

Webinar Q&A Report:

Integrating Noninvasive Blood Pressure Monitoring with Human Physiology Measurements



1. Any special concerns with recording with older adults, including those who may have arthritic issues with fingers?

No concerns. CNAP® requires sufficient perfusion in the subject’s fingers to start a measurement – check the Pulsation Index for values from 1-6 (PI bar goes green).

The only limitation is the presence of peripheral oedema, particularly in the subjects’ fingers. CNAP® may even get a signal, however, in the course of measurement fluid is pressed out of the patients’ fingers, which causes a drift in the signal.

2. How does the CNAP® system compare to Finapres technology, or a Finometer?

CNAP® HD is superior to Finapres technology during short-term responses to interventions and long-term accuracy.

Feature	CNAP® HD	Finapres Technology (Human NIBP, Finometer MIDI)
Easy to record	<ul style="list-style-type: none"> ➤ 3 double barrel sensors ➤ Easy to setup 	<ul style="list-style-type: none"> ➤ 2 (single) velcro sensors ➤ Setup requires training 
Calibrated & reproducible	<ul style="list-style-type: none"> ➤ NBP calibration to brachial pressure ➤ Perfect short- & longterm performance 	<ul style="list-style-type: none"> ➤ Brachial pressure “reconstructed” ➤ Lack of calibration & Velcro sensors influence performance negatively
Quick startup	Up & running in 1.5 minutes	Setup requires time & training
Reliable performance	Excellent short- and longterm performance <ul style="list-style-type: none"> ➤ NBP calibration ➤ VERIFI & Signal Quality Check (continuous without interruption) 	Lack of performance: <ul style="list-style-type: none"> ➤ “true” calibration missing ➤ Temporary interruptions “PhysioCal”
Validation	Against clinical invasive gold standards ^{1,2} (peer reviewed)	No validation studies known
Parameters	BP-wave, Sys, Dia, Mean, CO, CI, SV, SI, SVR, SVRI	BP-wave, Sys, Dia, Mean; HD with separate <i>BeatScope</i> software (<i>Finometer MIDI</i> only!)

3. Can these systems be used during exercise? And if yes, what are some important details to consider that will ensure quality data collection?

Yes, the system can be used to measure blood pressure during exercise but certain forms of exercise are more suitable than others. For example, a recumbent bike, leg squats, and walking are all good exercises that have little to moderate arm movement and impact on the sensor. Here are some recommendations for improving data quality while a subject is exercising.

1. Make sure that the controller remains still on the participants forearm and avoid bouncing the arm around.
 - a. Wrapping a bandage or Coban wrap around the control unit and forearm will help to keep the unit in place and prevent unnecessary movement and jostling. See [WRAP1](#)
2. Keep the hand at the same height it was at during the calibration process throughout the test.
 - a. Placing the arm in a sling can help maintain a constant height.

4. Is it possible to use the equipment demonstrated in Hyper or Hypobaric chambers?

Yes, it is. Here is a simple setup list:

HYPERBARIC/HYPOBARIC CHAMBER SETUP

1. Cuff controller and CNAP® Monitor must be in the same chamber with the same “pressure” environment as both are equipped with pressure sensors for surrounding pressure.
2. Pressure must be increased / decreased continuously rather than abruptly.
3. Hypobaric: take measures against overheating of the device as conventional cooling is limited (dim CNAP display low; do not restrict airflow through case).
4. No draught on cuff.
5. Hand on heart level in steady position.

5. Does the analysis of baroreflex sensitivity work with MP150 and Acknowledge 4.1? Do I need an INISO Adapter to monitor CO and SV?

The [Baroreflex Sensitivity analysis](#) is a licensed feature in AcqKnowledge. It was not available for version 4.1 of the software, but you can upgrade the software and add this feature. The following links will provide information about upgrading AcqKnowledge and the Baroreflex Sensitivity feature.

<https://www.biopac.com/product/acqknowledge-software/>

<https://www.biopac.com/product/baroreflex-sensitivity-licenses/>

The [NIBP100D-HD](#) output signals interface with a [HLT100C](#), via [INISO](#) Isolated Input Adapters and one is required for each signal that comes from the NIBP100D-HD. The unit supports four output signals and

the user can select which signals are output to the [MP160](#) system. The system comes with the appropriate output cable.

AcqKnowledge software also includes an analysis routine for cardiac output. The Estimate of Cardiac Output routine that was demonstrated during the webinar allows the user to estimate cardiac output from the noninvasive blood pressure waveform that comes from the regular NIBP100D module. The following links will provide additional information about the routine.

<https://www.biopac.com/?app-advanced-feature=cardiac-output-estimate-from-bp>

6. Could you elaborate on the devices that you use? and how it is related to syncope? I am a cardiologist doing syncope of unknown origin, do you have any experience with the arrhythmogenic origin of syncope?

The NIBP100D is perfectly suitable to monitor blood pressure in syncopal patients without interruption.

Although it is a research tool it carries full medical approval (CNAP® Monitor 500).

The NIBP100D-HD even provides an additional set of hemodynamics including SV, CO and SVR – which are essential parameters in the regulation of human BP.

7. Is it possible measure Pulse Transit Time (PPT)? If yes, what is the process?

Yes, it is possible to use the system to measure Pulse Transit Time. AcqKnowledge will identify the peak or the R-wave and peak of the pressure signal and measure the time difference between the two points. The following link will provide you with additional information about performing the measurement in real-time.

<https://www.biopac.com/application-note/pulse-transit-time-and-velocity-calculation/>

<https://www.biopac.com/application/plethysmography/advanced-feature/pulse-transit-time-ptt-and-relative-bp-measurement/>

8. I frequently measure blood pressure during short bouts of exercise (~1 min). My challenge is with the arm cuff, used for calibrating the blood pressure signal, during the 1 minute of exercise. Consequently, I lose 20-30 seconds of data because the equipment is recalibrating. How can I adjust my protocol to ensure I do not lose data?

The calibration interval of the NIBP100D can be set to one hour and this will allow you to record a lot of data inbetween calibrations. It is also possible to manually invoke a calibration at a convenient point in your protocol, typically during a resting phase.

9. Can you please provide a resource that lists the specifications and reviews principle of operation of CNAP monitor?

The following links will provide you with further information, specifications and videos for the [NIBP100D](#)/CNAP monitor.

<https://www.biopac.com/product/noninvasive-blood-pressure-amplifier/>

<https://www.biopac.com/wp-content/uploads/NIBP100D-Product-Sheet.pdf>

<https://www.biopac.com/product/noninvasive-blood-pressure-amplifier/>

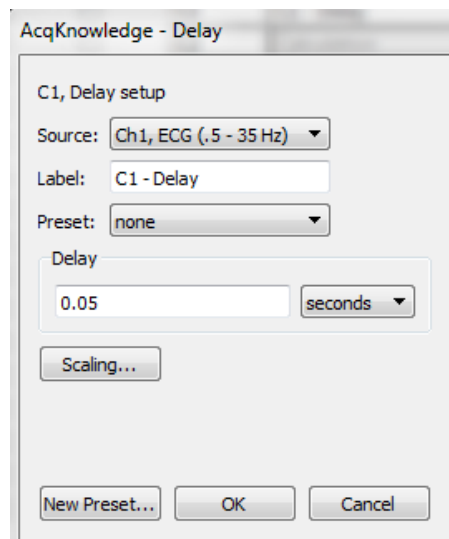
<https://www.biopac.com/wp-content/uploads/NIBP100D-CNAP500-Research-System.pdf>

https://www.biopac.com/wp-content/uploads/20151029_Validation_Research_Papers_Overview_NIBP100D_V1.8.pdf

10. We have BIOPAC MP36R and MP36 units. Can we connect the NIBP100D using them? Also, what is inter-channel time difference in MP36R

The [MP36R](#) interfaces with the NIBP100D, via a [BSL-TCI5](#) interface connector. The BSL-TCI5 connects to one of the input channels on the front of the MP36R. The time offset between the NIBP100D and other signals is 50msec.

The current shipping version of AcqKnowledge does not automatically account for this offset but you can create Delay calculation channels to delay the other signals by 50msec. The Delay calculation dialog can be set with a 50msec delay and then a Preset can be created to hold the information for future use.



11. What happens with finger BP measurement/signal during inflation of the brachial BP cuff on the same arm?

When the upper arm cuff is used on the same arm, the pulse waveform gets lost at the finger and is not displayed when the cuff inflates and occlusion occurs. However, if the cuff is placed on the opposite arm, the pulse signal is still visible throughout the occlusion.

12. I want to see the feasibility of NIBP monitoring during sleep studies. Do you have any recommendations?

If you set the calibration interval to sixty minutes, the system will only perform a calibration once every hour during the night.

13. Are there disposable cuffs available for the NIBP100D?

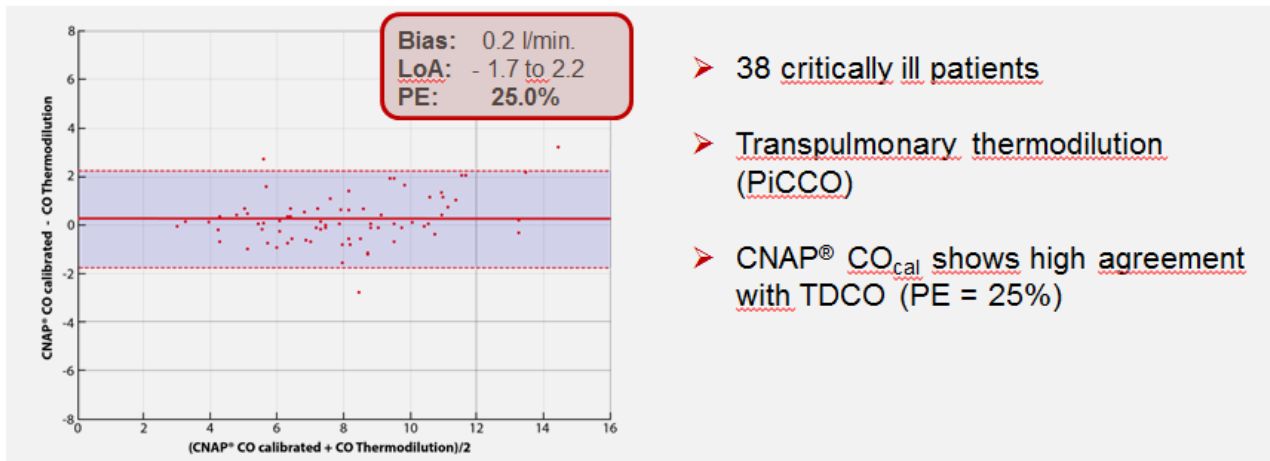
No, the CNAP® System uses reusable finger sensors with a limited lifetime (75h, 150h, 300h and 600h). After the lifetime is expired, the finger sensor needs to get replaced

14. How accurate are CO, SV and SVR measures compared to thermodilution?

The following chart and associated references compare cardiac output as measured by the CNAP® System and transpulmonary thermodilution.

ACCURACY OF CNAP® CO VS. TDCO

➤ **CNAP® CO shows high agreement with transpulmonary thermodilution (TDCO using PiCCO) in critically ill patients¹.**



[Watner, JY et. Al. \(2015\) Continuous noninvasive cardiac output determination using the CNAP system: evaluation of a cardiac output algorithm for the analysis of volume clamp method-derived pulse contour. J Clin Monit Comput. Aug;30\(4\):487-93. doi: 10.1007/s10877-015-9744-1](#)

[Critchley, L.A. & Critchley, J.A. \(1999\) A meta-analysis of studies using bias and precision statistics to compare cardiac output measurement techniques. J Clin Monit Comput. Feb;15\(2\):85-91.](#)

15. What is the intended use of the CNAP® Monitor according to the CE mark?

The CNAP® Monitor 500 is intended for the non-invasive continuous measurement and display of blood pressure (blood pressure waveform, beat-to-beat numerics, systolic, diastolic and mean pressures), and pulse rate in hospitals, clinical institutions, medical practices and outpatient settings. Furthermore, the display of alarms can be set for the parameters of blood pressure and pulse rate. The CNAP® Monitor 500 is to be used for adults and pediatric patients from the age of 4 years and is to be operated by medical professional staff or persons especially trained for the use of the device.

16. How well does the NIBP100D work in people with cold fingers? (finger BP, radial BP and reconstructed central BP)

CNAP® requires sufficient perfusion in the subject's fingers to start measurements – check for Pulsation Index values from 1-6 (PI bar goes green). On this system there is no radial BP available, but finger BP calibrated to brachial level (cont. brachial BP).

17. What is the sampling frequency range available for the systems presented?

The maximum sample rate of the [MP160](#) system is 200,000 samples a second and the data recorded during the webinar was recorded at 2,000 samples a second. The MP160 system also supports variable sample rates so different signals can be recorded at different rates.

18. Do you analyse ECG signal to identify the type of each beat?

The AcqKnowledge software includes a Lead II ECG Classifier that will identify beats as Normal, PVC, or Unknown. The software attempts to identify the ECG complex and then applies a label to the waveform. The software also includes a Lead II ECG complex analysis routine that labels the appropriate points of the complex (P, Q, R, S, T). The analysis routine also measures the appropriate amplitudes and intervals and exports the results to a spreadsheet, plots them as new channels of data, and/or pastes them into a Journal file.

<https://www.biopac.com/application/ecg-cardiology/advanced-feature/automated-ecg-analysis/>
<https://www.biopac.com/application/ecg-cardiology/advanced-feature/ecg-classification/>

19. Is “pulse height” the same as “pulse pressure”?

Yes, pulse height (PH) is the same as pulse pressure. It is the difference between systolic and diastolic readings.

20. During the demonstration of AcqKnowledge you activated visualization of specific waveform markers. Is it possible to manually adjust these fiducial points on the blood pressure signal?

Yes, it is possible to move any of the markers in the system, including both the markers that are applied during automated analysis routines and manual event marks that were applied during acquisition. The following screencasts will provide you with additional information about the analysis and the event marks.

<https://youtu.be/wfS6AVSKZFU>

<https://youtu.be/GUEv2GxTCKo>

21. In the selected window one of the beats was a premature supraventricular beat and this was included in the analysis of the baroreflex slope. Why?

The data was selected to illustrate the point that you can easily examine individual beats and eliminate them from the analysis. It is easy to identify outliers from the X/Y display and view them in the time-series display and determine whether you want to include the beat in the analysis.

22. I would like to know if there is a fast way to calculate coherence between BP and another variable (e.g., HR or respiration)

AcqKnowledge does not include a specific Coherence analysis option. The software does include an automated Correlation Coefficient option that looks at two channels of data and provides the degree of variance between the two signals. However, this is not looking at the frequency components of the respective signal though.

AcqKnowledge overview video: https://www.biopac.com/video/?video_category=acqknowledge-new-features&v=acqknowledge-4-4-gui-overview

Video: Integrating BIOPAC systems for research: <https://youtu.be/-bwTQXrXUi4>

If you have additional questions for [BIOPAC Systems](#) and [CNSystems](#) regarding content from their webinar or wish to receive additional information about their products, please contact them by phone or email:



BIOPAC Systems, Inc.

42 Aero Camino
Goleta, CA 93117
USA
Phone: +1 (805) 685-0066
Fax: +1 (805) 685-0067
Email: info@biopac.com

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BIOPAC [International Offices](#)



CNSystems Medizintechnik AG

Reininghausstraße 13
8020 Graz
Austria
Phone: +43 316 723456 0
Fax: +43 316 723456 2
Email: office@cnsystems.com

