

PERFORMANCE VERIFICATION AND CALIBRATION CHECK PROCEDURE

MODEL 3100-B MINI-LAB

MODEL 3100-B MAINTENANCE SCHEDULE

The Model 3100-B Mini-Lab should be cleaned as often as conditions require. It is recommended that the Mini-Lab be cleaned and inspected every 1000 hours of operation. If your system has the optional computer, it will need attention to the cooling fan for the microprocessor at least this often. This may be needed more often if the Mini-Lab is used in an area with carpeted floors, or in other adverse conditions.

THE PERFORMANCE VERIFICATION AND CALIBRATION CHECK PROCEDURE SHOULD BE PERFORMED ONCE A YEAR, or whenever there is a question that the Mini-Lab may be in need of repair. The test or adjustment procedure may help in localizing certain troubles in the system, and in some cases may correct the problem.

PERFORMANCE VERIFICATION

This test is designed so that an in-field calibration can be performed with the use of limited test equipment. However, the test does require the Model 80 test fixture (purchase from factory), an accurate pressure gage, and the use of the built-in chart recorder and computer interface (if so equipped). If this performance test reveals a deficiency, there is an adjustment procedure following.

If the system you are testing has the computer option you can test the interface by following all of the tests listed below and refer to the signal displayed on the monitor instead of the chart recorder or you may choose to do them simultaneously.

EQUIPMENT REQUIRED:

- MODEL 80; PARKS CALIBRATION FIXTURE
- PRESSURE GAGE; READING 0 – 300mm MERCURY
- SPHYGMOMANOMETER, "PROPPER" BRAND; PARKS 989-1000-00



1. Remove the top cover of the unit. This consists of removing 6 screws from each side of the cover (total of 12). Once the screws are removed simply lift the cover up and away from the instrument.
2. Inside this instrument you'll see several vertical plug-in circuit cards. You will need to remove one of these. The circuit card with a label that reads 8.0, 8.1 or 8.3 is the high frequency RF card and it is necessary to remove it temporarily so the test card can be installed.
3. Install the MODEL 80 test card in place of the high frequency RF card. Make sure the test card is installed with the components facing the same direction as the other cards.
4. Temporarily remove the blue jumper at the front left corner of the mother board. Connect the cable that is provided with the test card from the mini-phone jack on the card to the two pins on the mother board in place of the blue jumper you have just removed. The blue wire in the test cable needs to be connected to the pin closest to the end of the board.

Notes for the Bio-Med, (computerized models only): To access the scope mode for testing the computer interface you will need to follow the instructions below.


- a. Power up the entire system (switch located on right side of the cart).
- b. When the computer display shows the choices menu you will need to press F3 on the computer keyboard. This will initialize the scope mode. All signals displayed on the chart recorder should also be displayed on the monitor screen. Amplitudes on the monitor should also be 125% of the amplitudes on the chart. (10 divisions on the monitor equal 8 divisions on the chart paper).

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5. Press the  MAIN POWER button on the front panel of the 3100-B to turn the MINI-LAB on. Set the front panel controls as follows:
 - a. OUTPUT FILTER to 28 Hz.
 - b.  VOLUME to MIN.
 - c. DOPPLER RECORDING selector to NORMAL or BOTH.
 - d. PPG / VPR / DOPPLER switch to DOPPLER.


RECORDER / COMPUTER INTERFACE VERIFICATION (COMPUTERIZED MODELS ONLY)

6. On the front panel of the instrument, set the chart recorder paper speed to \rightarrow **5 mm/S** and adjust the  POSITION control knob so that the trace is in the middle of the graph. Adjust the SIZE control knob to 0.
7. Verify that the trace on the computer monitor is at the center of the graph, and aligned with the small red cursor at the left.

RECORDER GAIN VERIFICATION

8. Adjust the  POSITION control knob on the front panel of the instrument so that the trace is 5mm (1 division) from the bottom edge of the graph paper.
9. Also on the front panel, adjust the SIZE control knob to 10, and set the SENSITIVITY HIGH / LOW switch to the HIGH position.
10. Put the CAL. switch on the test card in the 'A' position. Turn the test card power to the ON position.
11. The trace should be moving near the top of the graph to near the bottom of the graph continuously 30mm (+/- 3mm) on the chart recorder paper.
12. Push the chart recorder  STOP button on the front panel of the instrument. Turn the Model 80 power OFF.
13. Disconnect the test cable from the mother board. Replace the blue jumper onto the two pins where the test cable has been.
14. Remove the test cable from the test card.
15. Set the chart recorder speed on the front panel of the instrument to the \rightarrow **5 mm/S** position.


DOPPLER GAIN VERIFICATION

16. Adjust the  POSITION control selector on the front panel so the trace is in the middle of the graph.
17. Turn the Model 80 test card power ON.
18. The trace should move to 5mm (+/- 2mm) from the top edge of the graph on the paper and the FLOW DIRECTION bar graph should have five green LED's on.
19. Set the CAL. switch on the test card to the center position B. The pen should move to 5mm (+/- 2mm) from the bottom of the paper and the FLOW DIRECTION bar graph should show five red LED's on.
20. Set the CAL. switch on the test card to the OSC position. The trace should move rapidly from near the top of the graph to near the bottom. The waveform should be 27-33mm peak to peak.

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OUTPUT FILTER TEST

21. Rotate the OUTPUT FILTER selector on the front panel to the 14 Hz. position then to the 7 Hz. position. Note that the size of the signal on the graph gets smaller with each position of the OUTPUT FILTER switch. At the 3.5 Hz. position the signal should be very small, and at MEAN FLOW there should be a flat line.
22. Turn the Model 80 test card OFF.
23. Turn the instrument off by pressing the front panel  MAIN POWER button.
24. Remove the Model 80 test card and replace the RF card.
25. You will need to connect a pressure gage (mercury column) to the air fittings on the front panel of the instrument and verify that the pressure display is correct.
26. Connect the pressure gage (mercury column) to the front panel air fitting labeled VPR SENSING CUFF.

Warning: Do not use the built-in cuff inflator to bring pressure in the system up. Because of the small volume of air, the pressure will rise very quickly. Doing so can cause serious damage to the mercury column. Pump up the pressure using a hand bulb type manometer.

CUFF PRESSURE VERIFICATION

27. Press the button labeled VPR on the front panel of the instrument. This will allow the pressure in the VPR port to be monitored on the LCD display.
28. Pump the pressure up to 40mm Hg using the manometer. Compare the readings on the mercury column and the LCD display on the front panel, they should be within 5mm Hg. The reading on the monitor above the graph should match the LCD reading.
29. Pump the pressure up to 200mm Hg using the manometer. Compare the readings, they should be within 5mm Hg of the calibration gage.
30. Disconnect the mercury column from the VPR SENSING CUFF fitting and move it to the air fitting labeled BP / OCCLUDING CUFF.
31. Press the BLOOD PRESSURE button on the front panel. This will allow the LCD to display the pressure in the B.P. Port.
32. Follow the same tests as listed on lines 28 and 29.
33. Disconnect the mercury column.

AIR SYSTEM LEAKAGE TEST:

34. On the front panel of the instrument, join the VPR SENSING CUFF and the BP / OCCLUDING CUFF connectors to each other with a short hose.
35. Inflate the system to 240 to 250mm pressure. Allow time for the pressure to stabilize. (There will be an initial drop as the hoses in the system expand under pressure.)
36. The system pressure must not drop more than 1mm in 30 seconds.

This completes the performance verification test. If there are adjustments needed, go to the adjustment procedure on the following page. If no adjustments are needed, replace the top cover and secure it using the same screws (#6 Flat head) that were removed at the start of the test. Be sure to use the short screws at the bottom edge.

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MODEL 3100-B ADJUSTMENT PROCEDURES

This procedure presumes that the performance verification procedure on pages 3 through 5 has just been completed, and that the 3100-B top cover has been removed. To remove the cover, remove 6 screws from each side of the cover (total of 12). Once the screws are removed simply lift the cover up and away from the instrument.

IF the pressure tests in the performance verification steps 26 through 33 passes as acceptable, move ahead to step 4 on page 7. If there is a need to adjust the pressure readings, begin at step 1 below.

EQUIPMENT REQUIRED:

- MODEL 80; PARKS CALIBRATION FIXTURE
- PRESSURE GAGE; READING 0 – 300 mm MERCURY
- SPHYGMOMANOMETER, “PROPPER” BRAND; PARKS 989-1000-00
- ADAPTER FEMALE, MQC-F (Opening blocked). PARKS 986-0005-00 and 800-0012-00 cap/cover.

STEP 1) PREP FOR INTERNAL ADJUSTMENTS:

To adjust the 3100-B pressure readings, it is necessary to “split the case” to access the adjustments. If an air leak was found during the performance verification, that problem should be repaired first, before any adjustments are made.

NOTE: The most likely cause of an air leak has been debris that has gotten into a valve, especially the pop-off valves. This problem can largely be prevented by keeping covers over the hose connections or the hose ends during transport or when the instrument is not in use.

- a. Disconnect the power cord from the back of the instrument, and the computer data cable (if so equipped). Remove the top as above.
- b. If your instrument was purchased with a cart, move the instrument from the cart and place it “on end” on the workbench, to access the bottom.
- c. Remove the two front rubber feet, then turn the instrument upright.
- d. Remove the four screws from the back and separate the two halves of the 3100-B. Note that the two screws in the middle are longer, and that there are lock washers between the metal panels.
- e. Set the front panel / top assembly on its right end, beside the base.
- f. Verify that all the wires and cables are correctly in place.
- g. Connect the AC power to the instrument. The computer is not needed yet.
- h. Verify that the two LEDs on the back panel of the instrument are on.
- i. Measure the power supply outputs at the side terminals of the two fuses on the LEFT side of the back panel. Connect the DMM negative lead to the negative lead of one of the two axial leaded electrolytic caps at the right center of the large PCB. At the fuse on the left you should measure 12V, +/- 5%, at the inner fuse you should measure +9V, +/- 5%.

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Warning: Do not use the built-in cuff inflator to bring pressure in the system up. Because of the small volume of air, the pressure will rise very quickly. Doing so can cause serious damage to the mercury column. Pump up the pressure using a hand bulb type manometer.

STEP 2) CUFF PRESSURE CALIBRATION:

Refer to the PCB drawing on the back of schematic 299-0211-XX in your Bioengineering Manual to locate the adjustments in the following steps.

- a. Press the VPR push-button switch on the front panel of the instrument.
- b. Adjust VR3 on the *inflator control board* until the LCD display on the front panel indicates a cuff pressure of 2 mm.
- c. Press the BLOOD PRESSURE push-button switch on the front panel of the instrument.
- d. Adjust VR1 on the *inflator control board* until the LCD display indicates a cuff pressure of 2mm.
- e. Screw the blocked adapter onto the BP / OCCLUDING CUFF connector on the front panel.
 1. Read the cuff pressure.
 2. Adjust VR1 on the *inflator control board* for a cuff pressure of the reading “minus 4mm”.
- f. Press the VPR SENSING CUFF push-button switch on the front panel of the instrument.
- g. Move the blocked adapter onto the VPR SENSING CUFF connector.
 1. Read the cuff pressure.
 2. Adjust VR3 on the *inflator control board* for a cuff pressure reading “minus 4mm”.
- h. Attach the pressure gage to the VPR SENSING CUFF connector.
 1. Pump the manometer to 200mm pressure.
 2. Adjust VR4 on the *inflator control board* for a cuff pressure reading of 200mm on the LCD display.
 3. Pump the manometer to 150 mm. The LCD display must read 150 mm +/- 5 mm.
 4. Pump the manometer to 50 mm. The LCD display must read 50 mm +/- 5 mm.
- i. Attach the pressure gage to the BP / OCCLUDING CUFF connector.
 1. Press the BLOOD PRESSURE button.
 2. Repeat steps h 1, 2, 3 & 4. Adjust VR2 on the *inflator control board* instead of VR4.

STEP 3) MEASURE V REF:

- a. Measure the voltage at U3 - 7 on the Inflator Mother Board.
 1. Record the value for use later in this procedure.
- b. With a DMM, monitor V REF stability. There must be no change while changing pressure from 0 to 200 to 0.

STEP 4) ASSEMBLE 3100-B:

- a. Remove the AC power.
- b. Re-assemble the two halves of the unit by reversing steps 1,c & 1,d. Be sure to replace the lock washers between the panels in the back. These help maintain the ground integrity between the parts of the case.
- c. Return the AC power.






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STEP 5) VPR BALANCE AND GAIN CALIBRATION:

- a. Attach the manometer to the VPR SENSING CUFF connector. Press the VPR button. Set the PPG / VPR / DOPPLER switch to VPR. Read pressures in the following steps under "cuff" on the LCD display.
- b. Connect the negative lead of the multimeter to the "GRD" test loop on the *analog PCB assembly*. Connect the positive lead to the end of R20 next to U5 (pin 1 of U10) on the *same PCB assembly*.
 1. With 0 cuff pressure, adjust VR1 on the *front panel PCB assembly* for 0 volts +/- 2 mv.
 2. With 200mm cuff pressure, adjust VR1 on the *analog PCB assembly* for 3.80 volts.
 3. Set the ARTERY / VEIN / RESET switch to ARTERY.
- c. Increase the pressure to approximately 270mm. READY LED must be off.
- d. Decrease pressure slowly.
 1. READY LED must come on between 210 and 230mm pressure.
 2. READY LED must go out between 80 and 100mm pressure.
- e. Switch the ARTERY / VEIN / RESET switch to RESET and then to VEIN.
 1. Repeat step d above.
 2. Remove the manometer.

STEP 6) 3100-B / AR42 INTERFACE ADJUSTMENT:

- a. Turn the instrument off by pressing the front panel  MAIN POWER button.
- b. Open the chart recorder door and take out the paper. Inside the recorder, loosen two captive screws, and slide the recorder out of the front of the instrument.
- c. Remove four 1/4" nuts and remove the recorder bracket.
- d. Remove three screws and separate the PCB from the bracket. Set the bracket aside temporarily, and connect the PCB to the recorder.
- e. Carefully set recorder to the side, with Interface board plugged in, and positioned so that the PCB is fully accessible. Avoid shorting board to chassis. Use the drawing on the back of schematic 299-0248-XX in your Bioengineering Manual to locate the adjustments and measurement points in the following steps.
- f. Replace the paper into the chart recorder.
- g. Turn on power by pressing the front panel  MAIN POWER button.
- h. Set the SIZE to zero, set the  POSITION to full counter-clockwise.
- i. On the AR42 Interface Board, monitor the voltage at U5 Pin 7. Adjust VR1 for 2.50 Volts.
- j. Monitor the voltage at U7 Pin 8. Adjust VR3 to the V REF Voltage measured earlier.
- k. Run the recorder at  5 mm/S. Adjust the  POSITION to center the trace.
- l. Adjust VR6 on the *Doppler front panel PCB* to turn on the tenth (10th) LED from the left in the LED display above the chart recorder.

STEP 7) RECORDER / COMPUTER INTERFACE CALIBRATION (COMPUTERIZED MODELS ONLY)

- a. Position the 3100-B cart next to the workbench. Re-connect the serial data cable from the computer to the 3100-B. The next adjustment will be made using the computer monitor.
- b. Power up the entire system (switch located on right side of the cart).

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- c. When the computer display shows the choices menu you will need to press the F3 button on the computer keyboard. This will initialize the scope mode.
- d. Turn the SIZE control to the maximum counter-clockwise position. (ZERO)
- e. Adjust VR2 on the *AR42 interface* until the trace on the computer monitor is at the center of the graph, and aligned with the small red cursor at the left.
- f. Turn off the entire 3100-B system with the switch located on right side of the cart.
- g. Assemble the *Interface board* to the recommended mounting bracket with 3 # 4 Phillips head screws.
- h. Replace the bracket and PCB back onto the panel of the 3100-B.
- i. Install recorder into bracket and tighten captive screws to bracket.
- j. Replace the paper into the chart recorder.

STEP 8) READOUT PCB / ASSY CALIBRATION

- a. Install the Model 80 test card in the RF-HI slot. Set the two toggle switches on the Model 80 test card to "OFF" and "A".
- b. Also temporarily remove the blue jumper at the front left corner of the *mother board*. Connect the DVM red lead to the pin closest to the plug-in boards. Connect the DVM black lead to ground. Set the DVM on the 2-volt range. Set PPG / VPR / DOPPLER switch to DOPPLER, the DOPPLER PROBE to HIGH FREQUENCY, and the DOPPLER RECORDING to TOWARD.
- c. Power up the entire system and adjust the *low pass circuit board* pot to zero volts as indicated on the DMM.
- d. Switch the Model 80 ON. Adjust "VR2" pot on the *readout circuit board* for a DMM reading of 220 mV.
- e. Check the mill volt reading at all the positions of the DOPPLER RECORDING switch.

TOWARD	220 mV
AWAY	0
BOTH	220 mV
INVERT BOTH	-220 mV
- f. If INVERT BOTH reading is not within three {3} mV of BOTH reading. Adjust the pot on the *lo pass board* to equalize the readings. Adjust the "VR2" pot on the *readout board* so that the TOWARD and BOTH readings are each the same amount away from 220 mV; i.e. 218 mV & 222 mV not 220 mV & 224 mV. Recheck all front panel DOPPLER RECORDING selector positions and repeat adjustments of the pots until all readings are 220mV within +/- 3 mV.
- g. Set the DOPPLER RECORDING selector to AWAY.
- h. Select "B" on the Model 80. Adjust "VR4" pot for a reading of 220mV. Turn the DOPPLER RECORDING selector to each of its positions. Recheck all front panel DOPPLER RECORDING selector positions and repeat adjustments of the pots until all readings are 220mV within +/- 3 mV.

TOWARD	0 mV
AWAY	220 mV
BOTH	-220 mV
INVERT BOTH	220 mV
- i. Set DOPPLER RECORDING selector to BOTH. Adjust "VR3" for 5 red LED's turned on.
- j. Change the Model 80 test card back to the "A" position. Adjust "VR1" for 5 green "LED's turned on.

OVER

PERFORMANCE VERIFICATION AND CALIBRATION CHECK PROCEDURE

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This completes the Model 3100-B adjustments.

- Replace the blue jumper onto the two pins on the *Doppler mother board*.
- Remove the model 80 test card and replace it with the original RF card.
- Replace the top cover and secure it with the eight screws (#6 flat head) in the upper holes.
- Replace the 3100-B onto the cart (if so equipped), and secure it with the four short screws (#6 flat head) that were removed at the start. Be sure to use the short screws at the bottom edge.
- Reconnect the computer data cable (if so equipped), and the power cable to the Mini-Lab.