NELLCOR N400
RS232 COMMUNICATION

RS232 Parameters:

- 1200, 2400, 9600, 19200 baud
- 8 data bits
- 1 stop bit
- no parity

Pinouts:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>not used</td>
</tr>
<tr>
<td>2</td>
<td>RXD</td>
</tr>
<tr>
<td>3</td>
<td>TXD</td>
</tr>
<tr>
<td>4</td>
<td>not used</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
</tr>
<tr>
<td>6</td>
<td>not used</td>
</tr>
<tr>
<td>7</td>
<td>not used</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
</tr>
<tr>
<td>9</td>
<td>not used</td>
</tr>
</tbody>
</table>

- Pin 8 (CTS) may be used to control data transmission. When held "high", data transmission takes place. When "low" data transmission is suspended temporarily.
- Loss of data may occur if pin 8 is held "low" for longer than four seconds.

DIP Switch Settings:

Output Format

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<th>Format</th>
<th>Description</th>
<th>Switch Settings</th>
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<td>Request for parameter</td>
<td>6</td>
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<td>Beat-to-Beat</td>
<td>Outputs heart rate and saturation once per beat</td>
<td>DOWN</td>
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Baud Rate

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>Switch Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200</td>
<td>UP</td>
</tr>
<tr>
<td>2400</td>
<td>DOWN</td>
</tr>
<tr>
<td>9600</td>
<td>UP</td>
</tr>
<tr>
<td>19200</td>
<td>DOWN</td>
</tr>
</tbody>
</table>
Communications Formats:

Conversation Format

In this mode, the output is a single parameter, sent by request only. For example, the computer requests the current pulse rate by sending an “R.” The interface responds with:

\[ <\text{STX}>Rnnn <\text{CR}> <\text{LF}> \]

where \((nnn)\) is the pulse rate. Other request codes are listed below:

- \(R\) = Pulse Rate \((nnn)\)
- \(S\) = Saturation % \((nnn)\)
- \(P\) = Signal Quality \((nnn)\)
- \(O\) = Low Saturation Alarm Limit \((nnn)\)
- \(A\) = Alarm Status in ASCII-coded decimal:
  - Bit 0 = not used (default = 0)
  - Bit 1 = not used (default = 0)
  - Bit 2 = Low Sat Limit (1 = alarm active, 0 = no alarm)
  - Bit 3 = not used (default = 0)
  - For example, ASCII 004 = binary 0100 = low sat alarm limit active.
- \(M\) = Monitor Status in ASCII-coded decimal
  - Bit 0 = Pulse Search Status 1 = Locked 0 = Search
  - Bit 1 = Sensor Status 1 = Attached 0 = Off or invalid sensor
  - Bit 2 = Audio Alarm Status 1 = Enabled 0 = Disabled
  - Bit 3 = ECG Signal Status 1 = Not in Use 0 = In Use
  - Bit 4 = Response Time 1 = Mode 2 0 = Mode 1
  - Bit 5 = Sensor Contact 1 = sensor in contact 0 = sensor lifted
  - Bit 6 = not applicable (default = 1)
  - Bit 7 = Monitor Communication 1 = Lost 0 = Intact
  - For example, if the monitor status byte is ASCII 015, (binary 00001111), this means that the monitor is locked on pulse, sensor attached, audio alarms enabled, and ECG signals are being received on the analog port.
- \(T\) = Time \((hhmmss)\)
- \(V\) = Version (Number Nellcor N-400 V 4.n.n.nn [4.n.n.nn])
  - \(n\) = ASCII character, normally a number

\[ <\text{STX}> = 02 \text{ hex} \]
\[ <\text{CR}> = 0D \text{ hex} \]
\[ <\text{LF}> = 0A \text{ hex} \]

Beat-to-Beat Format

This mode transmits saturation and pulse rate data once per beat in the following format:

\[ RnnnSnnn<\text{space}><\text{CR}><\text{LF}> \]

\(<\text{space}> = 20\text{H} \]
\[ <\text{CR}> = 0D \text{ hex} \]
\[ <\text{LF}> = 0A \text{ hex} \]