

Nonin Model 4100 containing Bluetooth Technology SPECIFICATIONS

1. Oxygen Saturation Range	0 to 100%
2. Pulse Rate Range	18 to 300 pulses per minute
3. Measurement Wavelengths Using Nonin Sensors	Red 660 Nanometers @ 3mW Nominal Infrared 910 Nanometers @ 3mW Nominal
4. Accuracy SpO ₂ (± 1 Standard Deviation) ♦	70 - 100% ± 2 digits for adults using the Finger Clip Sensor. Model 8000AA-WO 70 - 100% ± 3 digits for adults using Flex Sensor. Model 8000J-WO
Heart Rate Accuracy	± 3% ± 1 digit
♦ Standard Deviation is a statistical measure: up to 32% of the readings may fall outside these limits.	
5. Temperature	
a) Operating	-20° C to +50° C
b) Non Operating	-30° C to +50° C
6. Humidity	
a) Operating	10 to 90% Non Condensing
b) Non Operating	10 to 95% Non Condensing
8. Input Power	2 AA Batteries
9. Battery Life	120 Hours Continuous Operation
9. Bluetooth Specification Version	V1.1
10. Bluetooth Profiles Supported	Serial Port Profile
11. Dimensions	3" x 2.74" x 1.34" (without wrist strap)
12. Weight	125g (with batteries installed)

13. Ruggedness

- a) Shock
- b) Vibration

IEC 60068-2-27
Sinusoidal – IEC 60068-2-6
Random – IEC 60068-2-64

14. Sensors

Designed to use *Nonin* sensors only

SERIAL INPUT SPECIFICATIONS

The serial data format desired is selected by sending a command to the model 4100.

The software allows serial input from the master when the 4100 is not transmitting data (/RTS low) and the master is connected to the 4100. If no data format command is received, the software will automatically send Data Format 2 five seconds after the Bluetooth connection is made. The following commands will be recognized:

1. Set Serial Data Format

Protocol:

Command: "Dn where n is Serial Data Format # in ASCII-decimal (1-9)

Response: <ACK>

Denied Response: <NAK> if out of range data

Note: 1 character expected following the "D" so length is inherent, no need for termination

2. Unrecognized Command (until 1st character of command is recognized)

Response: <NAK>

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

There are currently two data formats. Data format 1 and Data format 2.

Bits 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	– An absence of signal, meaning the sensor is disconnected
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	– Indicates an artifact condition
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.

FRAME						
PACKET		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	SpO2	CHK
	4	01	STATUS	PLETH	SREV	CHK
	5	01	STATUS	PLETH	reserved	CHK
	6	01	STATUS	PLETH	reserved	CHK
	7	01	STATUS	PLETH	reserved	CHK
	8	01	STATUS	PLETH	BTS	CHK
	9	01	STATUS	PLETH	SpO2-D	CHK
	10	01	STATUS	PLETH	SpO2 Fast	CHK
	11	01	STATUS	PLETH	SpO2 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-SpO2	CHK
	17	01	STATUS	PLETH	E-SpO2-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

Note 1: Byte number 1 in each frame is set to a value of 1.

Note 2: Reserved bytes are undefined

Byte 2 - STATUS							
BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
1	SNSD	ARTF	OOT	SNS A	YPRF		SYNC
					RPRF	GPRF	

*Note: Bit 7 is always set

The following are all active high.

SNSD: Sensor Disconnect – An absence of signal, meaning the sensor is gone
 ARTF: Artifact – Indicates an artifact condition
 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
 BTS: Battery status, bit01=low, bit02=critical
 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	SpO2 and pulse rate updated on every pulse beat	Values are set to out of range, sensor alarm indicated.
Display	SpO2 and pulse rate updated every 1½ seconds	Last in track values transmitted for ten seconds and sensor alarm indicated. After ten seconds values are set to out of range.