Tech Note

BP-600 Non-Invasive Blood Pressure Sensor

Overview

A person's cardiac output, peripheral vascular resistance, blood pressure, and other cardiovascular parameters change hundreds of times in response to the activities and events taking place in the person's daily schedule. A device like the BP-600 makes it easy to study the changes in blood pressure that take place over the course of an event or an activity.

The BP-600 has two major components: a blood pressure cuff used to occlude the flow of blood in a subject's brachial artery; and a pressure transducer used to monitor the pressures in the cuff that correspond to the systolic and diastolic blood pressures. The output of the pressure transducer is a voltage that can be recorded by a data acquisition unit and converted into units of pressure (mmHg) by calibration.

After blood flow in the subject's arm is occluded, the pressure is released from the cuff by another student who is listening for the return of pulsatile blood flow in the arm, The first Korotkoff sound to be heard occurs at the systolic pressure and the second Korotkoff sound is at the diastolic pressure. To make it easier for students to find the systolic and diastolic pressures, the output of a pulse transducer attached to the subject's finger can be used to indicate the presence or absence of blood flow in the arm before, during, and after the occlusion of the subject's brachial artery.

How It Works

When the blood pressure cuff is placed on a subject's upper arm and inflated to a pressure above that person's systolic pressure, blood flow to the lower arm is occluded so that pulse wave will not be seen when a pulse plethysmograph is used or heard when a stethoscope is used. As pressure is released from the cuff, the output of the pressure transducer will go down. Blood will begin to flow as the pressure in the cuff falls below the subject's systolic pressure. The pressure at which the pulse is first heard or seen on the recording from the pulse plethysmograph can be identified on the recording by a mark that labels the systolic pressure. As the pressure continues to be released from the cuff and the output of the pressure continues to go down, the amplitude of the pulse wave increases up to a maximum. The pressure at which the first maximum pulse wave is seen or heard during the release of pressure from the cuff is the diastolic pressure.

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BP-600 Non-Invasive Blood Pressure Sensor

Equipment Setup

Plug the DIN connector of the BP-600 into the female end of the DIN-DIN extension cable. Plug the male end of the DIN-DIN extension cable into to DIN input of an iWorx data acquisition unit or amplifier (Figure 1).

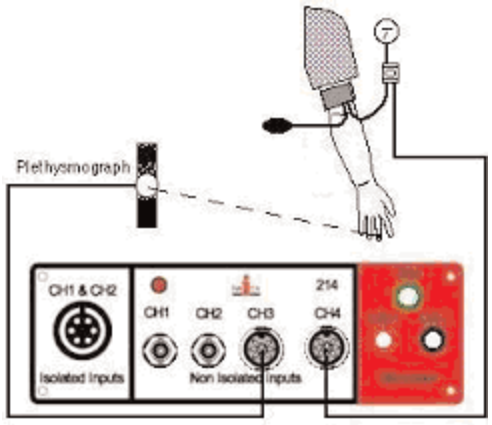

Figure 1: Devices used to record blood pressure: a non-invasive blood pressure sensor; and a pulse plethysmograph which is used to indicate blood flow or occlusion.

Calibration of the BP-600

1. Put the blood pressure cuff on the upper arm of the subject. Align the arrow on the cuff over the subject's brachial artery. Place the plethysmograph on the distal segment of the middle finger. Wrap the Velcro strap around the end of the finger to hold the unit firmly in place.

2. Inflate the pressure in the cuff to 20 mmHg as read on the aneuroid gauge of the cuff.

3. Click Start and record the output of the BP-600 for five seconds. Type "50 mmHg" on the comment line to the right of the Mark button. Continue recording.

4. Increase the pressure in the cuff to 50 mmHg and press the Enter key on the keyboard. Hold the pressure in the cuff at this level for another five seconds. Type "100 mmHg" on the comment line. Continue recording.

5. Increase the pressure in the cuff to 100 mmHg and press the Enter key on the keyboard. Hold the pressure in the cuff at this level for another five seconds.

6. Click the Stop button. Release all the pressure from the blood pressure cuff.

7. Use the Display Time icons on the LabScribe toolbar to adjust the time displayed on the Main window so that the complete block of calibration data can be viewed on the screen

8. Click the 2-Cursor icon so that two blue vertical lines appear on the Main window. Place one cursor on the section of the recording marked as "50 mmHg" and the second cursor on the section of the recording marked as "100 mmHg".

9. Right-click on the data area of the blood pressure channel to open its right-click menu. Select Units from this menu and Simple from the submenu to open the Units Conversion dialogue window.

10.. Perform a two-point calibration by selecting 2 point cal from the pull-down menu at the top of the dialogue window. The voltages at the positions of the two cursors are already entered on the window.

11. Change the values in the boxes to the right of these voltages to the corresponding calibration pressures, 50 and 100. Change the units to mmHg. Click OK and the units on the y-axis of the blood pressure channel change.

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Recording Blood Pressures

1. Click Start to begin recording the subject's pulse wave and the pressure in the cuff of the blood pressure sensor. Inflate the blood pressure cuff until the finger pulse wave on the pulse channel disappears.

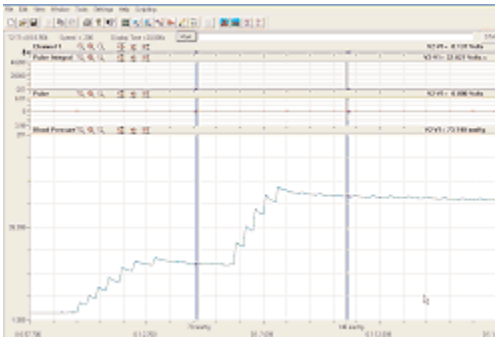

Figure 2: Recording of the output of the non-invasive blood pressure used to calibrate the sensor at known pressures.

2. Once the pulse wave disappears, release the cuff pressure at the rate of 10 mmHg per second. Continue to release the cuff pressure until the aneuroid gauge reads 0 mmHg. Click the Stop button.

3. Scroll to the section of data recorded while the pressure in the cuff was being released Use the Display Time icons on the LabScribe toolbar to display the data that includes the reappearance of the pulse wave and its return to maximum amplitude on one screen.

4. Click the 1 Cursor icon on the LabScribe toolbar to place a single blue cursor on the window.

5. On the pulse channel, find the first detectable pulse wave that occurs as pressure is released from the cuff. Place the cursor over this pulse wave.

6. The pressure in the cuff during this particular pulse wave is equal to the systolic blood pressure of the subject. Look in the upper right corner of the data window for the blood pressure channel to find the systolic blood pressure. It is listed next to the label Value (V).

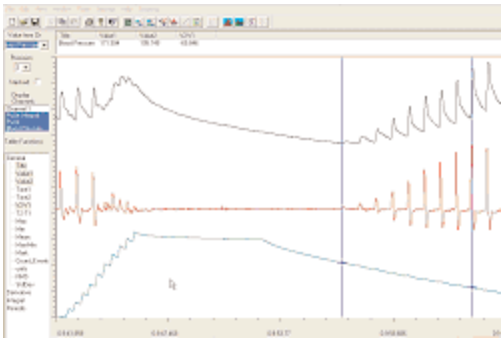

Figure 3: A recording of the pulse wave before, during, and after the occlusion of the brachial artery. Pulses disappeared as the pressure in the cuff exceeded that in the artery. As the pressure in the cuff is released, the pulse waves reappears with increasing amplitude.

7. To the right of the cursor, the amplitude of the pulse wave increases as the pressure in the cuff decreases. In this sequence of progressively larger pulse waves, find the first pulse wave that has the greatest amplitude. Place the single cursor on the peak of this pulse wave.

8. The pressure in the cuff during this particular pulse wave is equal to the diastolic blood pressure of the subject. Look in the upper right corner of the data window for the blood pressure channel to find the diastolic blood pressure. It is listed next to the label Value (V).

Experiments

Experiments using the BP-600 Non-Invasive Blood Pressure Sensor can be downloaded by clicking on the following links:

Print-disabled Pulse Contour Analysis experiment (PDF file).

User Area (password protected)
High resolution press optimized or low resolution screen optimized Pulse Contour Analytis experiment (PDF file).

Specifications

Impedance:	<900 ohms	Operating Pressure:	+0.50 to +300mmHg
Sensitivity:	5uV/V/mmHg	Temperature Effect:	+0.25mmHg/C
Excitation voltage:	+4 VDC	Power:	From DIN8 input of iWorx amplifier or A/D
Output connector:	DIN8		

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