Application Note 286   NIBP100D Calibration with Acq*Knowledge* and BSL *PRO*

The **NIBP100D** is a noninvasive blood pressure system that provides a continuous, beat-to-beat, blood pressure signal recorded from the fingers of a subject. The system outputs a continuous blood pressure waveform that is similar to a direct arterial pressure waveform. The monitor displays values for systolic, diastolic, mean blood pressure, and heart rate.

With just a few easy calibration steps, Acq*Knowledge* or BSL *PRO* software and **NIBP100D** work together to provide automated, continuous, noninvasive blood pressure measurements.

NIBP100D CALIBRATION – ACQ*KNOWLEDGE* WITH MP160/MP150 SYSTEMS

IMPORTANT: If calibrating NIBP100D with Acq*Knowledge* or BSL *PRO* using MP36/36R/35/45 Systems, proceed directly to page 4.

EQUIPMENT

- BIOPAC MP160 or MP150 System with Acq*Knowledge* software
- BIOPAC NIBP100D (CN Systems CNAP 500 Non-Invasive Blood Pressure Patient Monitor System)
- BIOPAC Systems DA100C amplifier
- BIOPAC Systems TCI105 transducer
- BIOPAC Systems CBLHLT1 cable with F/F RJ11 coupling

HARDWARE SETUP

1. Connect the components of the NIBP100D as indicated in the CNAP manual, Quick Setup section.

2. Set the DA100C amplifier switches: Gain to 1000, 10HzLP filter to OFF, 300Hz LP filter ON, and HP filter to DC.

3. Connect the DA100C to the UIM100 module of the MP160/150 System.

4. Connect the TCI105 to the front of the DA100C.

5. Connect the **CNAP** system to the BIOPAC system using the modular line phone cable between the "BP Wave Out" on the side of the NIBP100D and the TCI105 phone jack input. (See above figures.)

ACQ*KNOWLEDGE* SOFTWARE SETUP

ACQ*KNOWLEDGE* 4.1 and ABOVE

1. In the Acq*Knowledge* software, click MP1xx > Setup Channels. (MP1xx > Set Up Data Acquisition > Channels in Acq*Knowledge* 4.4 and above.)

2. In the Analog tab, click ADD NEW MODULE.

3. Click DA100C and ADD. Choose the appropriate Channel, not in contention with other amplifiers.

4. In the next dialog, set the gain and filter settings to match the DA100C amplifier settings detailed above.

5. CONNECTED TO: NIBP100D Noninvasive Blood Pressure

The unit is now scaled. **If the values are not correct, please follow the ADDITIONAL CALIBRATION NOTES**.

ACQ*KNOWLEDGE* 4.0 and BELOW

1. In the Acq*Knowledge* software, click MP1XX > Setup Channels.

2. Click SETUP to generate the Change Scaling Parameters dialog; use this dialog to calibrate the range of interest of the BP measurements.

3. Set the Gain for the DA100C to 1000 and set Scaling as follows:

CAL1 = 1	SCALE VALUE = -130	UNITS LABEL = mmHg
CAL2 = 0	SCALE VALUE = -30	

4. Close the Scaling dialog.

5. In the Acq*Knowledge* software, click MP1XX > Setup Acquisition.

6. Set the Sample Rate; recommended Sample rate for BP is 100 samples/second.

7. Close the dialog.

ADDITIONAL CALIBRATION NOTES

The NIBP100D is able to generate a square voltage pulse wave which can be used for further calibration/verification needs. Prior to using this method, make sure the following steps are followed.

1. The DA100C offset must be at zero, with the recommended settings in the Hardware Setup section, step # 5. To do this, refer to Application Note #110 AMPLIFIER BASELINE OFFSET ADJUSTMENT (at www.biopac.com).

2. Use a Voltage meter to verify that the excitation voltage of the DA100C amplifier reads ±2 VDC.

   • Simply plug the leads of the meter into the Vref1 and Vref2 slots on the front of the amplifier and adjust the Vref screw until the voltage meter reads 2 VDC.

3. Complete the following adjustments on the NIBP100D to generate a square wave pulse at 50 and 150 mmHg:
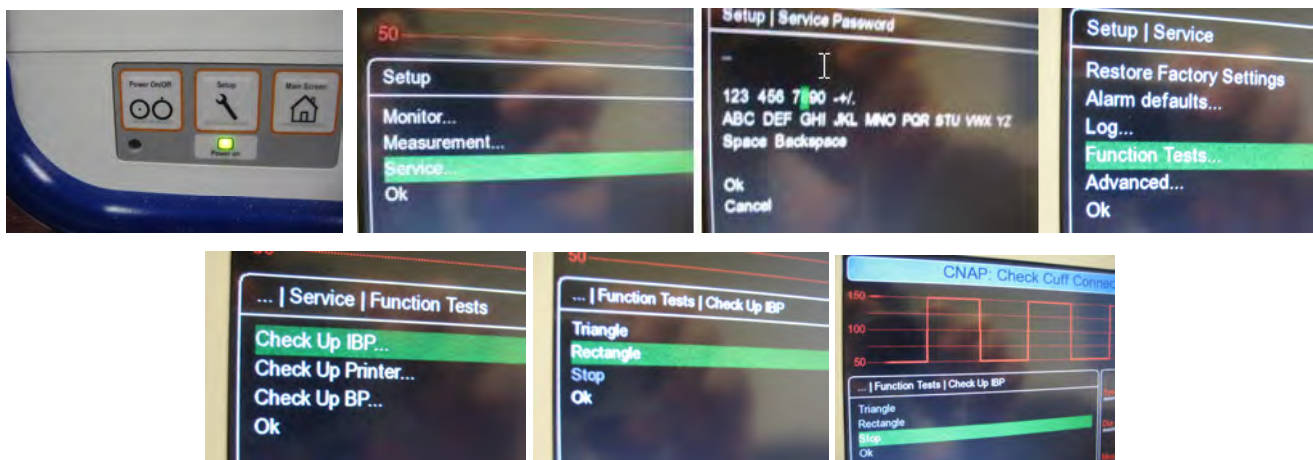

a) Click the SETUP button on the front of the NIBP100D.

b) Using the front dial, scroll to highlight SERVICE and press down on the dial to display the menu.

c) Enter a password to access the service screen. The default password number is 8737. Use the front dial to scroll, and push to enter the digits.

d) Scroll and choose the FUNCTION TESTS setting.

e) Scroll and choose the CHECK UP IBP setting.

f) Scroll and Choose RECTANGLE.

2) In Acq*Knowledge*, set the scaling to default. This can be done in versions 4.1 and above by clicking on the wrench icon when in "setup in modules" mode, walking through the setup, and then choosing "connected to: TCI Custom." The default voltage and Map values will appear. In versions 4.0 and below, click on Setup and change the scaling parameters as follows:

        CAL1 = -10   SCALE VALUE = -10
        CAL2 = 10   SCALE VALUE = 10

3) Run the square wave for a few seconds, then measure the Max and Min values (example shown below).
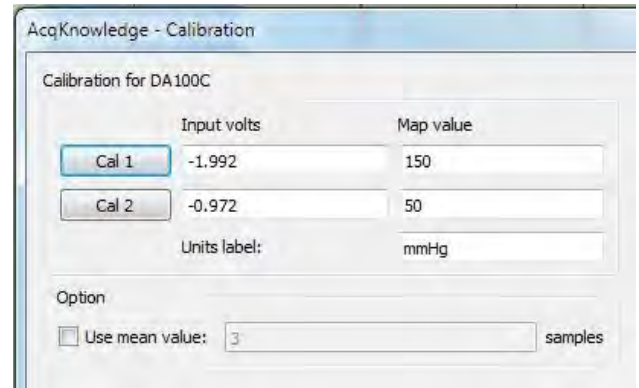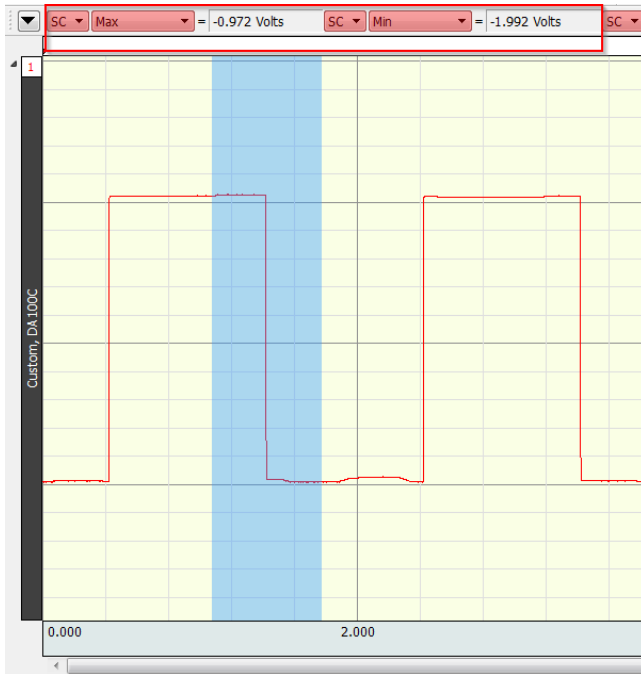
4. Enter the values into the CAL1 and CAL2 voltage value and set the MAP VALUES to 150 and 50. Set units to mmHg (example shown above right).

5. Generally the calibration and actual measure values fall within 1%. If the values exceed your specification, an adjustment can be made to the scaling within the software.

- The values should reflect the square wave value of 50 and 150 mmHg. →
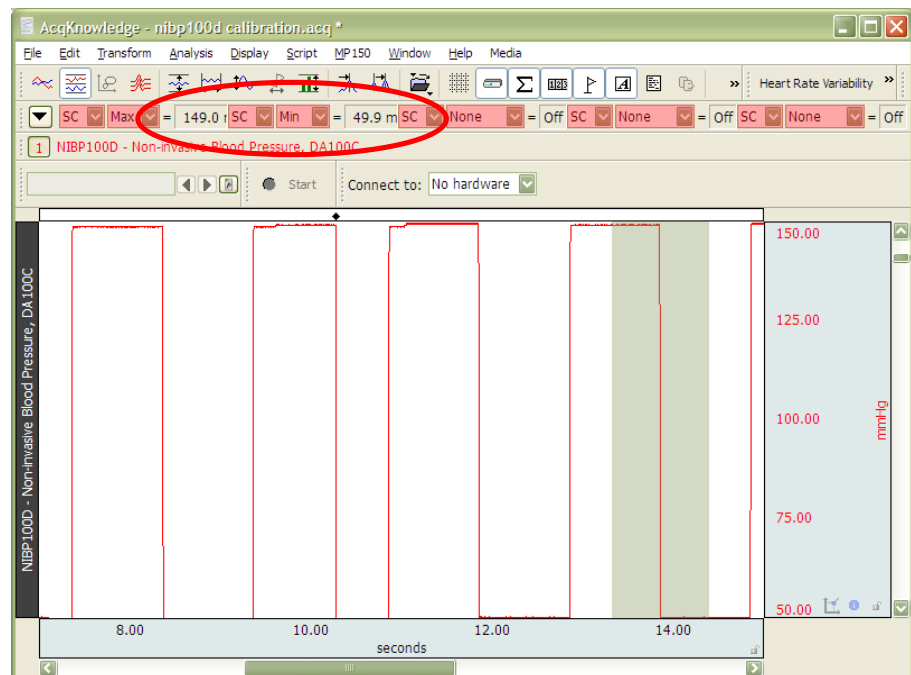
EQUIPMENT

- BIOPAC MP36/35/45 System with BSL *PRO* software or MP36R System with Acq*Knowledge* software
- BIOPAC NIBP100D (CN Systems CNAP 500 Non-Invasive Blood Pressure Patient Monitor System)
- BIOPAC BSL-TCI5 transducer
- BIOPAC CBLHLT1 cable with F/F RJ11 coupling

HARDWARE SETUP

1. Connect the components of the NIBP100D as indicated in the CNAP manual, Quick Setup section.

2. Connect the BSL-TCI5 to CH 1 of the MP3x/4xunit.

3. Connect the **NIBP100D** (CNAP) system to the BIOPAC system using the modular line phone cable between the "BP Wave Out" output on the left side of the NIBP100D unit and the BSL-TCI5 phone jack input.

CALIBRATION NOTES

The NIBP100D is able to generate a square voltage pulse wave which can be used for further calibration/verification and graph template needs. To use this method, perform the following steps:
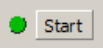
1. Complete the following adjustments on the NIBP100D to generate a square wave pulse at 50 and 150 mmHg:
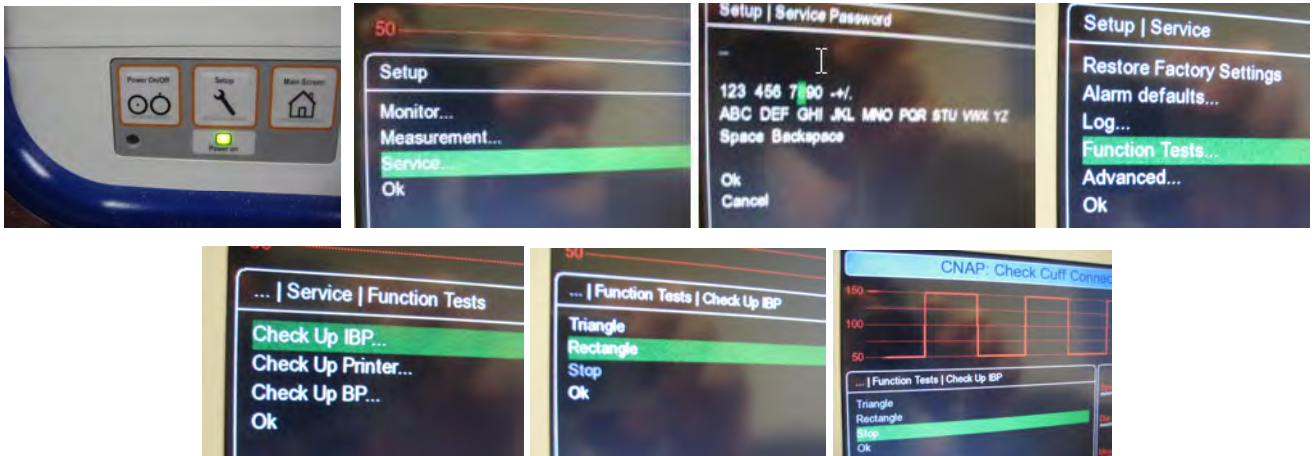

- Press the "**Setup**" button on the front panel of the NIBP100D.

- Using the front dial on the NIBP100D, scroll to the Setup menu's "**Service**" item to highlight it and press the front dial.

- Enter a password to access the Service screen. The default password number is **8737**. Use the front dial to scroll, and press it to enter the digits.

- After entering the password numbers, scroll down to "**Ok**" and press the front dial to complete the entry.

- Scroll down the Service menu to the "Function Tests" setting and press the NIBP100D front dial to select.

- Scroll and choose the "**Check Up IBP**" setting and press the front dial to select.

- Scroll down to "**Rectangle**," and press the front dial to select. The square waveform will appear on the NIBP100D screen.

SOFTWARE SETUP AND CALIBRATION

(Acq*Knowledge* 4.1 and higher and BSL *PRO* 4.0.1 and higher)

1. Open a default graph in the Acq*Knowledge* or BSL *PRO* software. (Startup > Create/Record a new experiment and select "Create empty graph," or if the application is already open, select "File > New > Graph Window.")

2. Click [● Start] in the new graph to acquire a few seconds of square wave data piped in from the NIBP100D.

3. Click [⇄ Stop] and use the software's I-beam tool [I▾] to measure the "Max" and "Min" values of the square wave. (See example graph above.)
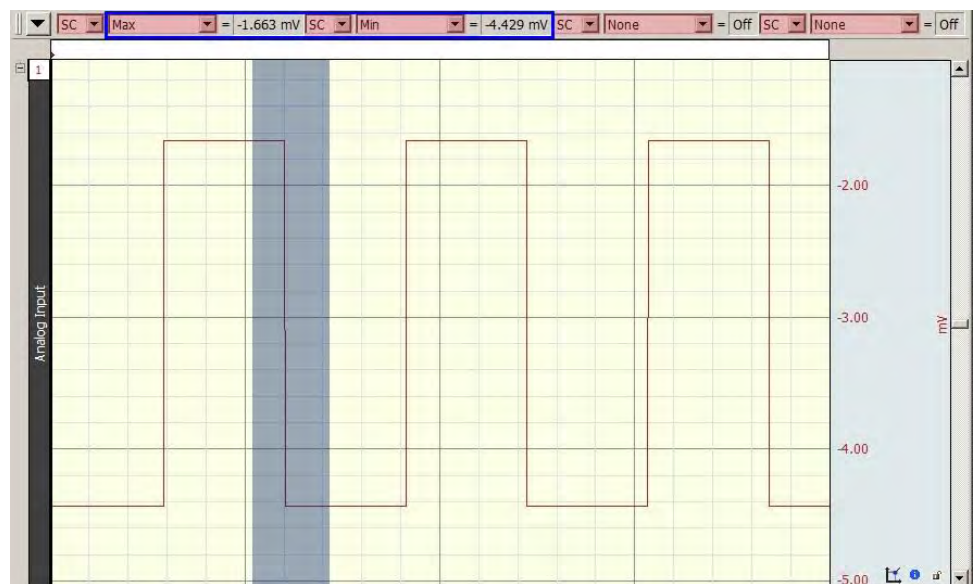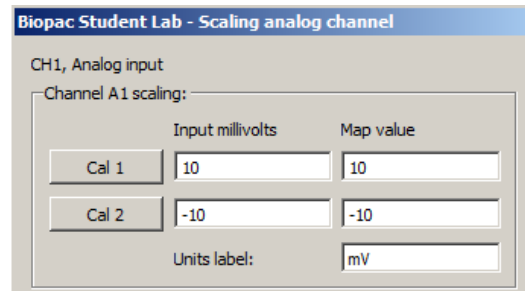
4. Select MP menu > Set Up Data Acquisition > Channels and click "**Setup...**"
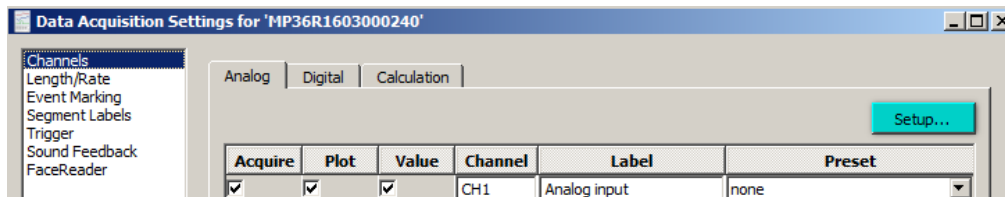
5. Click the "**Scaling…**" button in the subsequent dialog. Depending on software used, one of the following default scaling dialogs will appear.
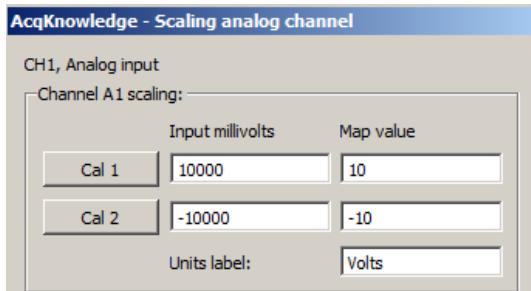

AcqKnowledge 4.x or 5.x   *BSL 4.x*

6. Manually enter the measured "**Max**" and "**Min**" values of the inputted square wave into the "**Input millivolts**" fields as shown in the example on right. (Enter the recorded "Max" value in Cal 1 and the recorded "Min" value in Cal 2.)

7. NOTE: The square wave values shown in the example graph above and the Scaling setup on right are for demonstration purposes only. User-observed values will vary.

8. Enter "**150**" as the Cal 1 Map value and "**50**" as the Cal 2 Map value.

9. Enter "mmHg" as the Units label and click OK to exit the Scaling dialog.

10. Click OK to exit the Input Channel Parameters dialog and click "Close" to exit the Data Acquisition Settings dialog.
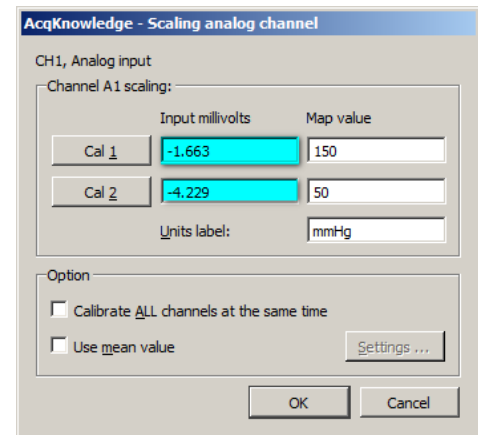
   NOTE: In some versions of BSL, the Scaling values and units from the first set of data (i.e. in milliVolt units) cannot be changed unless the previous waveform is removed from the graph. If this occurs, use **Edit > Remove Waveform** to delete the previous square wave data.

11. Click "**Start**" in the AcqKnowledge or BSL PRO graph. The Max and Min values in the graph should now reflect the Map values entered in Step 7. (Max = 150, Min = 50.)

   Generally the calibration and actual measure values fall within 1%. If the values exceed specification, an additional adjustment can be made to the software scaling.

12. Save the graph as a "**Graph Template - *.GTL**" file to preserve the calibration settings.

13. Exit the NIBP100D "**Service**" window and record data.