Rate	Alarm upper limit for adult: (Lower limit+2) bpm $\sim$ 300 bpm Alarm upper limit for pedi: (Lower limit+2) bpm $\sim$ 350 bpm Alarm upper limit for neonate: (Lower limit+2) bpm $\sim$ 350 bpm
Lower Limit of ECG Heart Rate	Alarm lower limit for adult: 15 bpm $\sim$ (Upper limit-2)bpm Alarm lower limit for pedi: 15 bpm $\sim$ (Upper limit-2)bpm Alarm lower limit for neonate: 15 bpm $\sim$ (Upper limit-2)bpm
Resolution	$\pm 1$ bpm
Accuracy	The tolerance of alarm limit setting is $\pm 1$ bpm. In addition, the ECF signal alarm below the publicized lower limit of the alarm will not fail. If the alarm is not disabled, the alarm will not fail if you enter the ECG input signal higher than the upper limit of alarm up to 300 bpm (350 bpm for neonate and pedi).
<b>HR</b>	
Heart Rate Testing Amplitude	$\pm 0.3$ mV $\sim$ $\pm 5$ mV
Resolution	1 bpm
Alarm Time for Tachycardia	Acc. to ANSI/AAMI EC13:2002 Part 4.1.2.1 g). 4ah-Range: 11 s 4a-Range: 11 s 4ad-Range: 11 s 4bh-Range: 11 s 4b-Range: 11 s 4bd-Range: 11 s
Heart Rate Average	Acc. to ANSI/AAMI EC13:2002 Part 4.1.2.1 g). The average heart rate is obtained by the method below: If the interval of the last continuous 3 RR is higher than 1200ms, the heart rate is averaged based on the most recent 4 RR intervals; otherwise, the heart rate is averaged based on the most recent 12 RR intervals. The heart rate displayed on the screen is refreshed every second.
Response to Irregular Rhythm of the heart	Acc. to ANSI/AAMI EC13:2002 Part 4.1.2.1 e). The heart rate displayed after 20s stabilizing period is: 3a (Ventricular bigeminy) $\sim$ 80 $\pm$ 1bpm 3b (Slow alternating ventricular bigeminy) $\sim$ 60 bpm $\pm$ 1 bpm 3c (Rapid alternating ventricular bigeminy) $\sim$ 120 bpm $\pm$ 1 bpm 3d (Bidirectional systoles) $\sim$ 90 bpm $\pm$ 1 bpm
Response Time to Heart Rate Change	Acc. to ANSI/AAMI EC13:2002 Part 4.1.2.1 f). Increase of heart rate: response time $\leq$ 11 s Decrease of heart rate: response time $\leq$ 11 s

High T-wave Suppression Capacity	Acc. to ANSI/AAMI EC13:2002 Part 4.1.2.1 c). The heart rate monitor inhibits all T-waves with amplitude lower than 1.2 mV, 100msQRS wave groups, T-wave period 180 ms and QT period 350ms.
Arrhythmia Type	a) Monitoring type: Asystole, VFib / VTac, VTac, Ventricular bradycardia, Extreme-Tachy, Extreme-Brady, Non-Sustained VT, PVC, Tachycardia, Bradycardia, VR, V-Bigeminy, V-Trigeminy, Irr.Rhythm, PVCs/min, Run PVCs > 2, Couplet, R on T, Multiform, HeartBeat Pause, Missed Beats. b) Pace-making: Pacemaker not captured (PNC), Pacemaker not paced (PNP).
<b>ST Interval Measuring</b>	
Range	(-2.0 mV)~(+2.0 mV)
Accuracy	Measuring Tolerance: measuring tolerance within (-0.8 mV)~(+0.8 mV) is $\pm 0.02$ mV or $\pm 10\%$ , whichever is higher. It not defined for other ranges.
ST Interval Updating Interval	A single heart beat interval or 1s, whichever is higher.

## 6.2 Respiration (Resp) Monitoring

Measuring Method	Chest Impedance Method
Measuring Lead	Lead I and II for selection. Lead I defaulted.
Respiration Exciting Waveform	< 300 $\mu$ A, Sine signal, 62.8 kHz ( $\pm 10\%$ )
Range of Respiration Impedance	0.5 $\Omega$ ~3 $\Omega$
Range of Base Impedance	250 $\Omega$ -2000 $\Omega$ (Use of ECG cable with 1k $\Omega$ resistor)
Differential Input Impedance	> 2.5 M $\Omega$
Bandwidth	0.2 Hz~2 Hz (-3 dB)
Waveform Sensitivity	$\times 1/4$ , $\times 1/2$ , $\times 1$ , $\times 2$ , $\times 4$ , Auto
Sweep Speed	6.25 mm/s; 12.5 mm/s; 25.0 mm/s
Resolution	1 rpm
Accuracy	$\pm 2$ rpm
Asphyxia Alarm	Off, 10 s, 15 s, 20 s, 25 s, 30 s, 35 s, 40 s
<b>RR</b>	
Range	Monitoring Range for adult: 0 rpm~120 rpm Monitoring Range for pedi: 0 rpm~150 rpm Monitoring Range for neonate: 0 rpm~150 rpm
Resolution	1 rpm
Respiration Monitoring Tolerance	Within 7 rpm~150 rpm, the measuring error is $\pm 2$ rpm or $\pm 2\%$ , whichever is higher. The tolerance is not defined for other ranges.
Asphyxia Alarm Tolerance	Within 10 s~40 s (Increase/decrease by 5s for each rotation of the knob), the asphyxia alarm tolerance is $\pm 5$ s.
Alarm Limit Specifications	<b>Range</b>



RR Upper Limit	Alarm upper limit for adult: (Lower limit+2) rpm~100 rpm Alarm upper limit for pedi: (Lower limit+2) rpm~100 rpm Alarm upper limit for neonate: (Lower limit+2) rpm~100 rpm
RR Lower Limit	Alarm lower limit for adult: 0 rpm~ (Upper limit-2) rpm Alarm lower limit for pedi: 0 rpm~ (Upper limit-2) rpm Alarm lower limit for neonate: 0 rpm~ (Upper limit-2) rpm

### 6.3 SpO<sub>2</sub> Monitoring

Alarm Limit Specifications	Range
SpO <sub>2</sub> Upper Limit	(Lower limit+1)%~100%
SpO <sub>2</sub> Lower Limit	80%~ (Upper limit-1)%
Accuracy Tolerance	±1% of the setting
Sensing element	Optical power <15 mW Red light wavelength: 658 nm~664 nm, infrared light: 897 nm~915 nm Information on the wavelength range is particularly useful for clinicians (e.g. in optical dynamic therapy)

### SpO<sub>2</sub> Module

Monitoring Parameters	SpO <sub>2</sub> and Pulse Rate (PR)
Range	0%~100%
Resolution	1%
Data update peiriod	1 s
Accuracy	Within 70%~100%, the measuring tolerance is ±2%. Within 0%~69%, the measuring tolerance is not defined.

### Masimo Oximeter Module

Monitoring parameter	Pulse oximetry (SpO <sub>2</sub> ) and pulse rate (PR)
Range	1%~100%
Resolution	1%
Accuracy	Adult and pedi:in the range of 70%~100%, the measurement error is ±2%; Neonate:in the range of 70%~100%, the measurement error is ±3%; In the range of 0%~69%, the measurement error is not defined.
Average time	2 s-4 s,4 s-6 s,8 s,10 s,12 s,14 s,16 s
Data update peiriod	1 s
Weak perfusion condition	Pulse amplitude: >0.02%; Light transmittance: >5%.
Weak perfusion SpO <sub>2</sub> accuracy	Adult and pedi: ±2% Neonate: ±3%.

**Nellcor Oximeter Module**

Monitoring parameter	Pulse oximetry (SpO <sub>2</sub> ) and pulse rate (PR)
Range	1%~100%
Resolution	1%
Data update period	1 s
Accuracy	Adult: in the range of 70%~100%, the measurement error is $\pm 2\%$ ; Neonate: in the range of 70%~100%, the measurement error is $\pm 3\%$ ; Insufficiency: in the range of 70%~100%, the measurement error is $\pm 2\%$ ; In the range of 0%~69%, the measurement error is not defined.

**6.4 PR Specifications**

Alarm Limit Specifications	Range
PR Upper Limit	Alarm upper limit for adult: (Lower limit+2) bpm~250 bpm Alarm upper limit for pedi: (Lower limit+2) bpm~250 bpm Alarm upper limit for neonate: (Lower limit+2) bpm~250 bpm
PR Lower Limit	Alarm lower limit for adult: 25 bpm~ (Upper limit-2)bpm Alarm lower limit for pedi: 25 bpm~ (Upper limit-2)bpm Alarm lower limit for neonate: 25 bpm~ (Upper limit-2)bpm

**PR from SpO<sub>2</sub> Module**

Range	30 bpm~250 bpm
Resolution	1 bpm
Measuring Tolerance	$\pm 2$ bpm
Average Time	8 s

**PR from Masimo SpO<sub>2</sub> Module**

Range	25 bpm~240 bpm
Resolution	1 bpm
Measuring Tolerance	The measuring tolerance is $\pm 3$ bpm or $\pm 1\%$ , whichever is higher.
Average Time	2 s-4 s, 4 s-6 s, 8 s, 10 s, 12 s, 14 s, 16 s

**PR from Nellcor SpO<sub>2</sub> Module**

Range	20 bpm~300 bpm
Resolution	1 bpm
Measuring Tolerance	Adult and Neonate: 20 bpm~250 bpm: $\pm 3$ bpm Insufficiency: 251 bpm~300 bpm: not defined.

**PR from IBP**

Range	30 bpm~350 bpm
Resolution	1 bpm
Measuring Tolerance	30 bpm~200 bpm: $\pm 1$ bpm or $\pm 1\%$ , whichever is higher; 201 bpm~350 bpm: $\pm 2\%$ .

### 6.5 NIBP Monitoring

Measuring Method	Automatic oscillometric method			
Safety Requirements	Acc. to ANSI/AAMI SP-10 Non-invasive Automated Blood Pressure Monitor, Part 4.4			
Work Mode	Manual, Auto, STAT Measuring			
Measuring Time under Continuous Mode	5 min			
Measuring Interval under Auto Mode	1 min, 2 min, 3 min, 4 min, 5 min, 10 min, 15 min, 30 min, 60 min, 90 min, 2 h, 3 h, 4 h, 8 h, Timer interval error: $< 10$ s			
Resolution	1 mmHg (0.133kPa)			
Nominal Range of Monitoring	Blood Pressure (unit)		Adult	Pedi
	Systolic Pressure	mmHg	40~270	40~200
		kPa	5.3~35.9	5.3~26.6
	Mean Pressure	mmHg	20~230	20~165
		kPa	2.7~30.6	2.7~22.0
	Diastolic Pressure	mmHg	10~210	10~150
		kPa	1.3~27.9	1.3~20.0
Range of Initial Inflation Pressure Setting	Adult: 80 mmHg, 100 mmHg, 120 mmHg, 140 mmHg, 160 mmHg, 180 mmHg, 200 mmHg, 220 mmHg, 240 mmHg Pedi: 80 mmHg, 100 mmHg, 120 mmHg, 140 mmHg, 160 mmHg, 180 mmHg, 200 mmHg Neonate: 60 mmHg, 80 mmHg, 100 mmHg, 120 mmHg, 145 mmHg			
Default of Initial Inflation Pressure	Adult: 160 mmHg (21.3 kPa) Pedi: 140 mmHg (18.6 kPa) Neonate: 100 mmHg (13.3 kPa)			
Measuring Tolerance of Pressure Source Testing	$\pm 3$ mmHg ( $\pm 0.4$ kPa)			
Overpressure Protection	Adult state: when the pressure in cuff exceeds 297 mmHg (39.5 kPa) $\pm 3$ mmHg (0.4 kPa), the control valve shall relieve the pressure. Pedi state: when the pressure in cuff exceeds 240 mmHg (31.9 kPa) $\pm 3$ mmHg (0.4 kPa), the control valve shall relieve the pressure. Neonate state: when the pressure in cuff exceeds 147 mmHg (19.6 kPa) $\pm 3$ mmHg (0.4 kPa), the control valve shall relieve the pressure.			

Alarm Limit Specifications	Range
Upper Limit of Systolic Blood Pressure	Adult: (Lower limit+5)mmHg~270 mmHg ( (Lower limit+0.7)kPa~35.9 kPa) Pedi: (Lower limit+5)mmHg~200 mmHg ( (Lower limit+0.7)kPa~26.6 kPa) Neonate: (Lower limit+5)mmHg~135 mmHg ( (Lower limit+0.7)kPa~18.0 kPa)
Lower Limit of Systolic Blood Pressure	Adult: 40 mmHg~ (Upper limit-5)mmHg (5.3 kPa~ (Upper limit -0.7)kPa) Pedi: 40 mmHg~ (Upper limit-5)mmHg (5.3 kPa~ (Upper limit-0.7)kPa) Neonate: 40 mmHg~ (Upper limit-5)mmHg (5.3 kPa~ (Upper limit-0.7)kPa)
Upper Limit of Mean Blood Pressure	Adult: (Lower limit+5)mmHg~230 mmHg ( (Lower limit+0.7)kPa~30.6 kPa) Pedi: (Lower limit+5)mmHg~165 mmHg ( (Lower limit+0.7)kPa~21.9 kPa) Neonate: (Lower limit+5)mmHg~110 mmHg ( (Lower limit+0.7)kPa~14.6 kPa)
Lower Limit of Mean Blood Pressure	Adult: 20 mmHg~ (Upper limit-5)mmHg (2.7 kPa~ (Upper limit-0.7)kPa) Pedi: 20 mmHg~ (Upper limit-5)mmHg (2.7 kPa~ (Upper limit-0.7)kPa) Neonate: 20 mmHg~ (Upper limit-5)mmHg (2.7 kPa~ (Upper limit-0.7)kPa)
Upper Limit of Diastolic Blood Pressure	Adult: (Lower limit+5)mmHg~210 mmHg ( (Lower limit+0.7)kPa~27.9 kPa) Pedi: (Lower limit+5)mmHg~150 mmHg ( (Lower limit+0.7)kPa~20.0 kPa) Neonate: (Lower limit+5)mmHg~100 mmHg ( (Lower limit+0.7)kPa~13.3 kPa)
Lower Limit of Diastolic Blood Pressure	Adult: 10 mmHg~ (Upper limit-5)mmHg (1.3 kPa~ (Upper limit-0.7)kPa) Pedi: 10 mmHg~ (Upper limit-5)mmHg (1.3 kPa~ (Upper limit-0.7)kPa) Neonate: 10 mmHg~ (Upper limit-5)mmHg (1.3 kPa~ (Upper limit-0.7)kPa)

## 6.6 Temperature (Temp) Monitoring

Range	0℃~50℃ (32°F~122°F)
Measuring Method	Thermal resistance method
Accuracy	The measuring tolerance is $\pm 0.1^{\circ}\text{C}$ (exclusive of probe tolerance)
Updating Interval	1 s
Nominal Resistance of Temp. Sensor	2252 $\Omega$ (25℃)
Type of Temp. Sensor	YSI400 Sensor or its Compatible Sensor (Precision $\pm 0.1^{\circ}\text{C}$ )
Channel Number	2 channels
Resolution	0.1℃
Alarm Indication	Audible & visual alarm, data and parameter blinking, alarm message displayed in the screen, 3 levels of alarm.
Alarm Limit Specifications	Range (℃)
Upper Limit	(Lower Limit +1)℃~50℃
Lower Limit	0℃~(Upper Limit -1)℃

## 6.7 IBP Monitoring

Measuring Method	Invasive direct measuring
Volume displacement (Abbott)	<0.04 mm <sup>3</sup> /100mmHg
<b>IBP</b>	

Measuring Range		-50 mmHg~350 mmHg
Resolution		1 mmHg
Accuracy		±2% or ±1 mmHg, whichever is higher (exclusive of the sensor)
Updating Interval		1 s
Alarm Limit Specifications		Range
Art P1 P2	Upper Limit of Systolic Blood Pressure	(Lower limit+2) mmHg~350 mmHg ( (Lower limit+0.3) kPa~46.7 kPa)
	Upper Limit of Mean Blood Pressure	
	Upper Limit of Diastolic Blood Pressure	
PA	Upper Limit of Systolic Blood Pressure	(Lower limit+2) mmHg~120 mmHg ( (Lower limit+0.3) kPa~16.0 kPa)
	Upper Limit of Mean Blood Pressure	
	Upper Limit of Diastolic Blood Pressure	
Art	Lower Limit of Systolic Blood Pressure	0 mmHg~ (Upper limit-2) mmHg (0 kPa~ (Upper limit-0.3) kPa)
	Lower Limit of Mean Blood Pressure	
	Lower Limit of Diastolic Blood Pressure	
P1 P2	Lower Limit of Systolic Blood Pressure	-50 mmHg~ (Upper limit-2) mmHg (-6.7 kPa~ (Upper limit -0.3) kPa)
	Lower Limit of Mean Blood Pressure	
	Lower Limit of Diastolic Blood Pressure	
PA	Lower Limit of Systolic Blood	-6 mmHg~ (Upper limit-2) mmHg (-0.8 kPa~ (Upper limit-0.3) kPa)

	Pressure	
	Lower Limit of Mean Blood Pressure	
	Lower Limit of Diastolic Blood Pressure	
LAP RAP	Upper Limit of Mean Blood Pressure	(Lower limit+2) mmHg~40 mmHg ( (Lower limit+0.3) kPa~5.3 kPa)
ICP CVP	Lower Limit of Mean Blood Pressure	-10 mmHg~ (Upper limit-2) mmHg (-1.3 kPa~ (Upper limit-0.3) kPa)

### 6.8 CO<sub>2</sub> Monitoring (Optional)

Measuring Mode	Sidestream type (support 50ml/min pumping rate), mainstream type
Measuring Method	Infrared radiation absorption technique

#### Phasein Sidestream ISA Module

Measuring Method	Infrared Spectrum Method
Measuring Mode	Sidestream
Range	0%~25%
Accuracy	At 0%~25%: $\pm(0.2\%+2\%$ of reading) At 15%~25%: undefined
Unit selection	%, mmHg, kPa
Operating temperature	0 °C~50 °C (32 °F~122 °F)
Storage&Transport temperature	-40 °C~70 °C (-40 °F~158 °F)
Operating humidity	10 %~95 % (non-condensing)
Storage&Transport humidity	5 %~100 % (non-condensing)
Operating atmospheric pressure	52.5 kPa~120 kPa (393.75 mmHg~900 mmHg)
Storage&Transport atmospheric pressure	20 kPa~120 kPa (150 mmHg~900 mmHg)
Preheating time	< 10 s (Report the concentration and reach the highest precision)
Total System Response Time	< 3 s (use of 2m sampling tube)
Primary agent threshold (ISA OR+/AX+)	0.15 vol%. When an agent is identified, concentrations will be reported even below 0.15 vol%
Secondary agent threshold (ISA OR+/AX+)	0.2 vol% + 10% of total agent concentration

Airway Leakage	≤0.5 ml/min
Range of Breathing Rate	0 rpm～150 rpm
Accuracy of Breathing Rate	±1 rpm
Asphyxia Alarm Delay	20 s, 25 s, 30 s, 35 s, 40 s, 45 s, 50 s, 55 s, 60 s
Sampling Flow Rate	50 ml/min ±10 ml/min
Automatic Pressure Compensation	yes
<b>Alarm Limit Specifications</b>	<b>Range</b>
EtCO <sub>2</sub> Upper Limit	(Lower Limit +2) mmHg～99 mmHg
EtCO <sub>2</sub> Lower Limit	0 mmHg～ (Upper Limit -2) mmHg
FiCO <sub>2</sub> Upper Limit	0 mmHg～99 mmHg
awRR Upper Limit	(Lower limit+2) rpm～100 rpm
awRR Lower Limit	0 rpm～ (Upper limit-2) rpm

**Phasein Mainstream IRMA Module**

Measuring Method	Infrared Spectrum Method
Measuring Mode	Mainstream
Range	0%～25%
Accuracy	Range:0 %～15 %, Default: ± (0.2 % + reading 2 %) ; Range:15%～25%, Default: Undefined。
Resolution	1 mmHg (0.133 kPa)
Unit selection	%, mmHg, kPa
Operating temperature	0 °C～40 °C (32 °F～104 °F)
Storage&Transport temperature	-40 °C～75 °C (-40 °F～167 °F)
Operating humidity	10 %～95 % (non-condensing)
Storage&Transport humidity	5 %～100 % (non-condensing)
Operating atmospheric pressure	52.5 kPa～120 kPa (393.75 mmHg～900 mmHg)
Storage&Transport atmospheric pressure	50 kPa～120 kPa (375 mmHg～900 mmHg)
Total System Response Time	< 1 s
Primary agent threshold	0.15 vol%. When an agent is identified, concentrations will be reported even below 0.15 vol% as long as apnea is not detected.
Secondary agent threshold	0.2 vol% + 10% of total agent concentration
Range of Breathing Rate	0 rpm～150 rpm
Accuracy of Breathing Rate	±1 rpm

Asphyxia Alarm Delay	20 s, 25 s, 30 s, 35 s, 40 s, 45 s, 50 s, 55 s, 60 s
Automatic Pressure Compensation	yes
<b>Alarm Limit Specifications</b>	<b>Range</b>
EtCO <sub>2</sub> Upper Limit	(Lower Limit +2) mmHg~99 mmHg
EtCO <sub>2</sub> Lower Limit	0 mmHg~ (Upper Limit -2) mmHg
FiCO <sub>2</sub> Upper Limit	0 mmHg~99 mmHg
awRR Upper Limit	(Lower limit+2) rpm~100 rpm
awRR Lower Limit	0 rpm~ (Upper limit-2) rpm

### Respironics Sidestream LoFlo Module

Measuring Method	Infrared Spectrum Method
Measuring Mode	Sidestream
Preheating time	Max. length of waveform is 20s. Full accuracy requirements satisfied after 2min (environment temp.: 25℃)
Range	0%~19.7% (0 mmHg ~150 mmHg) (0 kPa~20 kPa)
Resolution	0.1 mmHg 0 mmHg~69 mmHg 0.25 mmHg 70 mmHg~150 mmHg
Stability	Short-term drift: ≤0.8 mmHg (0.1 kPa) within 4h Long-term drift: accuracy maintained within 120h.
Unit selection	%, mmHg, kPa
Operating temperature	0 ℃~40 ℃ (32 ℉~104 ℉)
Storage temperature	-40 ℃~70 ℃ (-40 ℉~158 ℉)
Operating humidity	10 %~90 % (non-condensing)
Storage humidity	10 %~90 % (non-condensing)
Storage atmospheric pressure	53.33 kPa~106.67 kPa (400 mmHg~800 mmHg)
Accuracy (Gas Temp. at 25℃)	0 mmHg~40 mmHg (0 kPa~5.3 kPa), ±2 mmHg (0.27 kPa) 41 mmHg~70 mmHg (5.5 kPa~9.3 kPa), ±5% of the reading 71 mmHg~100 mmHg (9.4 kPa~13.3 kPa), ±8% of the reading 101 mmHg~150 mmHg (13.4 kPa~20 kPa), ±10% of the reading  (When the breathing rate is > 80 rpm, all ranges are ±12% of the reading)
Total System Response Time	< 3 s
Range of Breathing Rate	2 rpm~150 rpm
Accuracy of Breathing Rate	±1 rpm
Asphyxia Alarm Delay	20 s, 25 s, 30 s, 35 s, 40 s, 45 s, 50 s, 55 s, 60 s
Sampling Flow Rate	≥50 ml/min (100Hz)



Automatic Pressure Compensation	no
<b>Alarm Limit Specifications</b>	<b>Range</b>
EtCO <sub>2</sub> Upper Limit	(Lower Limit +2) mmHg~99 mmHg
EtCO <sub>2</sub> Lower Limit	0 mmHg~ (Upper Limit -2) mmHg
FiCO <sub>2</sub> Upper Limit	0 mmHg~99 mmHg
awRR Upper Limit	(Lower limit+2) rpm~100 rpm
awRR Lower Limit	0 rpm~ (Upper limit-2) rpm

**Respironics Mainstream CAPNOSTAT5 Module**

Measuring Method	Infrared Spectrum Method
Measuring Mode	Mainstream
Preheating time	Max. length of waveform is 15s. Full accuracy requirements satisfied after 2min (environment temp.: 25℃)
Range	0%~19.7% (0 mmHg~150 mmHg) (0 kPa~20 kPa)
Resolution	0.1 mmHg 0 mmHg~69 mmHg 0.25 mmHg 70 mmHg~150 mmHg
Stability	Short-term drift: ≤0.8 mmHg (0.1 kPa) within 4h Long-term drift: accuracy maintained within 120h.
Rise Time	< 60 ms
Unit selection	%, mmHg, kPa
Operating temperature	0 °C~45 °C (32 °F~113 °F)
Storage temperature	-40 °C~70 °C (-40 °F~158 °F)
Operating humidity	10 %~90 % (non-condensing)
Storage humidity	0 %~90 % (non-condensing)
Storage atmospheric pressure	50 kPa~106 kPa (375 mmHg~795 mmHg)
Accuracy (Environment Temp. at 35℃)	0 mmHg~40 mmHg (0 kPa~5.3 kPa), ±2 mmHg (0.27 kPa) 41 mmHg~70 mmHg (5.5 kPa~9.3 kPa), ±5% of the reading 71 mmHg~100 mmHg (9.4 kPa~13.3 kPa), ±8% of the reading 101 mmHg~150 mmHg (13.4 kPa~20 kPa), ±10% of the reading
Range of Breathing Rate	0 rpm~150 rpm
Accuracy of Breathing Rate	±1 rpm
Asphyxia Alarm Delay	20 s, 25 s, 30 s, 35 s, 40 s, 45 s, 50 s, 55 s, 60 s
Sampling Flow Rate	100 Hz
Automatic Pressure Compensation	no
<b>Alarm Limit</b>	<b>Range</b>

Specifications	
EtCO <sub>2</sub> Upper Limit	(Lower Limit +2) mmHg~99 mmHg
EtCO <sub>2</sub> Lower Limit	0 mmHg~ (Upper Limit -2) mmHg
FiCO <sub>2</sub> Upper Limit	0 mmHg~99 mmHg
awRR Upper Limit	(Lower limit+2) rpm~100 rpm
awRR Lower Limit	0 rpm~ (Upper limit-2) rpm

**Kingst KM7002-V33/KM7003-V40 Sidestream Module**

Measuring Method	Non-scattering Infrared Gas Analysis
Measuring Technology	Non-dispersive Infrared Gas Analysis (NIDR)
Range	0%~20% (0 mmHg~150 mmHg) (0 kPa~20 kPa)
Protection Level / Type	BF
Preheating time	2 min at 25 °C
Response Time	50 ml/min
Delay Time	50 ml/min
Fully-automatic Drift Calibration	Automated according to the time and temperature. Time 5 s~8 s
Operating temperature	5 °C~50 °C (41 °F~122 °F)
Storage temperature	-40 °C~70 °C (-40 °F~158 °F)
Environment humidity	30 %~75 % (non-condensing)
Environment pressure	80 kPa~106 kPa (600 mmHg~795 mmHg)
Airway Leakage	< 0.1% (within the flow range above)
Accuracy	When < 5.0%: ±0.3% (±2.0 mmHg) (0.27 kPa) When ≥5.0%: < 6% of the reading
Range of Breathing Rate	3 rpm~150 rpm
Accuracy of Breathing Rate	1% or ±1 rpm, whichever is higher.
Asphyxia Alarm Delay	30 s, 35 s, 40 s, 45 s, 50 s, 55 s, 60 s
Automatic Pressure Compensation	yes
<b>Alarm Limit Specifications</b>	<b>Range</b>
EtCO <sub>2</sub> Upper Limit	(Lower Limit +2) mmHg~99 mmHg
EtCO <sub>2</sub> Lower Limit	0 mmHg~ (Upper Limit -2) mmHg
FiCO <sub>2</sub> Upper Limit	0 mmHg~99 mmHg
awRR Upper Limit	(Lower limit+2) rpm~100 rpm
awRR Lower Limit	0 rpm~ (Upper limit-2) rpm

**6.9 C.O. Specifications(Optional)**

Measurement method	Thermodilution method	
Measuring range	C.O.:	0.01 ~ 20L/min
	TB:	23 ~ 43 °C
	TI:	0 ~ 27 °C
Resolution	C.O.:	0.01L/min
	TB, TI:	0.1 °C
Accuracy	C.O.:	± 5% or ±0.1 L /min, whichever is greater
	TB, TI:	±0.1 °C (without sensor)
Alarm Limit Specifications	Range	
TB Upper Limit	(Lower Limit + 1.1) ~ 43 °C (Lower Limit + 2) ~ 109.4 °F	
TB Lower Limit	23 ~ (Upper Limit - 1.1) °C 73.4 ~ (Upper Limit - 2) °F	

#### 6.10 AG Specifications(Optional)

Measurement method	Infrared radiation absorption characteristics	
Warm-up time	30 s	
Measuring range	CO <sub>2</sub> :	0% ~ 25 %
	O <sub>2</sub> :	0% ~ 100 %
	N <sub>2</sub> O:	0% ~ 100 %
	Des:	0% ~ 25 %
	Sev:	0% ~ 25 %
	Enf:	0% ~ 25 %
	Iso:	0% ~ 25 %
	Hal:	0% ~ 25 %
	awRR:	0 rpm ~ 254 rpm
Resolution	CO <sub>2</sub> :	1 mmHg
	awRR:	1 rpm
Measurement accuracy drift	Meet the accuracy requirements within 6 hours	
Suffocation alarm delay	20 s、25 s、30 s、35 s、40 s、45 s、50 s、55 s、60 s	
Update time	1 s	
IRMA AX+	Primary agent threshold	0.15 vol%. When an agent is identified, concentrations will be reported even below 0.15 vol% as long as apnea is not detected.

	Secondary agent threshold	0.2 vol% + 10% of total agent concentration			
ISA OR+/AX+	Primary agent threshold	0.15 vol%. When an agent is identified, concentrations will be reported even below 0.15 vol% as long as apnea is not detected.			
	Secondary agent threshold	0.2 vol% + 10% of total agent concentration			
Interfering gases and steam effect					
gases and steam	Gas concentration	Carbon dioxide			
		IRMA CO <sub>2</sub> 、OR	IRMA AX+/OR+	Anesthetic gas	Nitrous oxide
N <sub>2</sub> O <sup>4)</sup>	60 vol%	┐ <sub>1&amp;2)</sub>	┐ <sub>1&amp;2)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>
Hal <sup>4)</sup>	4	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>
Enf, Iso, Sev <sup>4)</sup>	5	Reading of +8% <sup>3)</sup>	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>
Des <sup>4)</sup>	15	Reading of +12% <sup>3)</sup>	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>
Xe (Xenon) <sup>4)</sup>	80	Reading of -10% <sup>3)</sup>		┐ <sub>1)</sub>	┐ <sub>1)</sub>
He (Helium) <sup>4)</sup>	50	Reading of -6% <sup>3)</sup>		┐ <sub>1)</sub>	┐ <sub>1)</sub>
Quantitative spray 4)		Not for quantitative spray			
Ethanol <sup>4)</sup>	0.3	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>
Isopropano <sup>4)</sup>	0.5	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>
Acetone <sup>4)</sup>	1	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>
Methane <sup>4)</sup>	3	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>
Carbon monoxide <sup>4)</sup>	1	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>
Nitric oxide <sup>5)</sup>	0.02	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>
Oxygen <sup>5)</sup>	100	┐ <sub>1&amp;2)</sub>	┐ <sub>1&amp;2)</sub>	┐ <sub>1)</sub>	┐ <sub>1)</sub>
Alarm Limit Specifications		Range			
EtCO <sub>2</sub> Upper Limit		(Lower Limit +2) mmHg～99 mmHg			
EtCO <sub>2</sub> lower limit		0 mmHg～ (Upper Limit -2) mmHg			
FiCO <sub>2</sub> Upper Limit		0 mmHg～99 mmHg			
awRR Upper Limit		(lower limit+2) rpm~100 rpm			
awRR lower limit		0 rpm~(upper limit-2) rpm			
FiEnf Upper Limit		(lower limit+0.2)%~8%			
FiEnf lower limit		0%~(upper limit-0.2)%			

EtEnf Upper Limit	(lower limit+0.2)%~8%
EtEnf lower limit	0%~(upper limit-0.2)%
EtHal Upper Limit	(lower limit+0.2)%~8%
EtHal lower limit	0%~(upper limit-0.2)%
Filso Upper Limit	(lower limit+0.2)%~8%
Filso lower limit	0%~(upper limit-0.2)%
EtIso Upper Limit	(lower limit+0.2)%~8%
EtIso lower limit	0%~(upper limit-0.2)%
EtSev Upper Limit	(lower limit+0.2)%~10%
EtSev lower limit	0%~(upper limit-0.2)%
FiSev Upper Limit	(lower limit+0.2)%~10%
FiSev lower limit	0%~(upper limit-0.2)%
EtDes Upper Limit	(lower limit+0.2)%~22%
EtDes lower limit	0%~(upper limit-0.2)%
FiDes Upper Limit	(lower limit+0.2)%~22%
FiDes lower limit	0%~(upper limit-0.2)%
FiO <sub>2</sub> Upper Limit	(lower limit+16) mmHg~760 mmHg((lower limit+2.1) kPa~101.1 kPa)
FiO <sub>2</sub> lower limit	136 mmHg~(upper limit-16) mmHg(18.1 kPa~(upper limit-2.1) kPa)
EtO <sub>2</sub> Upper Limit	(lower limit+16) mmHg~760 mmHg((lower limit+2.1) kPa~101.1 kPa)
EtO <sub>2</sub> lower limit	136 mmHg~(upper limit-16) mmHg(18.1 kPa~(upper limit-2.1) kPa)
FiN <sub>2</sub> O Upper Limit	(lower limit+2)%~100%
FiN <sub>2</sub> O lower limit	0%~(upper limit-2)%
EtN <sub>2</sub> O Upper Limit	(lower limit+2)%~100%
EtN <sub>2</sub> O lower limit	0%~(upper limit-2)%

### 6.11 Recorder Specifications

Recorder	To record the patient information, the hospital information, waveform, parameters and others displayed in the screen
Method	Thermal array recorder
Printing Paper	Thermal paper

## Product Specifications

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Print Resolution	8 dots/mm on Y-Axis
Delay Characteristics	$\leq 0.5$ mm
Amplitude-frequency Characteristics	Monitor Mode: 0.5 Hz $\sim$ 25 Hz; Diagnose Mode: 0.05 Hz $\sim$ 100 Hz.
Time Constant	$\geq 0.3$ s



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