

Xpod® Specification and Technical Information

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NONIN® Xpod Specifications

| | | | |
|----|--|---|-----------------|
| 1. | Displayed Oxygen Saturation Range (SpO₂) | 0 to 100% | |
| 2. | Displayed Pulse Rate Range | 18 to 321 beats per minute (BPM) | |
| 3. | Measurement Wavelengths and Output Power** | | |
| | Red: | 660 nanometers @ 0.8 mW maximum average | |
| | Infrared | 910 nanometers @ 1.2 mW maximum average | |
| | (using NONIN PureLight® Sensor): | | |
| 4. | SpO₂ Accuracy (A_{rms}*) | 70-100% | |
| | | Adults/Pediatrics | Neonates |
| | No Motion | | |
| | REUSABLE: | Finger Clip: ± 2 digits | ± 3 digits |
| | | Flex: ± 3 digits | ± 3 digits |
| | | Soft Sensor: ± 2 digits | N/A |
| | | 8000R: ± 3 digits | N/A |
| | | 8000Q: ± 4 digits | N/A |
| | DISPOSABLE: | 6000 Series: ± 2 digits | ± 3 digits |
| | | 7000 Series: ± 3 digits | ± 4 digits |
| | Motion | | |
| | REUSABLE: | Finger Clip: ± 2 digits | ± 3 digits |
| | | Flex: ± 3 digits | ± 4 digits |
| | | Soft Sensor: ± 3 digits | ± 4 digits |
| | Low Perfusion | | |
| | | All Sensors: ± 2 digits | ± 3 digits |
| 5. | Pulse Rate Accuracy | | |
| | | Adults/Pediatrics | Neonates |
| | No Motion (18-300 BPM) | | |
| | RESUABLE: | Finger Clip: ± 3 digits | ± 3 digits |
| | | Flex: ± 3 digits | ± 3 digits |
| | | Soft Sensor: ± 3 digits | ± 3 digits |
| | | 8000R: ± 3 digits | ± 3 digits |
| | | 8000Q: ± 3 digits | ± 3 digits |
| | DISPOSABLE: | 6000 Series: ± 3 digits | ± 3 digits |
| | | 7000 Series: ± 3 digits | ± 3 digits |
| | Motion (40-240 BPM) | | |
| | REUSABLE: | Finger Clip: ± 5 digits | ± 5 digits |
| | | Flex: ± 5 digits | ± 5 digits |
| | | Soft Sensor: ± 5 digits | ± 5 digits |
| | Low Perfusion (40-240 BPM) | | |
| | | All Sensors: ± 3 digits | ± 3 digits |

Notes:

Reusable Group:

Finger Clip Sensors: 8000AA-1, 8000AA-3, 8000AP-1, 8000AP-3

Flex Sensors: 8000J-1, 8000J-3, 8008J, 8001J

Soft Sensors: 8000SS, 8000SM, 8000SL

Disposable Group:

Flexi-Form® II (7000 Series) Sensors: 7000A, 7000P, 7000I, 7000N

6000 Series Sensors: 6000A, 6000P, 6000I, 6000N

* ±1 A_{rms} represents approximately 68% of measurements.

** This information is especially useful for clinicians performing photodynamic therapy.

| | | |
|-----|--------------------------------------|---|
| 6. | Temperature (Operating) | 0°C to +50°C (32°F – 122°F) |
| | | <ul style="list-style-type: none"> • Specified operating temperature is for the module. • Operating temperature of Sensor is not to exceed 40°C (104°F) |
| | Temperature (Storage/Transportation) | -20°C to +50°C (-4°F - +122°F) |
| 7. | Humidity (Operating) | 10 to 90% non-condensing |
| | Humidity (Storage/Transportation) | 10 to 95% non-condensing |
| 8. | Power Draw | 60 mW typical operation |
| 9. | Voltage Input | 2 to 6 VDC, w/100 mV max. ripple |
| 10. | I/O Signals | 0 to +5.0 VDC (nominal) |
| 11. | Patient Isolation | Meets IEC 60601-1 Dielectric withstand |
| 12. | Leakage Current | Not applicable |
| 13. | Dimensions | 2.1" x 0.8" x 0.6" (53 x 20 x 15 mm) |
| 14. | Weight | 75g (.27 oz.) (including 6' cable and connector) |
| 15. | Fluid Spill Resistance | None |
| 16. | Ruggedness (Shock) | IEC 60068-2-27 |
| | Ruggedness (Vibration) | Sinusoidal – IEC 60068-2-6 Random – IEC 60068-2-64 |
| 17. | Sensors | Designed to use NONIN®-branded PureLight® sensors only (see Accessories) |
| 18. | Shielding | An RF shield is included (placed over the analog components) |

Input/Output Formatting Options

INPUTS

Red Wire = V+ (2-6VDC, 60 mw typical)

Black Wire = Ground

Cable Shield = Ground (both Black wire and Cable Shield must be attached to ground on the host device)

Yellow Wire = ECG Sync (Optional)

Note: Sensor is not isolated from input voltage.

OUTPUTS

Green Wire = Serial Output

FORMATTING OPTIONS

| Order # | Model # | Serial Format # | With Connector |
|----------|---------|-----------------|----------------|
| 3873-001 | 3011 | #1 | No |
| 3873-002 | 3012 | #2 | No |
| 3873-101 | 3011 | #1 | Yes |
| 3873-202 | 3012 | #2 | Yes |

The serial transmission rate for all data formats shall be as follows:

| Bit Per Second | Data Bits | Parity | Stop Bits | Flow Control |
|----------------|-----------|--------|-----------|--------------|
| 9600 | 8 | None | 1 | None |

SERIAL DATA FORMAT #1

Packet Description

Three bytes of data are transmitted 1 once per second.

| Byte 1 - Status | | | | | | | |
|-----------------------------------|------|------|------|------|------|------|------|
| BIT7 | BIT6 | BIT5 | BIT4 | BIT3 | BIT2 | BIT1 | BIT0 |
| 1 | SNSD | OOT | LPRF | MPRF | ARTF | HR8 | HR7 |
| *Note: Bit 7 is always set | | | | | | | |

| Byte 2 - Heart Rate | | | | | | | |
|-------------------------------------|------|------|------|------|------|------|------|
| BIT7 | BIT6 | BIT5 | BIT4 | BIT3 | BIT2 | BIT1 | BIT0 |
| 0 | HR6 | HR5 | HR4 | HR3 | HR2 | HR1 | HR0 |
| *Note: Bit 7 is always clear | | | | | | | |

| Byte 3 - SpO2 | | | | | | | |
|-------------------------------------|------|------|------|------|------|------|------|
| BIT7 | BIT6 | BIT5 | BIT4 | BIT3 | BIT2 | BIT1 | BIT0 |
| 0 | SP6 | SP5 | SP4 | SP3 | SP2 | SP1 | SP0 |
| *Note: Bit 7 is always clear | | | | | | | |

The following are all active high:

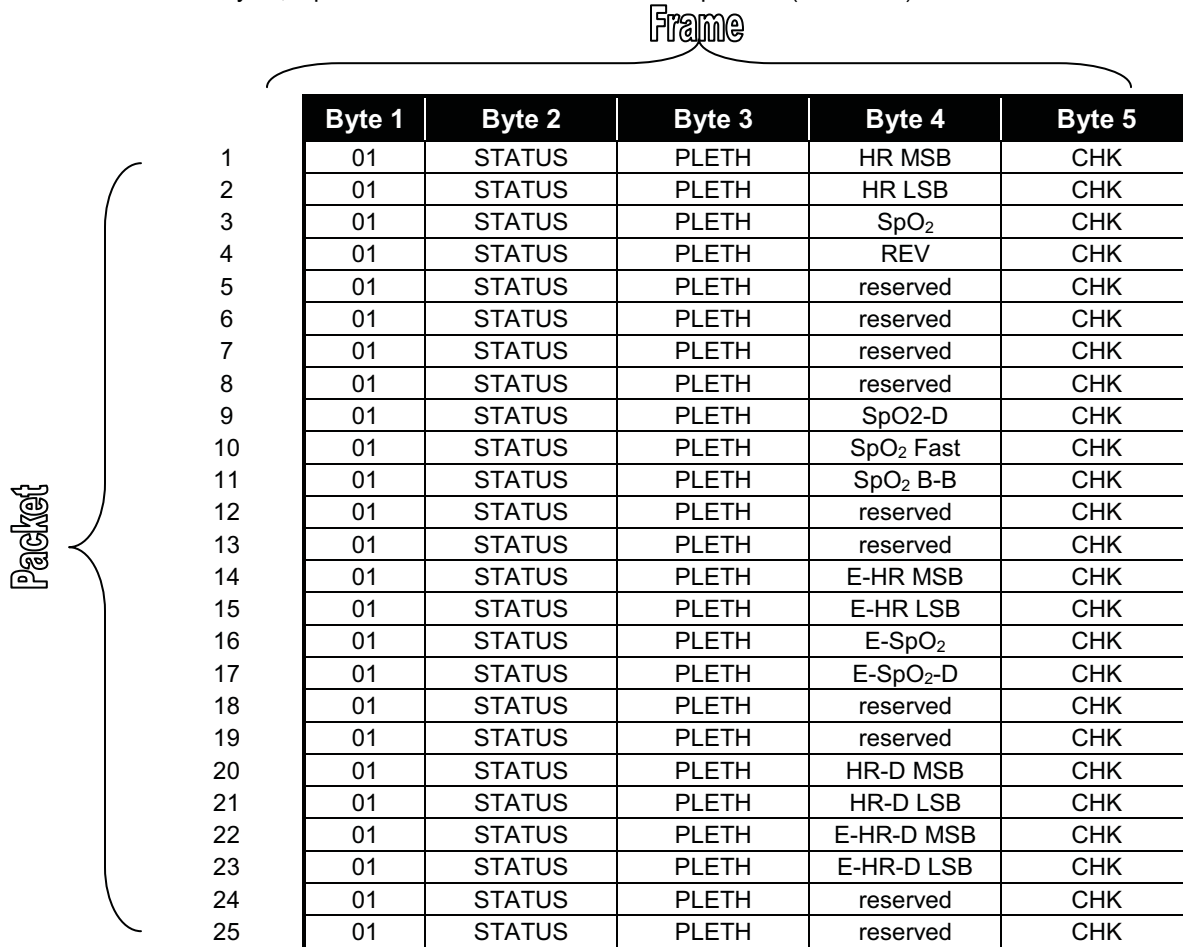
| | | |
|------------|--------------------|--|
| SNSD: | Sensor Disconnect | – Sensor is not connected to oximeter or sensor is inoperable. |
| OOT: | Out Of Track | – An absence of consecutive good pulse signals. |
| LPRF: | Low Perfusion | – Amplitude representation of low signal quality (holds for entire duration). |
| MPRF: | Marginal Perfusion | – Amplitude representation of medium signal quality (holds for entire duration). |
| ARTF: | Artifact | – A detected pulse beat didn't match the current pulse interval. |
| HR8 – HR0: | Heart Rate | – Standard 4-beat average values not including display holds. |
| SP6 – SP0: | SpO ₂ | – Standard 4-beat average values not including display holds. |

When SpO₂ and HR cannot be computed, the system will send a missing data indicator. For missing data, the HR equals 511 and the SpO₂ equals 127.

Serial Data Format #2:

Packet Description

A frame consists of 5 bytes; a packet consists of 25 frames. Three packets (75 frames) are transmitted each second.



| | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 |
|----|--------|--------|--------|-----------------------|--------|
| 1 | 01 | STATUS | PLETH | HR MSB | CHK |
| 2 | 01 | STATUS | PLETH | HR LSB | CHK |
| 3 | 01 | STATUS | PLETH | SpO ₂ | CHK |
| 4 | 01 | STATUS | PLETH | REV | CHK |
| 5 | 01 | STATUS | PLETH | reserved | CHK |
| 6 | 01 | STATUS | PLETH | reserved | CHK |
| 7 | 01 | STATUS | PLETH | reserved | CHK |
| 8 | 01 | STATUS | PLETH | reserved | CHK |
| 9 | 01 | STATUS | PLETH | SpO ₂ -D | CHK |
| 10 | 01 | STATUS | PLETH | SpO ₂ Fast | CHK |
| 11 | 01 | STATUS | PLETH | SpO ₂ B-B | CHK |
| 12 | 01 | STATUS | PLETH | reserved | CHK |
| 13 | 01 | STATUS | PLETH | reserved | CHK |
| 14 | 01 | STATUS | PLETH | E-HR MSB | CHK |
| 15 | 01 | STATUS | PLETH | E-HR LSB | CHK |
| 16 | 01 | STATUS | PLETH | E-SpO ₂ | CHK |
| 17 | 01 | STATUS | PLETH | E-SpO ₂ -D | CHK |
| 18 | 01 | STATUS | PLETH | reserved | CHK |
| 19 | 01 | STATUS | PLETH | reserved | CHK |
| 20 | 01 | STATUS | PLETH | HR-D MSB | CHK |
| 21 | 01 | STATUS | PLETH | HR-D LSB | CHK |
| 22 | 01 | STATUS | PLETH | E-HR-D MSB | CHK |
| 23 | 01 | STATUS | PLETH | E-HR-D LSB | CHK |
| 24 | 01 | STATUS | PLETH | reserved | CHK |
| 25 | 01 | STATUS | PLETH | reserved | CHK |

Notes:

- Byte number 1 in each frame is set to a value of 1.
- Reserved bytes are undefined.

| Byte 2 - Status | | | | | | | |
|-----------------------------|------|------|------|------|------|------|------|
| BIT7 | BIT6 | BIT5 | BIT4 | BIT3 | BIT2 | BIT1 | BIT0 |
| 1 | SNSD | ARTF | OOT | SNSA | YPRF | | SYNC |
| | | | | | RPRF | GPRF | |
| *Note: Bit 7 is always set. | | | | | | | |

The following are all active high:

| | | |
|-------|-------------------|--|
| SNSD: | Sensor Disconnect | – Sensor is not connected to oximeter or sensor is inoperable. |
| ARTF: | Artifact | – A detected pulse beat didn't match the current pulse interval |
| OOT: | Out Of Track | – An absence of consecutive good pulse signals |
| SNSA: | Sensor Alarm | – Sensor is providing unusable data for analysis |
| RPRF: | Red Perfusion | – Amplitude representation of low signal quality (occurs only during pulse) |
| YPRF: | Yellow Perfusion | – Amplitude representation of medium signal quality (occurs only during pulse) |
| GPRF: | Green Perfusion | – Amplitude representation of high signal quality (occurs only during pulse) |
| SYNC: | Frame Sync | (occurs 1 of 25) |

Generic HR Format:

| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------------|---|-----|-----|-----|-----|-----|-----|-----|
| HR MSB | X | X | X | X | X | X | HR8 | HR7 |
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| HR LSB | X | HR6 | HR5 | HR4 | HR3 | HR2 | HR1 | HR0 |

Generic SpO₂ Format:

| | | | | | | | | |
|------------------------|---|-----|-----|-----|-----|-----|-----|-----|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| SPO₂ | X | SP6 | SP5 | SP4 | SP3 | SP2 | SP1 | SP0 |

- HR: 4-beat average values in standard mode.
- SpO₂: 4-beat average values in standard mode.
- HR-D: 4-beat average displayed values in display mode
- SpO₂-D: 4-beat average displayed values in display mode
- SpO₂ Fast: Non-slew limited saturation with 4-beat averaging in standard mode.
- SpO₂: B-B: Un-averaged, non-slew limited, beat to beat value in standard mode.
- E-HR: 8-beat average values in standard mode.
- E-SpO₂: 8-beat average values in standard mode.
- E-HR-D: 8-beat average displayed values in display mode
- E-SpO₂-D: 8-beat average displayed values in display mode
- PLETH: 8-Bit Plethysmographic Pulse Amplitude
- SREV: Oximeter Firmware Revision Level
- CHK: Checksum = (Byte 1) + (Byte 2) + (Byte 3) + (Byte 4) modulo 256

When SpO₂ and HR cannot be computed, the system will send a missing data indicator. For missing data, the HR equals 511 and the SpO₂ equals 127.

| Mode | In Track | Out of Track |
|----------|---|--|
| Standard | SpO ₂ and pulse rate updated on every pulse beat | SpO ₂ and Heart Rate values are set to missing data values and out of track indicated. |
| Display | SpO ₂ and pulse rate updated every 1.5 seconds | Last in track values transmitted for ten seconds and out of track indicated. After ten seconds, values are set to missing data values. |

Indications for Use

The Xpod® module is intended to provide medical device manufacturers with a small, low-power device that can be easily integrated into a host device. The module measures functional oxygen saturation of arterial hemoglobin (%SpO₂) and pulse rate (BPM) for adult, pediatric, infant and neonatal patients. The module also has the ability to measure SpO₂ and higher pulse rates for veterinary use. When integrated with a medical device manufacturer's host system, the Xpod® module may be used in any environment where pulse oximetry measurements are made.

Contraindications

- Do not use this device in an MR environment.
- Explosive Hazard: Do not use this device in an explosive atmosphere or in the presence of flammable anesthetics or gases
- This module does not meet defibrillation-proof requirement per IEC 60601-1: 1990, clause 17.h.

Warnings

- Use only with NONIN®-branded PureLight® pulse oximeter sensors. These sensors are manufactured to meet the accuracy specifications for NONIN® pulse oximeters. Using other manufacturers' sensors can result in inaccurate pulse oximeter performance.
- Loss of monitoring can result if any objects hinder the pulse measurement. Ensure that no blood flow restrictors (e.g., blood pressure cuff) hinder pulse measurements.
- As with all medical equipment, carefully route cables and connections to reduce the possibility of entanglement or strangulation.
- Operation of this module below the minimum amplitude of 0.3% modulation may cause inaccurate results.
- The use of accessories, sensors, and cables other than those specified by NONIN® (may result in increased emission and/or decreased immunity of this device.
- Do not use a damaged sensor.



Cautions

- The accuracy of the SpO₂ measurement may be affected if the total sensor cable length (including extension cables) is greater than 3 meters.
- Follow local, state, or national governing ordinances and recycling instructions regarding disposal or recycling of the device and device components.
- In compliance with the European Directive on Waste Electrical and Electronic Equipment (WEEE) 2002/96/EC, do not dispose of this product as unsorted municipal waste. This device contains WEEE materials; please contact your distributor regarding take-back or recycling of the device.
- This pulse oximeter module is designed to determine the percentage of arterial oxygen saturation of functional hemoglobin. Significant levels of dysfunctional hemoglobin, such as methemoglobin, might affect the accuracy of the measurement. Factors that may degrade pulse oximeter performance or affect the accuracy of the measurement include the following: excessive ambient light, excessive motion, electro-surgical interference, blood flow restrictors (arterial catheters, blood pressure cuffs, infusing lines, etc.), moisture in the sensor, improperly applied sensor, incorrect sensor type, poor pulse quality, venous pulsations, anemia or low hemoglobin concentrations, cardiogreen or other intravascular dyes, carboxyhemoglobin, methemoglobin, dysfunctional hemoglobin, artificial nails or fingernail polish, or a sensor not at heart level.
- This device has motion tolerant software that minimizes the likelihood of motion artifact being misinterpreted as good pulse quality. In some circumstances, however, this device may still interpret motion as good pulse quality. This covers all available outputs (i.e. SpO₂, HR, PLETH, PPG).
- Inspect the sensor application site at least every 6 to 8 hours to ensure correct sensor alignment and skin integrity. Patient sensitivity may vary due to medical status or skin condition. Discontinue use of adhesive tape strips if the patient exhibits an allergic reaction to the adhesive material.



Cautions

- This equipment complies with IEC EN 60601-1-2:2001 for electromagnetic compatibility for medical electrical equipment and/or systems. This standard is designed to provide reasonable protection against harmful interference in a typical medical installation. However, because of the proliferation of radio-frequency transmitting equipment and other sources of electrical noise in healthcare and other environments, it is possible that high levels of such interference due to close proximity or strength of a source might disrupt the performance of this device. Medical electrical equipment needs special precautions regarding EMC, and all equipment must be installed and put into service according to the EMC information specified in this manual.
- Portable and mobile RF communications equipment may affect medical electrical equipment.
- Oximeter readings may be affected by the use of an electrosurgical unit (ESU)
- The oximeter sensor may not work on cold extremities due to reduced circulation. Warm or rub the finger to increase circulation, or reposition the sensor.
- A functional tester cannot be used to assess the accuracy of a pulse oximeter or sensor.

For more information about required safety and regulatory requirements for pulse oximeters, refer to ISO 9919: 2005 and IEC 60601-1:1990. Additional safety information can be found in the labeling provided with each NONIN® sensor.

Equipment Response Time

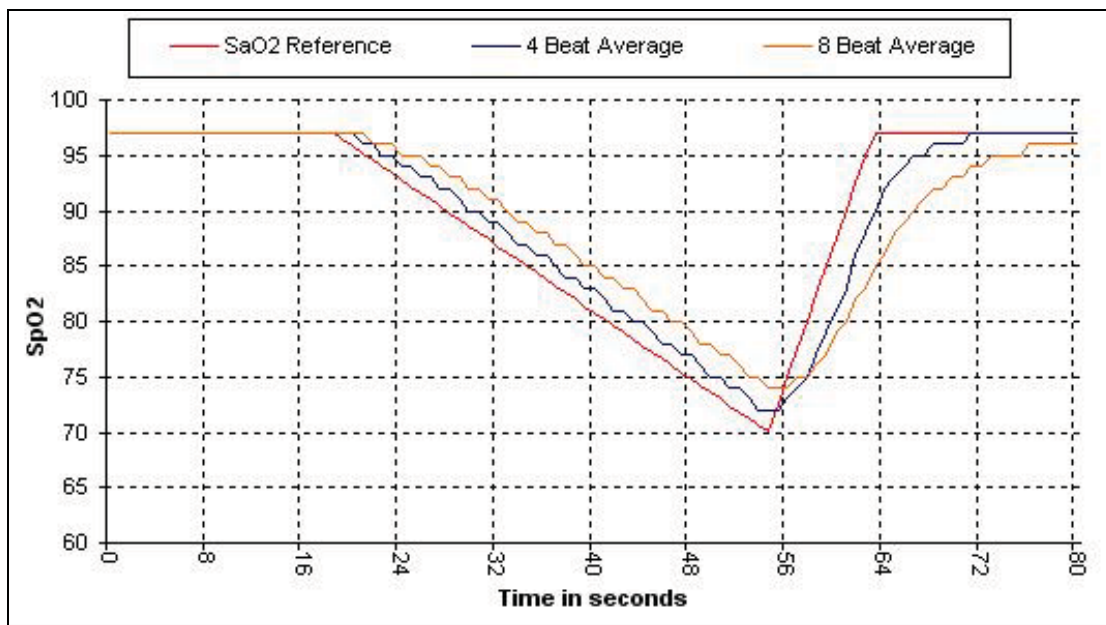
| SpO ₂ Values | Average | Latency |
|---|--------------------|---------|
| Standard/Fast Averaged SpO ₂ | 4 beat exponential | 2 beats |
| Extended Averaged SpO ₂ | 8 beat exponential | 2 beats |

| Pulse Rate Values | Average | Latency |
|-----------------------------------|--------------------|---------|
| Standard/Fast Averaged Pulse Rate | 4 beat exponential | 2 beats |
| Extended Averaged Pulse Rate | 8 beat exponential | 2 beats |

Example – SpO₂ Exponential Averaging

SpO₂ decreases 0.75% per second (7.5% over 10 seconds)

Pulse Rate – 75 BPM



Specific to this example:

The response of the 4-beat average is 1.5 seconds.

The response of the 8-beat average is 3 seconds.

Accessories

The following NONIN® accessories may be used with the Xpod® module. See the respective sensor instructions for detailed information regarding specified sensor use (patient population, body/tissue, and application).

| Model Number | Description |
|---------------------|---|
| 8000AA | Adult Articulated Internal Spring Finger Clip, 3 feet / 1 meter cable |
| 8000AP | Pediatric External Spring Finger Clip, 3 feet / 1 meter cable |
| 8000J | Adult Flex, 3 feet / 1 meter cable |
| 8001J | Neonatal Flex, 3 feet / 1 meter cable |
| 8008J | Infant Flex, 3 feet / 1 meter cable |
| 8000Q | Ear Clip, 3 feet / 1 meter cable |
| 8000R | Reflectance, 3 feet / 1 meter cable |
| 8000SS | Sensor, Reusable, Soft, Small, 1 Meter |
| 8000SM | Sensor, Reusable, Soft, Medium, 1 Meter |
| 8000SL | Sensor, Reusable, Soft, Large, 1 Meter |
| 7000A | Flexi-Form® II Adult, 3 feet / 11 meter, 10-pack |
| 7000P | Flexi-Form® II Pediatric, 3 feet / 1 meter cable, 10-pack |
| 7000I | Flexi-Form® II Infant, 3 feet / 11 meter, 10-pack |
| 7000N | Flexi-Form® II Adult, 3 feet / 11 meter, 10-pack |
| 6000A | Sensor, Disposable, Adult, 45cm Cable |
| 6000P | Sensor, Disposable, Pediatric, 45cm Cable |
| 6000I | Sensor, Disposable, Infant, 90cm Cable |
| 6000N | Sensor, Disposable, Neonate, 90cm Cable |
| UNI-RA-0 | 7.5" 90-degree Patient Cable |
| UNI EXT-X | Patient Extension Cable (select 1, 3, 6 or 9 meters) |

Testing Summary

SpO₂ accuracy, motion and low perfusion testing was conducted by NONIN® Medical, Incorporated as described below.

SpO₂ Accuracy Testing

SpO₂ accuracy testing is conducted during induced hypoxia studies on healthy, non-smoking, light-to-dark-skinned subjects during motion and no-motion conditions in an independent research laboratory. The measured arterial hemoglobin saturation value (SpO₂) of the sensors is compared to arterial hemoglobin oxygen (SaO₂) value, determined from blood samples with a laboratory co-oximeter. The accuracy of the sensors in comparison to the co-oximeter samples measured over the SpO₂ range of 70 – 100%. Accuracy data is calculated using the root-mean-squared (A_{rms} value) for all subjects, per ISO 9919:2005, Standard Specification for Pulse Oximeters for Accuracy.

Pulse Rate Motion Testing

This test measures pulse rate accuracy with motion artifact simulation introduced by a pulse oximeter tester. This test determines whether the oximeter meets the criteria of ISO 9919:2005 for pulse rate during simulated movement, tremor, and spike motions.

Low Perfusion Testing

This test uses an SpO₂ Simulator to provide a simulated pulse rate, with adjustable amplitude settings at various SpO₂ levels. The module must maintain accuracy in accordance with ISO 9919:2005 for pulse rate and SpO₂ at the lowest obtainable pulse amplitude (0.3% modulation).

Manufacturer's Declaration

See the following tables for specific information regarding this module's compliance to IEC 60601-1-2:2001.

Table 1: Electromagnetic Emissions

| Emissions Test | Compliance | Electromagnetic Environment—Guidance |
|--|------------|---|
| <i>This module is intended for use in the electromagnetic environment specified below. The customer and/or user of this device should ensure that it is used in such an environment.</i> | | |
| RF Emissions CISPR 11 | Group 1 | This module is suitable for use in all establishments, including domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes. |
| RF Emissions CISPR 11 | Class B | |
| Harmonic Emissions IEC 61000-3-2 | N/A | |
| Voltage Fluctuations/ Flicker Emissions IEC 61000-3-3 | N/A | |

Table 2: Electromagnetic Immunity

| Immunity Test | IEC 60601 Test Level | Compliance Level | Electromagnetic Environment—Guidance |
|--|----------------------------|----------------------------|---|
| <i>This module is intended for use in the electromagnetic environment specified below. The customer and/or user of this device should ensure that it is used in such an environment.</i> | | | |
| Electrostatic Discharge (ESD) IEC 61000-4-2 | ±6 kV contact ±8 kV air | ±6 kV contact ±8 kV air | Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%. |
| Electrical Fast Transient/Burst IEC 61000-4-4 | N/A | N/A | Mains power quality should be that of a typical commercial or hospital environment. |
| Surge IEC 61000-4-5 | N/A | N/A | Mains power quality should be that of a typical commercial or hospital environment. |
| Voltage dips, short interruptions, and voltage variations on power supply input lines IEC 61000-4-11 | N/A | N/A | Mains power quality should be that of a typical commercial or hospital environment. If the user of the module requires continued operation during power mains interruptions, it is recommended that the device be powered from an uninterruptible power supply or battery pack. |
| Power Frequency (50/60 Hz) Magnetic Field IEC 61000-4-8 | 3 A/m | 3 A/m | Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment. |
| Note: U_T is the AC mains voltage before application of the test level. | | | |

Table 3: Guidance and Manufacturer’s Declaration—Electromagnetic Immunity


| Immunity Test | IEC 60601 Test Level | Compliance Level | Electromagnetic Environment—Guidance |
|---|--|-------------------------|---|
| <p><i>This module is intended for use in the electromagnetic environment specified below. The customer and/or user of this module should ensure that it is used in such an environment.</i></p> | | | |
| <p>Portable and mobile RF communications equipment should be used no closer to any part of the module, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> | | | |
| <p>Conducted RF IEC 61000-4-6</p> <p>Radiated RF IEC 61000-4-3</p> | <p>3 Vrms 150 kHz to 80 MHz</p> <p>3 V/m 80 MHz to 2.5 GHz</p> | <p>3 V</p> <p>3 V/m</p> | <p>Recommended Separation Distance</p> <p>$d = 1.17 \sqrt{P}$</p> <p>$d = 1.17 \sqrt{P}$ 80 MHz to 800MHz</p> <p>$d = 2.33 \sqrt{P}$ 800MHz to 2.5 GHz</p> <p>where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey^a, should be less than the compliance level in each frequency range.^b</p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> <div style="text-align: center;">  </div> |
| <p>Notes:</p> <ul style="list-style-type: none"> • At 80 MHz and 800MHz, the separation distance for the higher frequency range applies. • These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people. <p>a) Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the device is used exceeds the applicable RF compliance level above, the device should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the module.</p> <p>b) Over the frequency range 150 kHz to 80 MHz, field strengths should be less than [3] V/m.</p> | | | |

Table 4: Recommended Separation Distances

The following table describes the recommended separation distances between portable and mobile RF communications equipment and this module.

| <i>This module is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. Customers or users of this module can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communication equipment (transmitters) and the module as recommended below, according to maximum output power of the communications equipment.</i> | | | |
|--|---|---|--|
| Separation Distance According to Frequency of Transmitter | | | |
| Rated Maximum Output Power of Transmitter W | 150 kHz to 80 MHz $d = 1.17\sqrt{P}$ | 80 MHz to 800 MHz $d = 1.17\sqrt{P}$ | 800 MHz to 2.5 GHz $d = 2.33\sqrt{P}$ |
| 0.01 | 0.12 | 0.12 | 0.23 |
| 0.1 | 0.37 | 0.37 | 0.74 |
| 1 | 1.2 | 1.2 | 2.3 |
| 10 | 3.7 | 3.7 | 7.4 |
| 100 | 12 | 12 | 23 |
| For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. | | | |
| Notes: <ul style="list-style-type: none"> • At 80 MHz and 800MHz, the separation distance for the higher frequency range applies. • These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people. | | | |