

PRIMATE STARTLE SYSTEM

SOF-828P

USER'S MANUAL

DOC-004

Rev. 2.7

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CHAPTER 1 | INTRODUCTION

The startle reflex is a motor response to an intense and unexpected stimulus. The neuroanatomy of the acoustic startle reflex is well-characterized and is often studied in humans, rodents, and primates to measure sensorimotor processing, emotional state, and/or attention. Alterations in the startle reflex response are often studied between animal strains, and within the pre-pulse inhibition of startle (PPI) and fear-potentiated startle (FPS) paradigms.

Our Primate Startle System allows users to obtain accurate quantification of the acoustic startle reflex in primates. The Startle Reflex software package is designed for use with Med Associates modules to produce stimuli, collect response data, plot data to the screen, and perform waveform analysis.

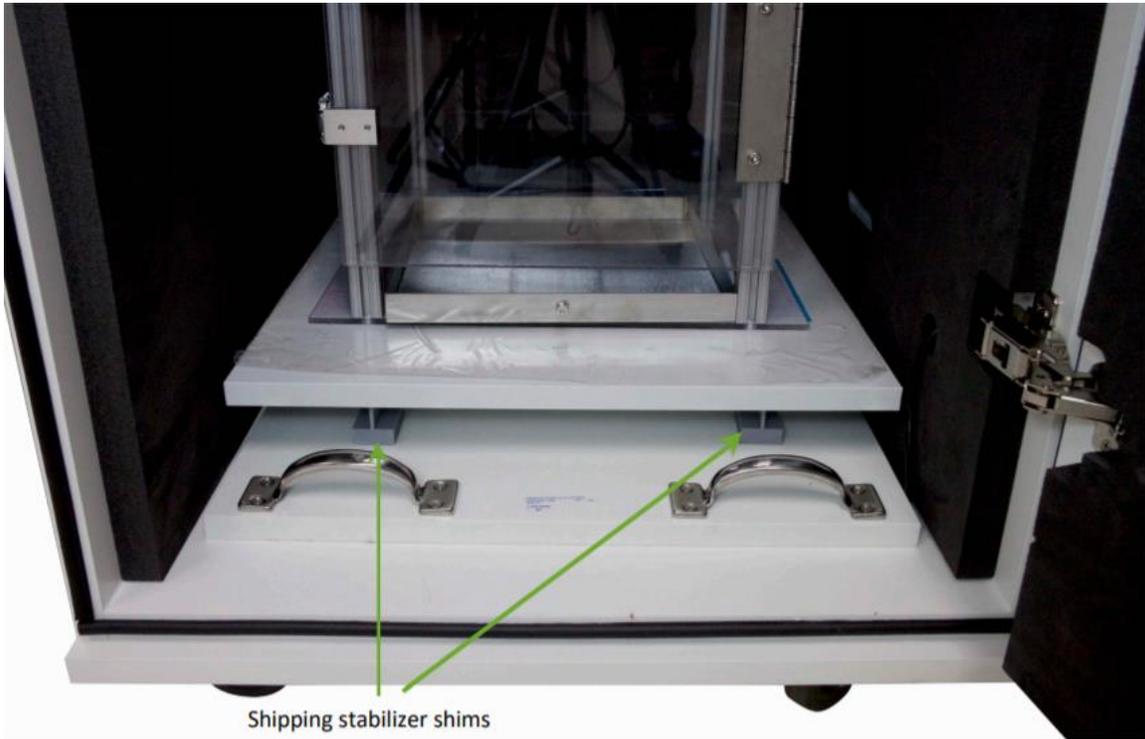
Please thoroughly read this manual prior to setup to gain an understanding of the system. Should any problems or questions arise, the technical support staff at Med Associates is available for assistance.

Figure 1-1 - Sound Attenuating Cubicle (SAC) with Restraint Chair and Interface Controller.



NOTE: Remove 4 shipping stabilizer shims before installing Restraint chair.

Figure 1-2 - SAC interior showing shipping stabilizer shims.



CHAPTER 2 | HARDWARE

General Computer Environment

The minimum recommended system is as follows:

- 2.0 GHz or higher with one available PCI slot and one available USB 2.0 port.
- Windows 7 or later (32 & 64-bit)

NOTE: Always switch off power prior to performing work on the computer or interface cabinets. Serious damage may occur if power is on.

Hardware Guide

Figure 2-1 - Interface Cabinet with ANL-729, ANL-925E and two ANL-925D Cards.



Figure 2-2 – Back of computer (DIG-744E card)

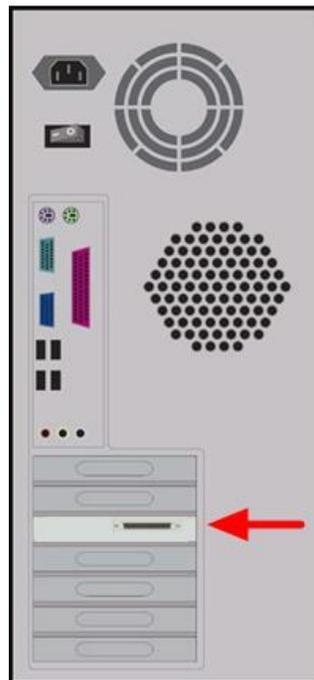


Figure 2-3 - PHM-255C Primate Startle Stimulus Controller (Mounted on the Top of the SAC).



Figure 2-4 – Acoustic Startle Speaker Assembly (Mounted Inside the SAC).



Figure 2-5 – ENV-226D 3 Channel Fader Controller



Figure 2-6 - PHM-250D Load Cell Amplifier and Potentiometer Trimmer Tool.



Figure 2-7 – Restraint Chair.



Figure 2-8 – Load Cell Platform.



Figure 2-9 - ANL-930 Standalone Sound Pressure Level Measurement Package.



Cable Guide

Figure 2-10 – Interface Cables.



SG-210CB - SmartCtrl™ Cable 25'



SG-244-68 – NI Shielded Cable



SG-USB-6 – USB A to B Cable

Air Puff System Hardware

Figure 2-11 - Solenoid with Pneumatic Tubing for Air System and Optional Compressor.



Solenoid



Compressor (Optional)



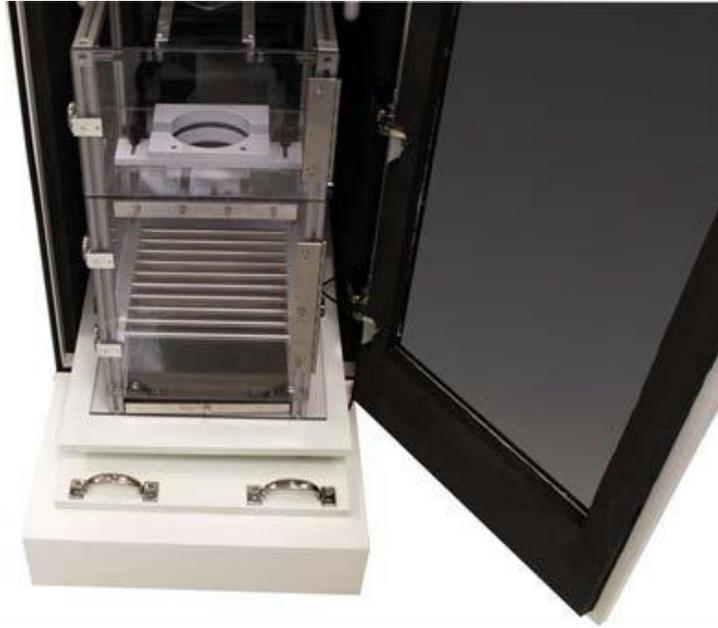
50' and 10' Pneumatic Tubing

Hardware Assembly

Open the primate startle Sound Attenuating Cubicle (SAC) door and place the load cell platform inside. Orient the load cell platform so that the amplifier cable is on the right.

Route the amplifier cable through the hole in the right side of the SAC, as shown in Figure 2-12. Place the restraint chair (shown in Figure 2-7) on top of the load cell platform.

Figure 2-12 - Open Primate Startle SAC with Load Cell Platform and Restraint Chair.



NOTE: The amplifier cable in the lower right corner of the SAC can become pinched when sliding the platform back inside the SAC. Use caution to avoid damage to the cable.

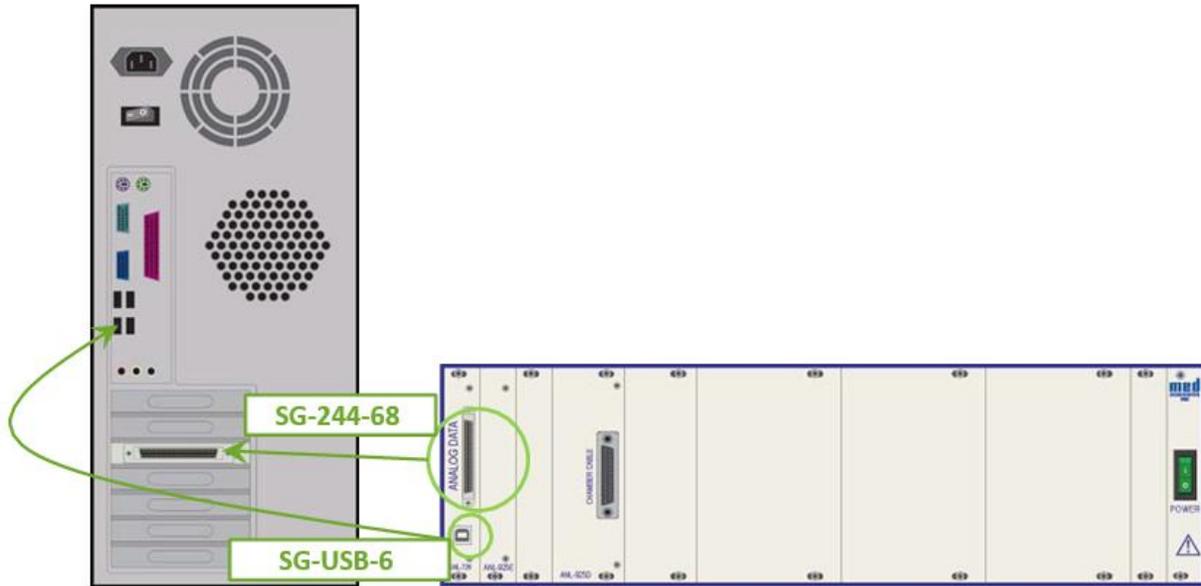
Figure 2-13 – Amplifier Cable.



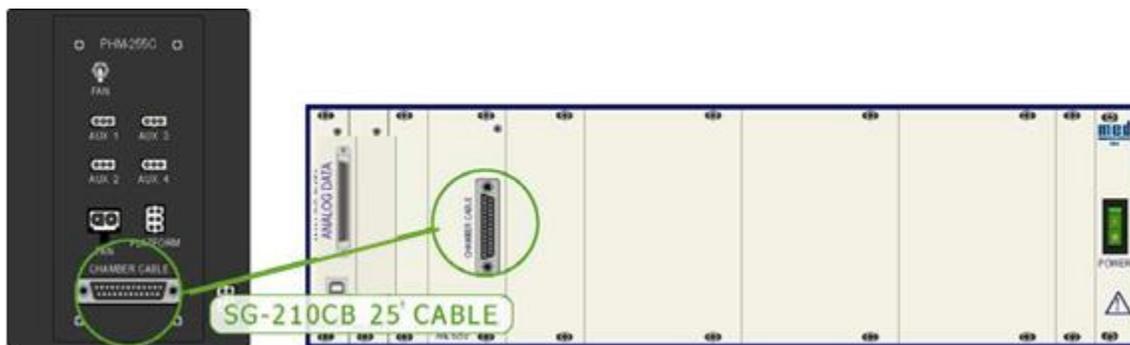
Wiring Instructions

NOTE: Some wiring may have been completed prior to shipping. Be sure that power to all hardware is disconnected prior to completing any wiring.

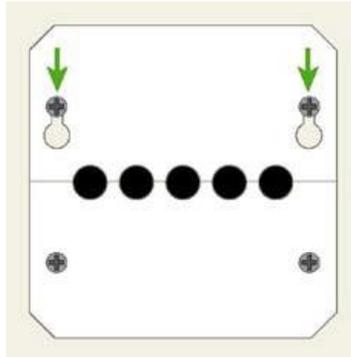
1. Using the SG-244-68 NI (National Instruments) cable, connect the DIG-744E card (back of the computer) to the **ANALOG DATA** connector on the ANL-729 (in the interface cabinet).
2. Using an SG-USB-6 USB cable, connect the **USB** connector on the front of the ANL-729 to any available USB connector on the computer.



3. Using an SG-210CB 25' SmartCtrl cable, connect the PHM-255C (top of the Primate Startle Cubicle) to the **CHAMBER CABLE** connector on the ANL-925D (in the interface cabinet).



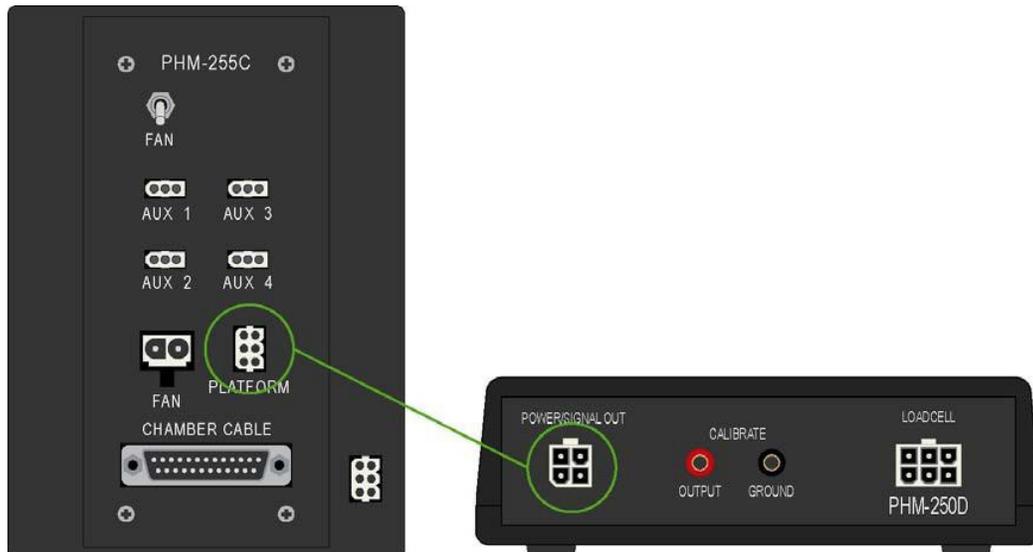
4. Open the grommet plate on the back of the SAC by loosening the two screws indicated below. The wiring in the remaining steps should be routed through this plate.



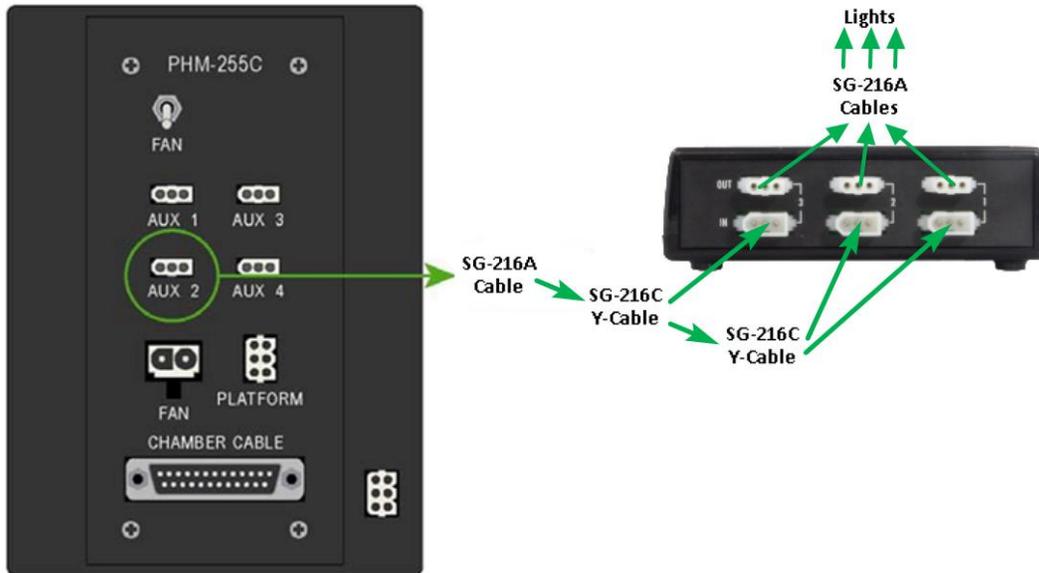
5. Connect the Load Cell cable to the **LOAD CELL** connector on the PHM-250D.



6. Connect the **POWER/SIGNAL OUT** on the PHM-250D to the **PLATFORM** cable on the PHM-255C.



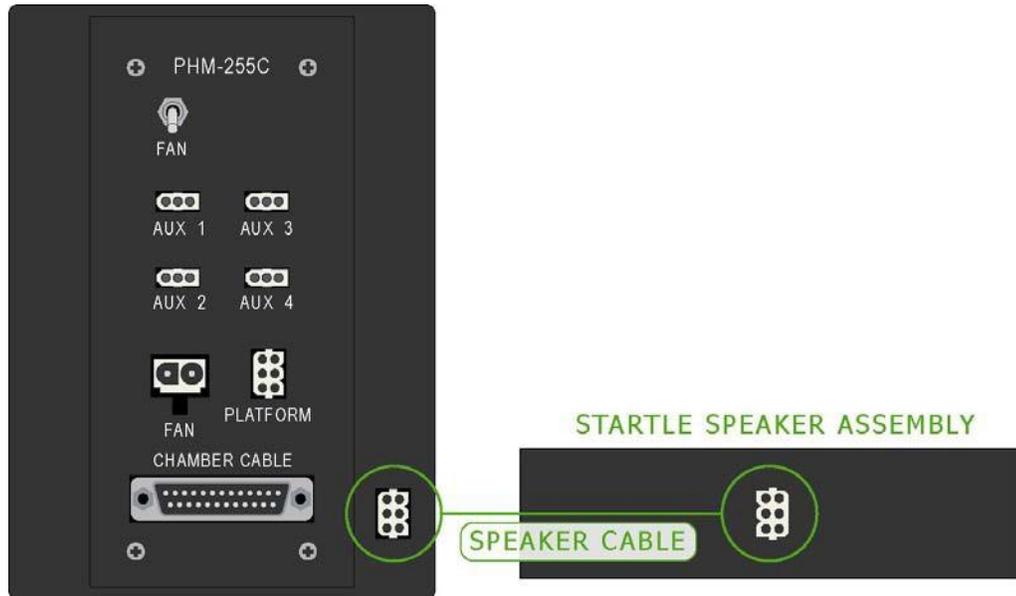
7. Connect the **AUX 2** connector on the PHM-255C using a series of SG-216* cables to the ENV226D 3 Channel Fader Controller **IN** connectors as seen below. Then connect the lights in no specific order to the ENV226D 3 Channel Fader Controller **OUT** connectors.



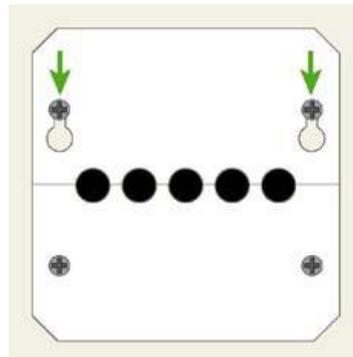
8. Connect the fan (mounted to the back of the SAC) to the **FAN** connector on the PHM-255C.



9. Connect the speaker assembly (mounted inside the SAC, Figure 2-4) to the 6-pin connector on the PHM-255C.



10. Close the grommet plate and tighten the screws, shown below.

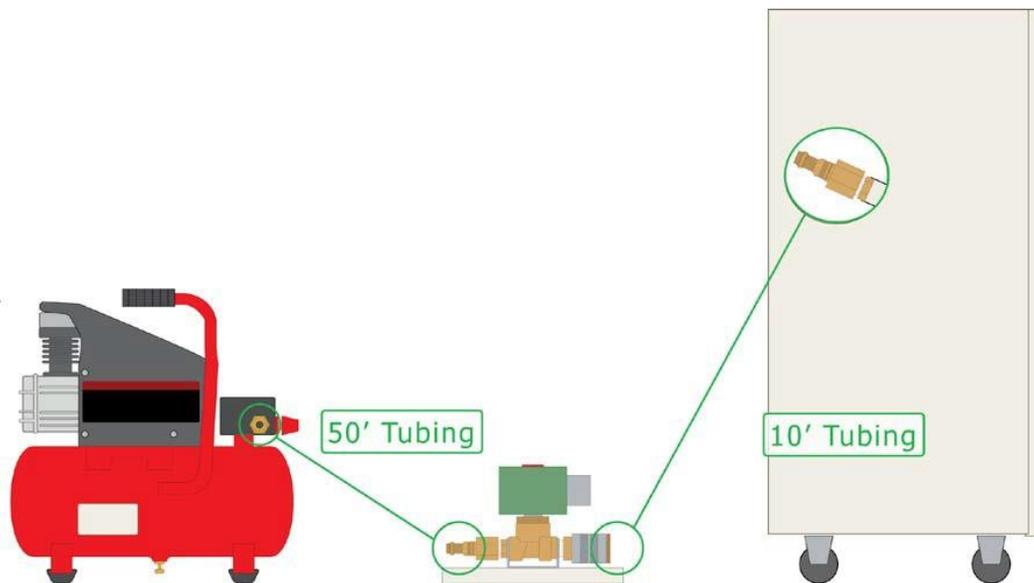


11. Repeat steps for each additional chamber.

Plumbing/Wiring Instructions for the Air Puff System

1. Using the 50' length of pneumatic tubing, connect the compressor to the solenoid.
2. Using the 10' length of pneumatic tubing, connect the solenoid to the air system connector inside of the Primate Startle SAC. The tubing should be run through the hole in the back of the SAC.

NOTE: The air compressor can cause incorrect data if it is operating too close to the Startle Chamber. If possible, the air compressor should not be in the same room.



3. Connect the 2-pin solenoid cable to the extension cable connected to **AUX 1** on the PHM-255C.

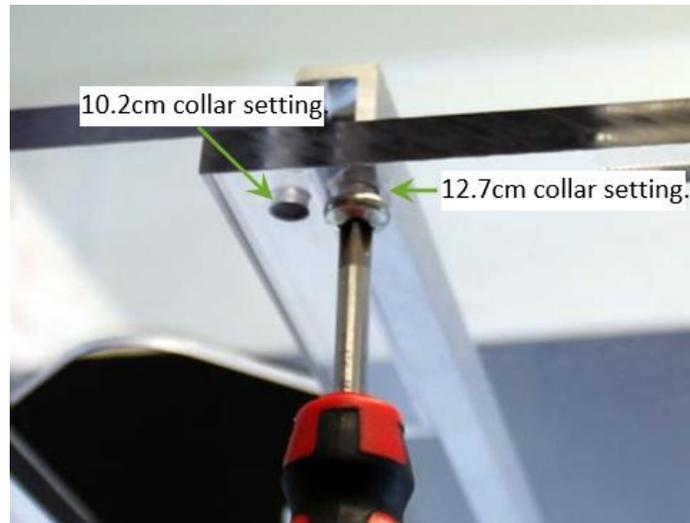


4. Plug in the compressor, turn it on and set the air pressure to the desired pressure (about 80-100 psi). Refer to manufacturer's instructions for operation and maintenance of compressor.

CHAPTER 3 | USE OF RESTRAINT CHAIR

The Restraint Chair accommodates 10.2cm and 12.7cm collars. (Purchased separately from a third party vendor.) Adjust the collar slots for the appropriate size of the collar.

Figure 3-1 – Collar Guide Adjustment.

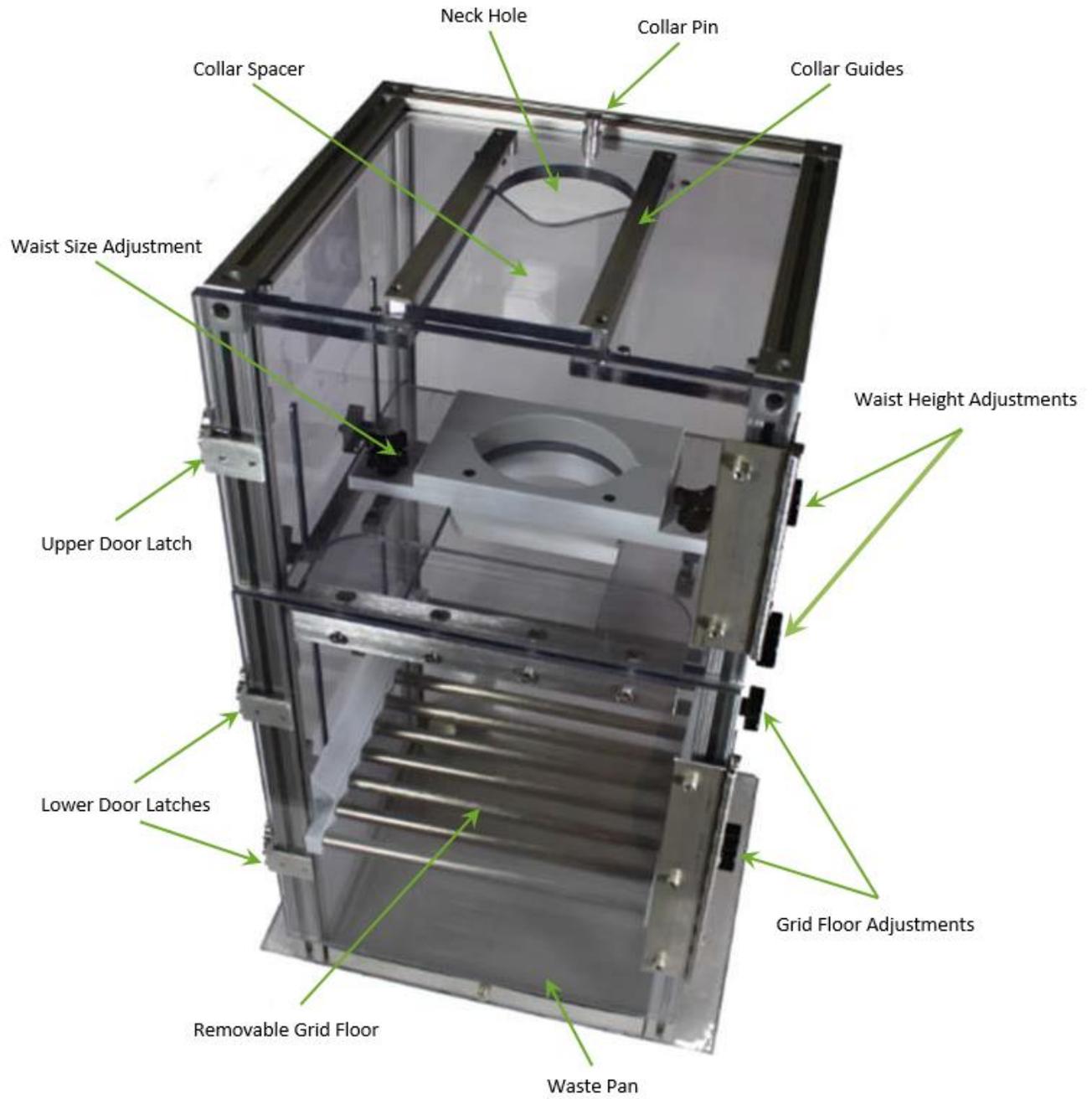


Remove the collar spacer and plate. Place the animal onto the restraint chair. Use the collar pin to temporarily hold the collar in the collar guides while installing the collar spacer. (See Figure 3-2 & Figure 3-3.)

Figure 3-2 – Collar Spacers.



Figure 3-3 – Restraint Chair with Labeled Features.



CHAPTER 4 | CALIBRATION PROCEDURES

After the Primate Startle system has been set up, it is important to test the system to ensure that it is functioning properly. A complete calibration procedure is performed prior to shipping; however, it is necessary to calibrate the system for each new protocol and/or set of animals. Audio calibration includes adjustment of volume. Calibration of the load cell amplification will depend on the animal's level of response. The Hardware menu in Advanced Startle contains utilities for complete testing and calibration of all hardware.

Audio Calibration

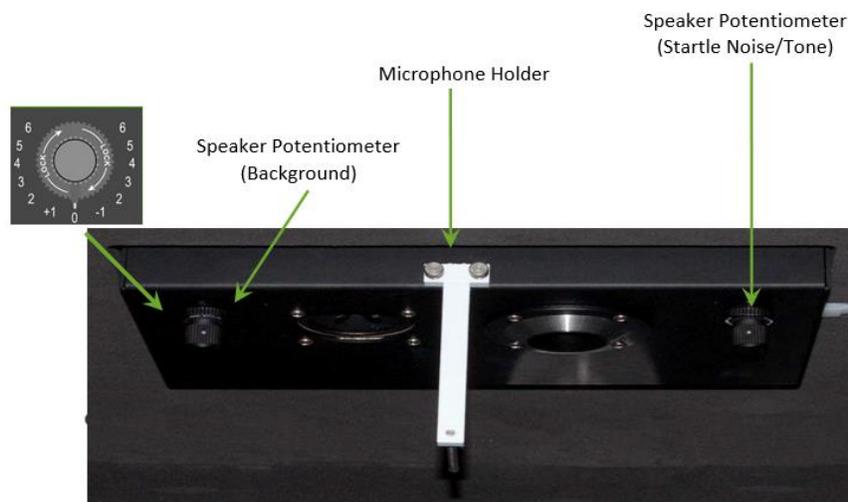
Some audio frequencies are produced at naturally different volumes than others. With the Hardware Check utility and the ANL-930 Standalone Sound Pressure Level Measurement Package, the speaker's frequency response can be tested, and the results can be used to correct for this. Calibrate based on the sound parameters (decibel (dB) and frequency (Hz) level) of the desired experiment protocol.

This system includes all components necessary for calibrating the speakers to generate reproducible startle stimuli. For more information regarding the use of the ANL-930 Standalone Sound Pressure Level Measurement Package, refer to **DOC-315 ANL-930 Sound Pressure Level Meter Manual**.

Calibrating Chamber 1 Audio

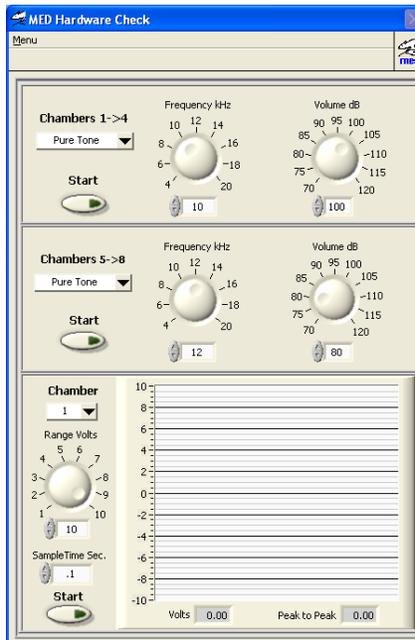
1. Utilizing the ANL-930, mount the microphone holder inside the Primate Startle SAC with the microphone pointed towards the speaker assembly, see Figure 4-1.
2. Set the dials on the speaker assembly to the center (0 Gain) of the adjustment range. Referring to Figure 4-1, turn the two speaker potentiometer dials located at rear of the SAC. This is an adjustment setting of 0dB.

Figure 4-1 – Speaker Assembly with Potentiometers and Microphone Holder.



3. Launch the Advanced Startle application. Select **Menu | Hardware | Hardware Check** from the Advanced Startle drop menu. The Hardware Check shown in Figure 4-2 will appear.

Figure 4-2 – Hardware Check Screen



Startle White Noise Calibration

4. Determine the Startle White Noise dB level appropriate for your protocol.
5. On the Hardware Check screen, choose Stimulus Type: **Startle Noise** from the drop down, and set the Volume (dB) to 100dB and click **Start**.
6. Verify the dB level using the ANL-930 Sound Pressure Level Meter.
7. If the volume is incorrect by + or - 2 dB, adjust the **Right** speaker potentiometer (Figure 4-1) to achieve the correct value. Turn counterclockwise to decrease volume and clockwise to increase volume.

Background Noise Calibration

8. Determine the Background Noise dB level appropriate for your protocol.
9. On the Hardware Check screen, choose Stimulus Type: **Background Noise** from the drop down, and set the Volume (dB) to 100dB and click **Start**.
10. Verify the dB level using the ANL-930 Sound Pressure Level Meter.
11. If the volume is incorrect by + or - 2 dB, adjust the **Right** speaker potentiometer (Figure 4-1) to achieve the correct value. Turn counterclockwise to decrease volume and clockwise to increase volume.

Tone Frequency Calibration

12. Determine the frequency and dB level for tone that will be used in your protocol.
13. On the Hardware Check screen, choose Stimulus Type: **Pure Tone**, and adjust to the desired Frequency (Hz) and Volume (dB) and click **Start**.
14. Observe the dB reading on the ANL-930 Sound Pressure Level Meter.
15. If the dB level is higher or lower than the dB level set in the **Hardware Check** screen, note the difference and use this value to offset the desired dB level within the protocol.

EXAMPLE: If the dB level is set to 100 and the actual reading is 98, increase the desired dB level by 2 (the dB offset is -2dB). So, if the protocol requires a dB level of 70dB, enter a value of 72dB in the protocol. See Figure 4-4.

Figure 4-3 – Protocol Example.

| | A | B | C | D | E | F |
|----|---------------------|------|--------------------|------|-------|-------|
| 1 | STL-DISPLAY | 0.3 | ACC/ITI | 60 | 5 | 7 |
| 2 | CS-DISPLAY | 0 | AUX1 CS | 0 | 0 | 0 |
| 3 | CS-FREEZE | 0 | AUX2 CS | 0 | 0 | 0 |
| 4 | RISE-TIME-NOISE(ms) | 0 | AUX3 CS | 0 | 0 | 0 |
| 5 | RISE-TIME-TONE(ms) | 3 | AUX4 CS | 0 | 0 | 0 |
| 6 | LATENCY(ms) | 3 | TONE CS | 0 | 0.11 | 0.11 |
| 7 | BACKGROUND(dB) | 0 | NOISE CS | 0 | 0 | 0 |
| 8 | AUX1(1=Always on) | 0 | NOISE CS(dB) | 0 | 0 | 0 |
| 9 | AUX2(1=Always on) | 0 | TONE CS(dB) | 0 | 70 | 70 |
| 10 | AUX3(1=Always on) | 0 | TONE CS(Hz) | 0 | 12000 | 4000 |
| 11 | AUX4(1=Always on) | 0 | TONE STL(Hz) | 0 | 0 | 0 |
| 12 | Reserved | 0 | TONE STL(dB) | 0 | 0 | 0 |
| 13 | Reserved | 3 | AUX1 STL | 0 | 0 | 0 |
| 14 | Reserved | 0 | AUX2 STL | 0 | 0 | 0 |
| 15 | Reserved | 0 | AUX3 STL | 0 | 0 | 0 |
| 16 | Reserved | 0 | AUX4 STL | 0 | 0 | 0 |
| 17 | Reserved | 0 | TONE STL | 0 | 0 | 0 |
| 18 | Reserved | 0 | NOISE STL | 0.01 | 0.01 | 0.01 |
| 19 | DAQ Gain(Volts) | 10 | NOISE STL(dB) | 100 | 100 | 100 |
| 20 | DAQ Frequency(Hz) | 1000 | Trial Comment 1 NB | | 70.12 | 70.04 |
| 21 | Reserved | 0 | Trial Comment 2 | 100 | 100 | 100 |
| 22 | Reserved | 0 | CS-STL DELAY | 0.1 | 0.1 | 0.1 |

If dB offset is -2, increase this value to 72dB to achieve a volume of 70dB.

16. Repeat steps 12-15 for each frequency that will be used in the protocol.
17. When completed, remove microphone.

NOTE: The human ear will incorrectly perceive certain frequencies to be louder than others even though a sound meter will show the same loudness level for both.

Input Calibration

Proper calibration of the load cell ensures consistent measurements across multiple chambers. Using the following calibration procedure ensures that an exhibited force, namely Startle response, will result in similar data output in all chambers.

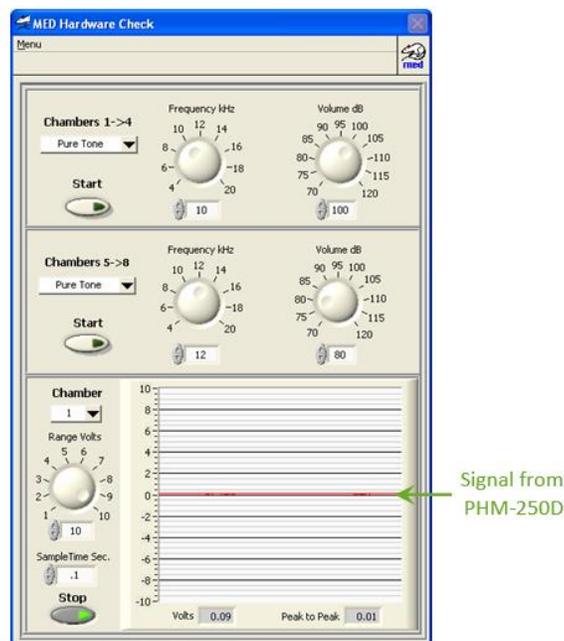
The input calibration procedure has two components:

- Adjust Tare (offset) so that the signal amplitude is zero over a range of gain settings. The Tare should be adjusted while only the restraint chair is on the load cell platform. This ensures a consistent reading of zero is obtained with no applied force.
- Apply a known weight and adjust the gain so that the signal amplitude is at the same reference value in all chambers. This procedure ensures that a given amount of force will result in the same signal in all chambers.

Steps for Calibrating the Load Cell

1. Start the Advanced Startle software, and click **Menu | Hardware | Hardware Checks**, see Figure 4-4.
2. Set the **Chamber** number on the bottom section of the screen to the correct Chamber.

Figure 4-4 – Hardware Check Screen.



3. Set the **Range Volts** setting to 10 Volts.
4. Set the **Sample Time** to 0.2 seconds.
5. Verify that the empty restraint chair is sitting correctly on the Primate Startle platform, and that it is the only thing on the platform.

6. Set the **GAIN** dial on the front of the PHM-250D amplifier to 1.0.

Figure 4-5 – PHM-250D Amplifier.



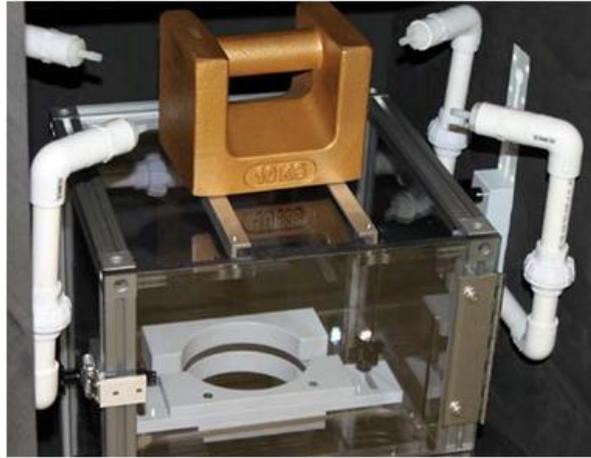
7. Set the **CAL/RUN** switch on the PHM-250D to **CAL**.
8. Click **Start** in the Hardware Check screen. The signal from the PHM-250D platform amplifier is displayed as a red line, see Figure 4-4.
9. Use the potentiometer trimmer tool to adjust the **TARE** potentiometer located on the front of the PHM-250D amplifier until the signal is as close to zero as possible. Some slight fluctuations are normal, as the signal from the load cell is affected by environmental conditions such as air currents and vibrations.
10. Turn the **TARE** potentiometer slowly clockwise to increase the output amplitude and move the red line up. Turn the **TARE** potentiometer slowly counter-clockwise to decrease the output amplitude.

NOTE: Turn the TARE potentiometer very SLOWLY, as it is possible to turn it too far and not be able to adjust the signal any further. If you have turned the potentiometer too far, you may hear a faint click upon each revolution. If this occurs, slowly turn in the opposite direction.

11. Once the zero adjustment is made at a gain of 1.0, increase the **GAIN** knob on the front of the PHM-250D amplifier to 2.0.
12. Adjust the **TARE** potentiometer until the signal is as close to zero as possible.
13. Increase the **GAIN** knob on the front of the PHM-250D amplifier to 3.0.
14. Adjust the **TARE** potentiometer until the signal is as close to zero as possible.
15. Repeat steps 8-10, increasing gain in increments, until the amplifier is tared at the highest setting desired. The maximum gain on the PHM-250D is 10.0, but typical experiments operate at a gain of 5.0-6.0.
16. Decrease the **GAIN** to 1.0. The load cell signal should stay near zero, even while you are decreasing the gain.

17. Place the calibration weight (Figure 4-6) on top of the Restraint Chair.

Figure 4-6 – Restraint Chair with Weight Applied.



18. Adjust the gain knob on the front of the PHM-250D until the signal is at 8 Volts.
19. Remove calibration weight from the Restraint Chair and verify that the signal returns to zero.
20. Set the **CAL/RUN** switch on the PHM-250D to **RUN**.
21. Repeat this procedure for each startle platform.

NOTE: To ensure the input calibration is within the ideal range for experiments, it is recommended to run a few test experiments with animals within an expected startle response range before acquiring data. Different individual animals or groups of animals may have different startle ranges or weights.

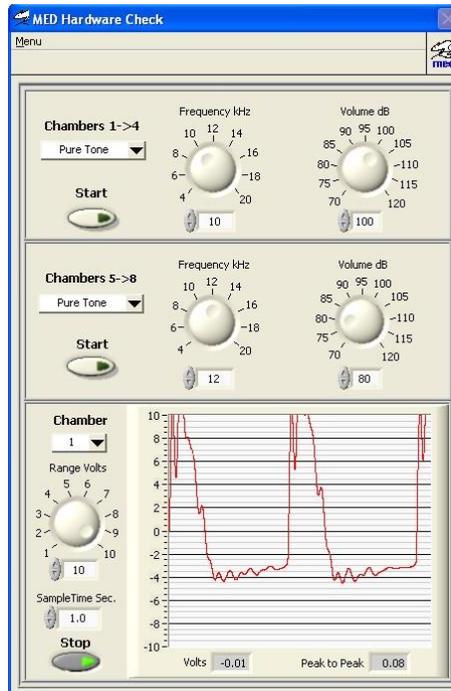
Gain Set Too Low

If gain is set too low, the system may report reduced or absent startle response. To fix this, re-calibrate to a higher voltage (9-10 Volts). If higher gain is necessary, a test weight of less mass may be used during calibration. The same weight must be used with all chambers during calibration.

Gain Set Too High

If gain is set too high, you may observe “clipping”, which occurs when the amplifier is attempting to produce a response that exceeds its maximum voltage capability. To fix this, re- calibrate using to a lower voltage level.

Figure 4-7 – Clipping Example.



APPENDIX A | CONTACT INFORMATION

Please contact Med Associates, Inc. for information regarding any of our products.

For Technical questions, email support@med-associates.com.

For Sales questions, email sales@med-associates.com.

Visit our website at www.med-associates.com.