

**PERIPHERAL NEUROPATHY: PERONEAL MOTOR NERVE CONDUCTION****TABLE OF CONTENTS**

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## PERIPHERAL NEUROPATHY: PERONEAL MOTOR NERVE CONDUCTION

### 1. Peripheral neuropathy background and rationale

Decrements in peripheral nerve function are known to increase both with advancing age and in the presence of diabetes mellitus. Since peripheral neuropathy (PN) involves both sensory and motor functions, PN may be associated with decrements in balance, strength, and mobility, all disability-related outcomes that are central to the scientific objectives of Health ABC.

Supporting a potential association between PN and various aspects of physical function in old age are several small studies in older adults that have suggested these effects. PN may be related both to performance tests and strength measures in the lower extremity, and are of equal scientific importance in older individuals with and without diabetes. Tests of PN in Health ABC are standard tests used in other epidemiologic studies, and involve measurement of both sensory and motor nerve function. PN measurements are divided into three parts:

- Quantitative sensory testing (QST) of the great toe using the Medoc vibration device,
- Nerve conduction (NC) studies using the NeuroMax 1002 to measure several parameters associated with the peroneal nerve, and
- Testing of loss of protective sensation using the monofilament.

Electrophysiologic tests provide reliable and reproducible information for the detection and characterization of peripheral nerve disease. These tests of large, myelinated nerves yield important information about nerve function that is often not clinically apparent. Since the function of large nerve fibers declines with age even in the absence of diabetes, these measures provide important information for both diabetic and non-diabetic individuals. Whole nerve electrophysiologic measures afford an objective and reliable measure of the integrity of specific aspects of nerve function. For Health ABC, nerve conduction studies will be performed on the right peroneal nerve. This test is non-invasive, and is conducted with surface electrodes.

*General description of nerve conduction studies with electrophysiologic equipment using surface electrodes:*

Among other measures, nerve conduction studies generate information on amplitude and velocity following a stimulus to a large myelinated nerve. Amplitude is the strength of the signal needed to achieve maximum stimulation of the nerve. Velocity is the speed at which the signal travels down the nerve. These measurements have been reported to vary with height, body mass index, and diabetes status, and may also vary with lifestyle factors such as smoking and alcohol consumption.

### 2. Equipment and supplies

- Surface thermistor
- XLTek NeuroMax 1002
- Laptop or desktop hook-up for data storage
- Printer (HP1320, HP2015, or Dell 1700)
- Conducting gel

- Disposable surface electrodes
- Paper towels or wipes
- Alcohol wipes
- “Sandpaper tape”
- Electrode tape
- Marker
- Measuring tape
- Calibration device

### 3. Safety issues and exclusions

- Participants are excluded if they are missing both legs (e.g., if both legs have been amputated) or if they have had bilateral knee replacements.
- There are no safety exclusions for nerve conduction studies conducted on the lower extremity.

### 4. Participant and exam room preparation

Nerve conduction studies can be performed either in a fasting or a non-fasting state. The right peroneal nerve will be evaluated, unless the left leg was tested at the prior visit or the right leg is contraindicated. Examination of this nerve requires that the pant leg of the leg being tested be rolled up above the knee. Contraindications for testing on the right leg include amputation, ulcer, trauma, knee replacement, and surgery. If the right leg cannot be tested, test the left leg, unless contraindicated.

The participant should be supine on the examining table, with the leg exposed. The surface electrodes are placed on the leg with conducting gel according to the protocol. The nerve is stimulated, and the electrophysiologic measures are collected in the computer.

Nerve conduction studies should be performed under standardized temperature conditions using the same equipment and the same brand of disposable electrodes. If the initial limb temperature is below 30°C, the leg should be heated with the heating pad until 30°C is achieved. Temperature measurements are performed with a surface thermistor held approximately four inches from the foot. The temperature is recorded before and after the nerve conduction study, and both values are reported on the data form. Nerve conduction values are reported as the recorded values without temperature corrections. A centralized temperature correction of data may be considered for subsequent analysis.

#### 4.1 General NCV Procedures

1. Calibration Signals

Motor

Calibration of the NCV equipment is described in detail in section 4.2

2. Measure limb temperature, holding the surface thermistor approximately four inches from the foot.

**Lower limb**  $\geq 30$  °C at beginning and end.

If not warm enough, heat at site indicated below:



3. Skin Prep: clean with alcohol or degreaser. [**Note:** Abrading the skin to obtain a good response is generally needed only in the presence of thick skin, or dry or scaly skin. It should therefore be rarely done in Health ABC].

4. Filter Settings

Motor: LLF = 2.0 Hz; HLF  $\geq 10$  kHz

5. Gain/Display Sensitivity: Set so that the response is at least 2 (two) divisions (NEVER clipped).

Motor: Usually 2-5 mV/division.

Do NOT change sensitivity after final waveform acquisition.

6. Stimulation:

5-10 % supramaximal

7. Amplitude Measurements: All at same sweep speed of final waveform acquisition.

**Motor Amplitude:** baseline to negative peak

8. Latency Measurements:

**Motor Latency:** Onset latency from take-off of negative wave; when there is positivity, measure amplitude from base of positive peak to top of negative peak.

9. NCV Calculations: To nearest 0.1 m/s.

Motor: use “long segment” distances.

10. **Filing completed studies:** All studies must be documented. A complete report consists of the following items:

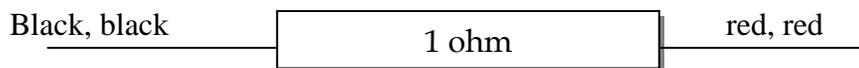
- Nerve conduction worksheet and data collection form
- A picture (printout) of the peroneal motor waveforms

## 4.2 Calibration

For most hardware, use the calibration output procedure to generate a motor calibration signal. Then proceed to conduction studies. This applies to section 4.1, item 1. Calibration should be done once per week.

**For XLTEK Neuromax ONLY:** *Because the Neuromax doesn't have a calibration procedure built in, use the following procedure to generate a motor calibration signal.*

1. First, pull up the previous participant named "Calibration," and change Examiner ID in the Examiner ID field if necessary.
2. Attach alligator clip electrodes from both the stimulator and recording electrodes across 1 ohm resistor.



3. Go to "Calibration—Motor—No Side" test screen
4. Settings:      Notch: Off      LFF: 0.5 Hz      HFF: 3 kHz  
Gain: 500  $\odot$ V/div   Timebase: 1 ms/div   Sweep delay: -2 ms
5. Set stimulation level to **1.0 mA**
6. Stimulate once or twice until a nice 1 mV square curve appears (Appendix 1).

## 5. Detailed measurement procedures

### 5.1 Overview of peroneal nerve conduction test

- a) Ask the participant if they have ever had a knee replacement.

**Script:** "Have you ever had knee surgery on either leg where all or part of the joint was replaced?"

If they answer, "Yes," ask which leg. If they have had the right knee replaced, test the left leg. If both knees have been replaced they are not eligible for the peroneal nerve conduction test.

- b) Press your fingers on the participant's lower front tibia for 5 seconds. If a dimple remains after you apply pressure, this indicates that the participant has pitting edema. Record results by answering question on the data collection form "Does the participant have evidence of pitting edema at the lower front tibia?" The response options are "Yes," "No," "Don't know," and "Not examined." If the participant was not examined, note the reason on the data collection form.
- c) Press your fingers on the participant's front ankle for 5 seconds. If a dimple remains after you apply pressure, this indicates that the participant has pitting edema. Record results by answering question on the data collection form "Does the participant have evidence of pitting edema at the ankle?" The response options are "Yes," "No," "Don't know," and "Not examined." If the participant was not examined, note the reason on the data collection form.
- d) Look at the participant's feet and legs and answer the following question: "Are open sores present on either foot." Record "Yes," "No," or, if participant was not examined, "Participant not examined."
- e) Describe the testing procedure to the participant, and allow them to become familiar with the equipment and provide the opportunity to ask questions.

Script: "This test measures how well a sensation travels down a big nerve in your leg. To do this, I will place small patches on your foot. Then I will use this tool (**show stimulator**) to stimulate your nerve. This test is not painful, but most people say that it feels uncomfortable for just a moment, like when you bump your 'funny bone.' Your foot or leg may twitch during the test. If you want to stop the test at anytime, just say so."

- f) Record the surface temperature on the dorsum of the foot being tested using the surface thermistor. Hold the thermistor approximately 4 inches from the foot.

Script: "Before we begin, I need to check the temperature of your foot. If it isn't warm enough we'll warm it in a heating pad."

If the foot temperature is below 30°C, warm the foot and record the temperature again. If, after 5 minutes of warming, the foot does not reach 30°C, record temperature and proceed with testing. Leave the fields for the second temperature measurement (called "Limb temperature following heating") blank if the participant's initial limb temperature was at least 30°C.

- g) Before beginning the test, say,

Script: "Now I'm going to start the test on your nerve."

- h) Begin testing of the peroneal nerve [see section 5.2]. Data on maximum responses will be recorded in the computer and downloaded later.
- i) Conclude the test when maximum responses have been evoked.

- j) Record the surface temperature of the dorsum of the foot that was tested.
- k) Record whether or not the peroneal motor nerve conduction test was started. If not, record why not.
- l) Record which leg was tested, and if the left leg was tested, record why the right leg was not tested.
- m) Answer the data collection form questions regarding:
- whether or not the distal, fibular head, and/or popliteal fossa stimulation were completed (if not completed, indicate why not);
  - record the amplitudes and whether or not the amplitudes at each stimulation site were greater than 1 mV (if “No,” flag the waveform for quality control).
  - Record the two conduction velocities
    - between the ankle and the fibular head; and
    - between the ankle and popliteal fossa.
- If either of these velocities is less than 20 m/s or more than 70 m/s, flag waveform for quality control.
- n) Determine if there is a greater than 10 m/s difference between results of conduction velocity between the ankle and fibular head and between the ankle and popliteal fossa. If so, re-test.
- o) Print out a hard copy of the peroneal motor nerve conduction results and waveforms to be placed in the participant’s chart.

## 5.2 Detailed peroneal nerve testing procedures

1. Test leg listed on Data from Prior Visits Report. If test was never done before, test on the right leg unless the right knee was replaced. If a participant has had a knee replacement their other leg should be tested.  
Instructions for completing the Peroneal Motor Nerve Conduction data collection form in the Clinic Visit Workbook:  
When answering Question #11 regarding why the right leg wasn’t tested, choose the “Trauma or surgery (including knee replacement)” response option if a participant has had a knee replacement in their right knee. If a participant has had bilateral knee replacements, do not administer the peroneal motor nerve conduction test. Choose the “No” response option when answering Question #10: “Was the peroneal motor nerve conduction test started?” and choose “Bilateral knee replacements” to answer “Why wasn’t the test started?”  
Test leg noted on Data from Prior Visits Report unless contraindicated above.
2. Make sure that **patient info** is entered. Enter the participant’s Health ABC enrollment ID# without the HA or HB, and enter their acrostic (no spaces between numbers and/or letters). For example 1234ASMI.
3. Enter the Staff ID# in the Staff ID# space.
4. For Gender, type M for male or F for female.

5. Choose **Peroneal—Motor—Right**.
6. **Measure limb temperature**,
  - A) Should be  $\geq 30^{\circ}\text{C}$
  - B) Warm and repeat as needed.
  - C) Record on study data collection form.
7. **Clean skin**.
8. **Place electrodes** (see **Figure 1**):
  - G1 (recording, black): over base of EDB muscle, 1 cm distal to calcaneus bone
  - G2 (reference, red): over 5<sup>th</sup> MTP joint, lateral to long extensor tendons
  - Ground (smaller rectangle ground): over anterior ankle as shown
9. **Measure distance** from G1 up 8.5 cm to stimulation site. Mark skin.
10. Filters: LLF = 2.0 Hz, HLF  $\geq 10.0$  kHz
11. Sweep speed: 2 ms/division. May need to be longer.
12. Gain/display: 2 mV/division. May need to be different to achieve waveform  $\geq 2$  divisions.
13. **Stimulate Site #1 (Ankle)**:
  - A) Cathode (black) at 8.5 cm (85 mm) from G1, which is about 5 cm proximal of malleoli.
  - B) Nerve runs 5 mm lateral to tendon of tibialis anterior.
  - C) Start with stimulator transverse or  $45^{\circ}$  to nerve, then rotate to reduce stim artifact. Start at 20 mA and increase each stimulus by 10 mA.
  - D) When supramaximal response is obtained, **record single waveform**.

**Note (also applies to #14-15): If you receive the message “stimulation impedance high”, then check the following:**

  1. **There is an adequate amount of gel applied.**
  2. **There is appropriate contact between the skin and the stimulator.**
  3. **The electrodes are in contact with the skin.**
14. **Stimulate Site #2 (Fibular head)**:
  - A) Cathode (black) over the nerve where it runs immediately below the fibula [fibular head] and enters the anterior compartment. If the participant had a test from a prior visit on the same leg, obtain the distance measurement from their Data from Prior Visits Report (DPVR). Starting from G1, use this distance from the DPVR to identify the same testing site as was used previously. Place cathode at this site. If the participant had the other leg tested previously, or if they did not have the test at Year 4, place cathode over the nerve where it runs immediately below the fibula [fibular head] and enters the anterior compartment. Mark skin.
  - B) Start at 20 mA and increase each stimulus by 10 mA. When supramaximal response is obtained, **record single waveform**.
  - C) Amplitude should be equal or slightly lower than ankle.



**Note:** If the ankle stimulation results were absent and the fibular head stimulation was satisfactory, repeat the ankle stimulation and place the cathode lateral to its initial placement.

**Note (also applies to #15):** The peroneal nerve response causes the foot to pull to the outside of the body. If you are inadvertently stimulating the tibial nerve, then you will notice the foot pull back toward the body.

15. **Stimulate Site #3 (Popliteal fossa):**
  - A) Cathode (black) over the nerve in the popliteal fossa approximately 10 cm proximal to the head of the fibula. If the participant had a test from a prior visit on the same leg, obtain the distance measurement from their Data from Prior Visits Report (DPVR). Starting from G1, use this distance from the DPVR to identify the same testing site as was used previously. Place cathode at this site. If the participant had the other leg tested previously, or if they did not have the test at Year 4, place cathode over the nerve in the popliteal fossa approximately 10 cm proximal to the head of the fibula. Mark skin.
  - B) Start at 20 mA and increase each stimulus by 10 mA. When supramaximal response is obtained, **record single waveform**.
  - C) Amplitude should be equal or slightly lower than ankle.
16. **Check/mark responses** with internal cursors.
  - A) **Onset** latency (from base of positivity if present).
17. **Measure and record actual distances** (enter into computer).
  - A) Ankle: from G1 to cathode should be 8.5 cm
  - B) Fibular head: measure actual distance from ankle cathode (distance between stimulation site #1 and stimulation site #2).
  - C) Popliteal fossa: measure actual distance from ankle cathode (distance between stimulation site #1 and stimulation site #3).
18. **Print out waveform** (screen copy). Make sure that the printed copy is a clipped curve so the waveform is at least two blocks high. Completed data collection forms should always contain the following information:
  - A) Name of nerve
  - B) Side studied
  - C) Date
  - D) Participant ID (participant number)
  - E) Participant acoustic
  - F) Temperature before and after
  - G) Staff ID number
19. **Save waveform.** Once you obtain a good waveform, save it. You must save the waveform so that the entire view is seen. If you have increased the size of the curve for printing, then you may need to reduce the size of the curve before saving.

You can find examples of problem waveforms in Appendix 2, 3, and 4.

# Figure 1 Peroneal Nerve

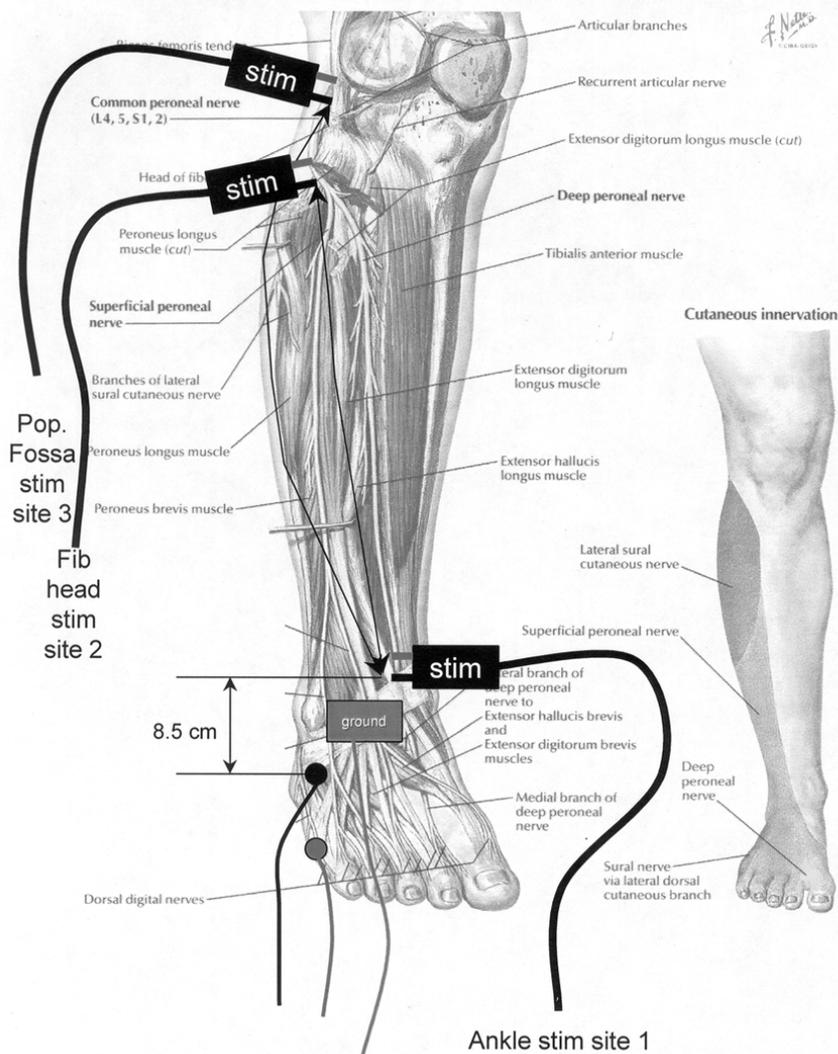
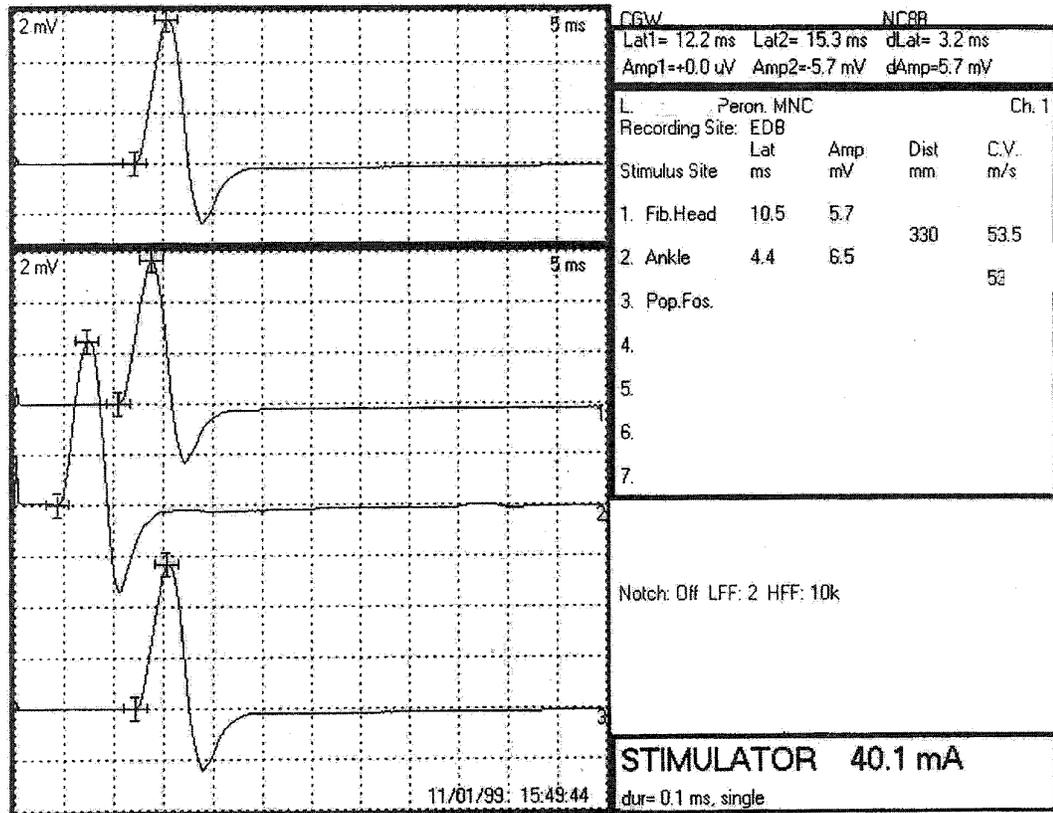


Figure 2: Peroneal Nerve Waveforms / Motor



## 6. Shipment and tracking

1. Every file that is started should be saved and logged (even if you cannot get a good wave form. (See Appendix 5)
2. Complete the left side of the tracking log fully:

Date of exam  
Participant Enrollment ID#  
Acrostic  
Staff ID#  
Number of waveforms captured  
Whether or not flagged for QC  
Comments – anything we might need to know

3. The right side of the tracking log should be left blank. This side is for the QC Center to complete.
4. DAILY: Print out wave forms for each participant, make xerox copies of pages 54 through 58 of the Clinic Visit Workbook, and mail it all to:  
Dr. Sasa Zivkovic  
University of Pittsburgh Medical Center  
PUHF875  
200 Lothrop St.  
Pittsburgh, PA 15213

This will continue until 100 waveforms total have been sent to Dr. Zivkovic from each clinic. Use Dr. Zivkovic's cover sheet (see Appendix 6). After the 100 waveforms are reviewed only flagged waveforms will be sent to Dr. Zivkovic.

5. WEEKLY: Back up all files created during the week following the instructions below (labeled with clinic, date, and "Nerve Conduction"), xerox the log for your records, and send the data and log to the address above.

Instructions for backup of files:

- a) Insert flash drive into USB port
- b) Go to main menu
- c) Highlight #4 administrative functions
- d) Hit select
- e) Highlight #1 patient directory
- f) Hit select
- g) Highlight patients to be archived
- h) Use right arrow key to select #9 Save file to USB
- i) Hit select
- j) The prompt will show when completed
- i) Remove flash drive

6. Start a new log sheet for the next week.

### **7. Procedures for performing the measurements at home (if applicable)**

This exam cannot be performed at home.

### **8. Alert values/Follow-up/Reporting to participants**

The results of the peroneal motor nerve conduction test are included in the Participant Results Report. If the nerve conduction velocity is at least 40 m/sec, check the box next to: "Nerve conduction velocity was normal." If the nerve conduction velocity was less than 40 m/sec, check the box next to "Nerve conduction velocity was slow." The participants are encouraged to share their results with their doctor.

If the participant's waveform has been flagged for QC, Dr. Zivkovic will be making a data correction and will fax the corrected waveform back to the field centers. Included on this fax will be the corrected conduction velocities which should be used to complete the report for the participants. The corrected waveform should be kept in the participant's chart. It will not be possible to give the participant the conduction velocity results on the day of the participant's clinic visit. Leave this portion of the Participant Results report blank on the day of the participant's clinic visit, and write on the report that the results are not yet available. Keep a copy of the report in the participant's chart. After you receive the corrected waveform from Dr. Zivkovic please enter the results on the Participant Results report and mail the entire report to the participant.

## 9. Quality assurance

Standardization of surface temperatures is needed. Surface temperature before initiation of nerve conduction studies should be at least 30°C and the surface thermistor should be held approximately 4 inches from the foot for these measurements. The machines should be calibrated weekly according to instructions in section 4.2. The same kind of surface electrodes should be used at both sites.

Individual waveforms may require adjustments by Dr. Sasa Zivkovic who will request that these particular files be sent to him by mail.

### 9.1 Training requirements

The examiner requires no special qualifications or experience to perform this assessment. Training should include:

- Read and study manual
- Attend Health ABC training session on measurement techniques
- Practice measurement protocol on other staff or volunteers
- Discuss problems and questions with local expert or QC officer

### 9.2 Certification requirements

- Complete training requirements
- Conduct exam on four volunteers, two of whom should be re-tested. Volunteers need not be age-eligible for Health ABC:
  - According to protocol, as demonstrated by completed QC checklist

### 9.3 Quality assurance checklist

- Main points of script correctly and clearly delivered
- Correctly warms leg, if necessary, before administration of protocol
- Correctly describes testing procedure
- Cleans skin
- Correctly places electrodes (over base of EDB muscle, over 5<sup>th</sup> MTP joint, lateral to long extensor tendons, and over anterior ankle.
- Measures distance from G1 (over base of EDB muscle, 1 cm distal to calcaneous bone) up 8.5 cm to stimulation site; marks skin
- Records which leg was tested or why test was not done on data collection form
- Correctly stimulates site #1 (distal)

- Records data for site #1 (distal)
- Correctly stimulates site #2 (fibular head)
- Records data for site #2 (fibular head)
- Correctly records velocity between ankle and fibular head
- Correctly stimulates site #3 (popliteal fossa)
- Records data for site #3 (popliteal fossa)
- Correctly records velocity between ankle and popliteal fossa
- Measures and records distances (into computer)
  - ankle to G1 cathode (should be 8.5 cm)
  - fibular head to ankle (distance between stimulation site #2 and stimulation site #1)
  - popliteal fossa to ankle (distance between stimulation site #3 and stimulation site #1)
- Records whether or not there is a greater than 10 m/s difference between velocities records on Question #14 and Question #16.
- Reviews form for completeness following completion of test
- Prints out hard copy of nerve conduction data and waveforms
- “Repeatability studies” satisfactorily completed

10. Data collection form

HABC Enrollment ID #	Acrostic	Type of Annual Contact	Staff ID#
H <input type="text"/>	<input type="text"/>	<input checked="" type="radio"/> Year 11 <input type="radio"/> Other1 <input type="radio"/> Other2	<input type="text"/>

**PERONEAL MOTOR NERVE CONDUCTION** ★

1. Have you ever had knee surgery on either leg where all or part of the joint was replaced?  
 Yes    No    Don't know    Refused

Which leg?

Right leg    Left leg    Both legs

Do NOT test right leg.   Do NOT test left leg.   Do NOT test either leg. Go to Question #10.

2. **Examiner Note: Test leg noted on Data from Prior Visits Report unless contraindicated above. Press your fingers on the participant's lower front tibia for 5 seconds and then on the ankle for 5 seconds. If a dimple remains after you apply pressure, this indicates that the participant has pitting edema.**

a. Does the participant have evidence of pitting edema at the lower front tibia?  
 Yes    No    Don't know    Participant refused / not examined

b. Does the participant have evidence of pitting edema at the ankle?  
 Yes    No    Don't know    Participant refused / not examined

**Examiner Note: Look at the participant's feet and legs and answer the following question.**

3. Are open sores present on either foot?  
 Yes    No    Participant refused / not examined

4. **Describe nerve conduction testing to the participant and conduct a mock test on the ankle.**

Script: "This test measures how well a sensation travels down a big nerve in your leg. To do this, I will place small patches on your foot. Then I will use this tool (show stimulator) to stimulate your nerve. This test is not painful, but most people say that it feels uncomfortable for just a moment, like when you bump your funny bone. Your foot or leg may twitch during the test. If you want to stop the test at any time, just say so. Before we begin, let's do a practice test so you can see what it feels like."





HABC Enrollment ID #	Acrostic	Type of Annual Contact	Staff ID#
H <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input checked="" type="radio"/> Year 11 <input type="radio"/> Other1 <input type="radio"/> Other2	<input type="text"/> <input type="text"/> <input type="text"/>

**PERONEAL MOTOR NERVE CONDUCTION** ★

5. Conduct practice test at ankle.

Record the surface temperature on the dorsum of the right foot using the surface thermistor. If the right foot cannot be tested, record the temperature of the left foot.

Warm the limb to at least 30°C if initial temperature is below that level.

Script: "Before we begin, I need to check the temperature of your foot. If it isn't warm enough we'll warm it in a heating pad."

Initial foot temperature:   .  °C

If the foot temperature is below 30°C, warm the foot and record the temperature again. If, after 5 minutes of warming, the foot does not reach 30°C, record the temperature and proceed with testing.

Foot temperature following heating:   .  °C *Leave blank if participant's initial foot temperature was at least 30°C.*

6. Before beginning testing of the peroneal nerve, say,  
Script: "Now I'm going to start the test on your nerve."

7. Begin testing of the peroneal nerve. Data on maximum responses will be recorded in the computer and downloaded later.

8. Conclude the test when maximum responses have been evoked.

9. Record the post-test surface temperature of the foot using the surface thermistor.

Foot temperature after test:   .  °C

10. Was the peroneal motor nerve conduction test started?  
 Yes       No

Why wasn't test started?  
**(Examiner Note: Mark all that apply.)**

Participant refused before the test began  
 Amputation of both legs  
 Bilateral knee replacements  
 Other *(Please specify: \_\_\_\_\_ )*

Go to Monofilament Testing.





HABC Enrollment ID #	Acrostic	Type of Annual Contact
H <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="radio"/> Year 11 <input type="radio"/> Other1 <input type="radio"/> Other2

**PERONEAL MOTOR NERVE CONDUCTION** ★

11. Which leg was tested?

- Right                       Left  
 ↓    ↓

Why wasn't the right leg tested?  
**(Examiner Note: Mark all that apply.)**

Left leg tested at Year 4  
 Amputation  
 Ulcer  
 Trauma or surgery (including knee replacement)  
 Other **(Please specify: \_\_\_\_\_)**

12. Was distal stimulation completed?

- Yes     No  
 ↓    ↓

a. What was the amplitude?  
  ·  mV

b. Was the amplitude greater than 1 mV?  
 Yes                       No  
 ↓  
 Flag waveform for quality control.

Why wasn't the distal stimulation completed?

Participant refused  
 Other **(Please specify: \_\_\_\_\_)**  
 \_\_\_\_\_ )  
 \_\_\_\_\_ )

13. Was fibular head stimulation completed?

- Yes     No  
 ↓    ↓

a. What was the amplitude?  
  ·  mV

b. Was the amplitude greater than 1 mV?  
 Yes                       No  
 ↓  
 Flag waveform for quality control.

Why wasn't the fibular head stimulation completed?

Participant refused  
 Other **(Please specify: \_\_\_\_\_)**  
 \_\_\_\_\_ )  
 \_\_\_\_\_ )





HABC Enrollment ID # H [ ] [ ] [ ] [ ] [ ]	Acrostic [ ] [ ] [ ] [ ] [ ]	Type of Annual Contact <input type="radio"/> Year 11 <input type="radio"/> Other1 <input type="radio"/> Other2
---	---------------------------------	---

**PERONEAL MOTOR NERVE CONDUCTION** ★

14. What was the conduction velocity between the ankle and fibular head?

[ ] [ ] [ ] . [ ] m/s

Conduction velocity not obtained

If less than 20 m/s or greater than 70 m/s, flag for quality control.

15. Was popliteal fossa stimulation completed?

Yes

No

a. What was the amplitude?  
[ ] [ ] . [ ] mV

b. Was the amplitude greater than 1 mV?  
 Yes    No

Flag waveform for quality control.

Why wasn't the popliteal fossa stimulation completed?

Participant refused

Other (Please specify:  
\_\_\_\_\_  
\_\_\_\_\_)

16. What was the conduction velocity between the ankle and popliteal fossa?

[ ] [ ] [ ] . [ ] m/s

Conduction velocity not obtained

If less than 20 m/s or greater than 70 m/s, flag for quality control.

17. Is there a greater than 10 m/s difference between results entered in Questions #14 and #16?

Yes

No

No results for Question #14 or Question #16

Redo Peroneal Motor Nerve Conduction test.  
Go to Question #18.

Go to Question #23 on next page.

18. Was distal stimulation completed?

Yes

No

a. What was the amplitude?  
[ ] [ ] . [ ] mV

b. Was the amplitude greater than 1 mV?  
 Yes    No

Flag waveform for quality control.

Why wasn't the distal stimulation completed?

Participant refused

Other (Please specify:  
\_\_\_\_\_  
\_\_\_\_\_)





HABC Enrollment ID # H	Acrostic	Type of Annual Contact <input checked="" type="radio"/> Year 11 <input type="radio"/> Other1 <input type="radio"/> Other2
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**PERONEAL MOTOR NERVE CONDUCTION** ★

19. Was fibular head stimulation completed?

Yes

No

a. What was the amplitude?  
  ·  mV

b. Was the amplitude greater than 1 mV?  
 Yes    No

Flag waveform for quality control.

Why wasn't the fibular head stimulation completed?

Participant refused

Other (Please specify:  
 \_\_\_\_\_  
 \_\_\_\_\_)

20. What was the conduction velocity between the ankle and fibular head?

·  m/s

Conduction velocity not obtained

If less than 20 m/s or greater than 70 m/s, flag for quality control.

21. Was popliteal fossa stimulation completed?

Yes

No

a. What was the amplitude?  
  ·  mV

b. Was the amplitude greater than 1 mV?  
 Yes    No

Flag waveform for quality control.

Why wasn't the popliteal fossa stimulation completed?

Participant refused

Other (Please specify:  
 \_\_\_\_\_  
 \_\_\_\_\_)

22. What was the conduction velocity between the ankle and popliteal fossa?

·  m/s

Conduction velocity not obtained

If less than 20 m/s or greater than 70 m/s, flag for quality control.

23. Print out a hard copy of peroneal motor nerve conduction results and place in participant's chart.

24. Are the results flagged for quality control?

Yes

No

25. Are the results flagged for other reason(s)?

Yes

No

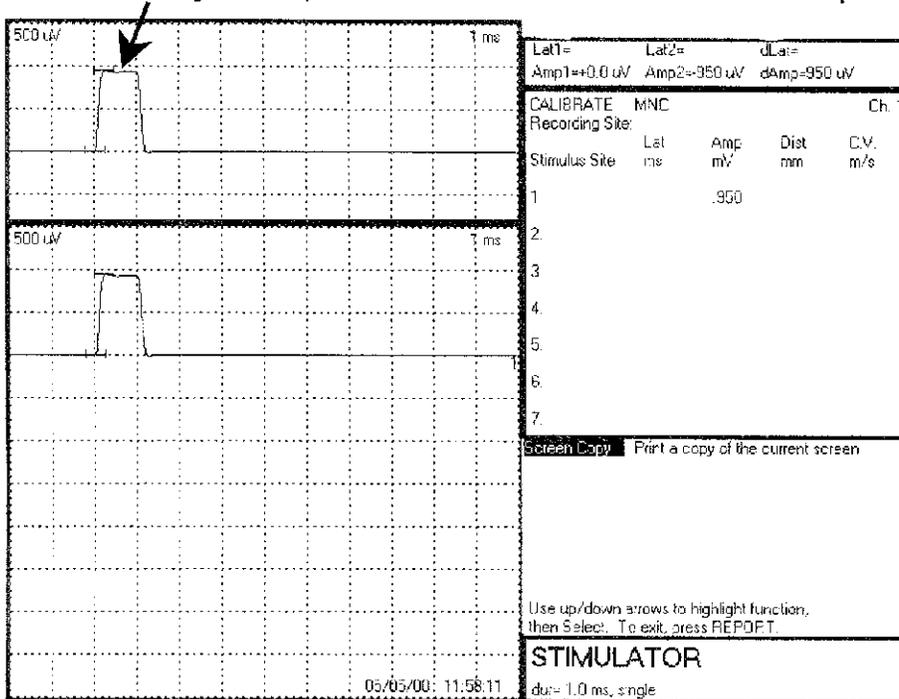
Please specify: \_\_\_\_\_



Appendix 1 Calibration Waveform

# Calibration Waveform

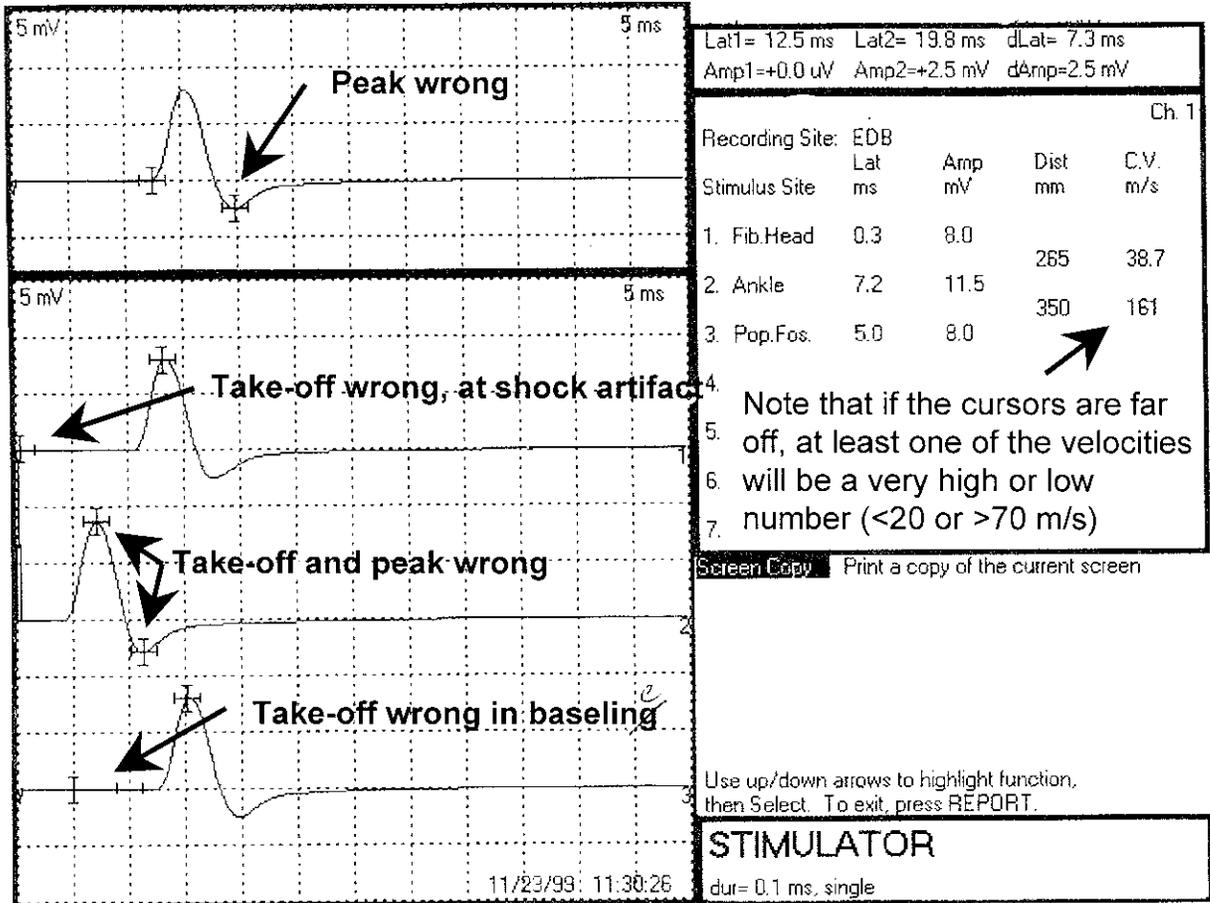
Note that the waveform should be essentially square and around 1 mV every time (between .700 and 1.3 mV is acceptable).



Be sure to store the waveform as number 1 before printing or exiting this screen.

Appendix 2 Cursor Placement

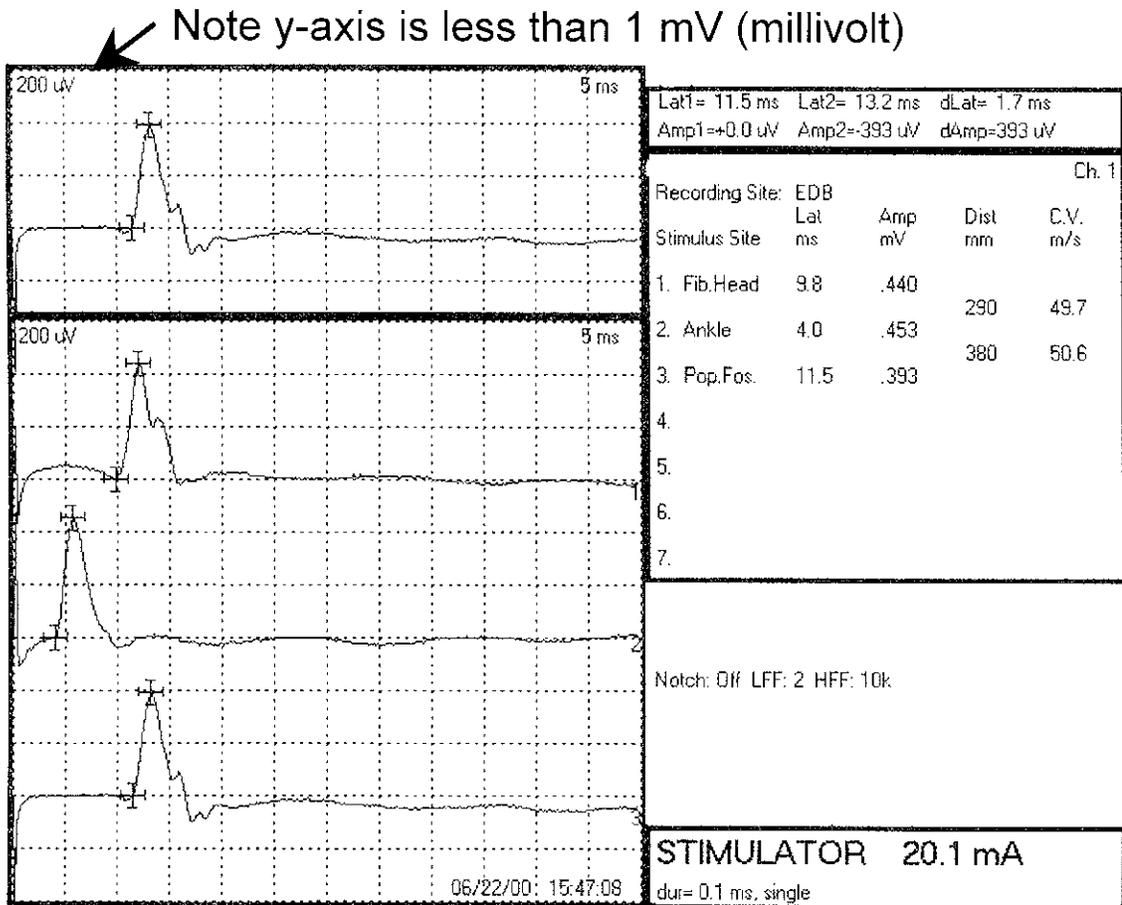
# Cursor Placement



These waveforms are good but the computer placed the cursors in the wrong places...they need to be flagged for QC.

Appendix 3 Low Amplitude

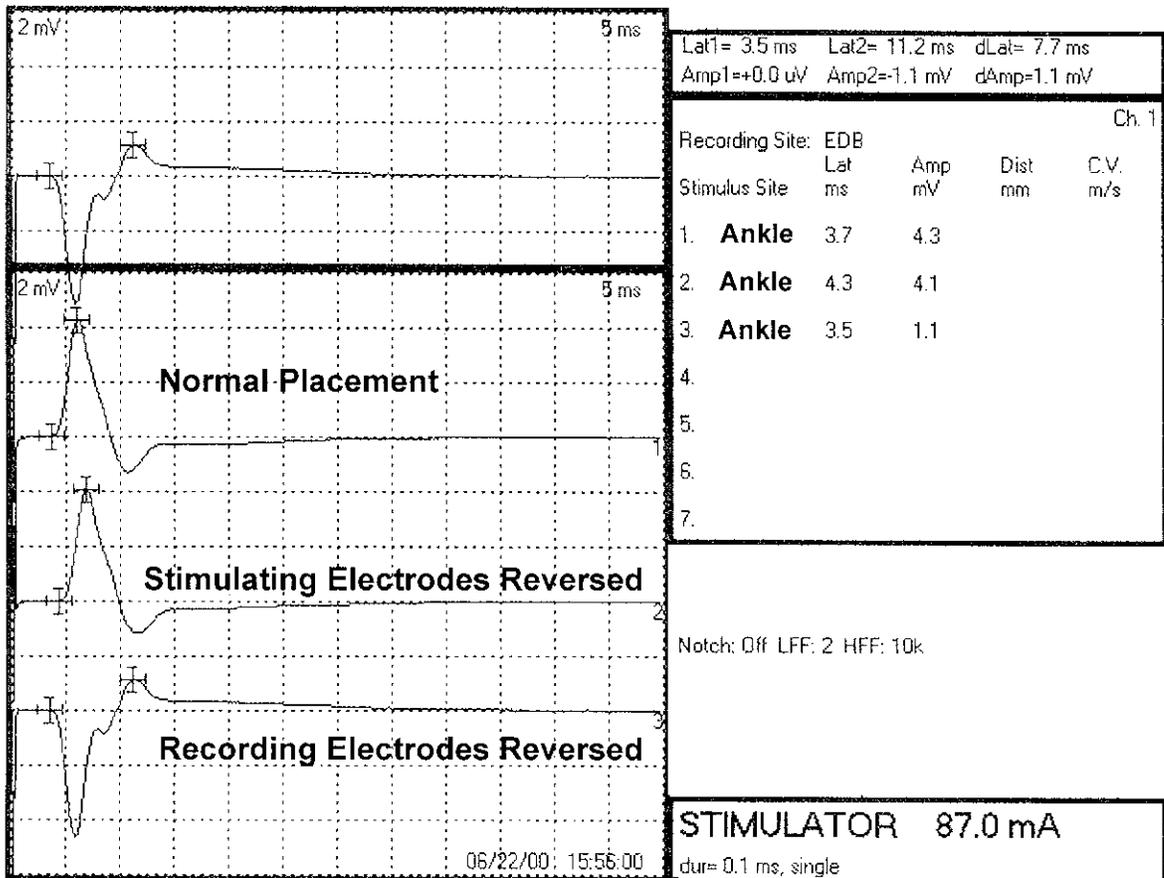
# Low Amplitude



This tracing is acceptable but does still get flagged for QC according to the data collection forms because the amplitude is less than 1 mV.

Appendix 4 Electrodes Reversed

# Electrodes Reversed



These, especially number 3, would be unacceptable. Note that number 2 (stimulating electrodes reversed) is difficult to spot from the tracing, so please be careful when choosing the red/black **stimulator** direction.



Appendix 6 Peripheral Neuropathy Review Cover Page

Health ABC Peripheral Neuropathy Review Fax Cover Page

**FAX**

Date: \_\_\_\_\_  
Number of pages including cover  
sheet: \_\_\_\_\_

**To: Dr. Sasa Zivkovic**

**University of Pittsburgh Medical Center**

PUH F875

200 Lothrop St.

Pittsburgh, PA 15213

Phone: (412) 647-8984

Fax: (412) 647-8398

E-mail: zivkovics@upmc.edu

**From:**

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

Examiner ID: \_\_\_\_\_

**REMARKS:**  Urgent  For your review  Reply ASAP  Please comment

**This fax contains (check one):**

- Non-participant Data for Examiner Certification
- Study participant data from first 100 participants
- Study participant data for other QC review

**Tests performed and sent for review (check all that apply):**

- Peroneal Motor Nerve Conduction
  - Printout of waveforms from Neuromax
  - Data collection pages 54-58 completed

**Comments to the reviewer:**

## Appendix 7 Peroneal Nerve Conduction Performance Tips

### Electrode Location:

Black electrode- belly of EDB muscle (An atrophied muscle may appear as a dip instead)- have the participant spread or wiggle their toes to try to determine location of the biggest portion of the muscle. Pushing down on their toes may also be helpful if you are having difficulty with location.

If stimulus response shows large dip on curve before the expected take-off response, placement of this electrode may need to be adjusted slightly.

Red electrode- over 5<sup>th</sup> MTP joint

Green electrode (ground)- anterior ankle (between black electrode and stimulator)

### Stimulation Location:

#### Ankle: (also called G1)

- 85 mm
- Just lateral to the shin bone- try moving slightly side to side to increase amplitude

**Fibular Head:** Check the participant's data prior visit report (DPVR) to obtain the distance measurement if testing the same leg as baseline. Starting from G1, use this distance from the DPVR to identify the same testing site as was used previously. If the previous distance does not fall on the correct location, re-measure the leg. Always use the measurement of the actual stimulation site.

- Just behind and below the prominent bone just below and lateral to the knee
- "Hook" the stimulator behind this bone adjust to 45 degree angle to improve quality of curve

**Knee (Popliteal fossa):** Check the participant's DPVR to obtain the distance measurement if testing the same leg as baseline. Starting from G1, use this distance from the DPVR to identify the same testing site as was used previously. If the previous distance does not fall on the correct location, re-measure the leg. Always use the measurement of the actual stimulation site.

- Approximately 100 mm from the fibular head stimulation site
- Just lateral to the outer tendon of the knee

### TIPS:

**Always stimulate with the black prong of the stimulator closest to the black electrode.**

Always use actual stimulation site black prong location for your measurements if measurement values from DPVR are not used.

**The peroneal nerve responses at the fibular head and popliteal fossa cause the foot to pull to the outside of the body. If you are inadvertently stimulating the tibial nerve, then you will notice the foot pull back toward the body.**

### If receive message saying "Stimulator Impedance High"

- You may need to re-clean the stimulation and/or electrode sites

- May need to use more or less electrode gel
- Check electrodes to make sure they are not dried out. If so, replace the electrodes.
- There is appropriate contact between the skin and the stimulator.
- The electrodes are in contact with the skin.

**Get supramaximal response** - 10% stimulation above highest amplitude stimulation. If this increases the amplitude return to increasing with the next multiple of 10. Supramaximal response should not increase the amplitude.

**Amplitudes should DECREASE as you move up the leg**

Amplitude at the ankle should be higher for almost all participants. If the knee or fibular head is higher re-stimulate at the ankle in attempt to get ankle amplitude highest.

**If response is present at any stimulation sites above a site with an absent response you MUST re-stimulate the site with the absent response.**

**Check and re-mark amplitude and latency if necessary.**

- In order to do this you must look at the clipped curve, by increasing the size of the curve 2 / 3 blocks. Do not re-mark a curve unless the size has been increased.
- Should have two cursors crossed at the base of the response at take off. This is the lowest point of the curve before take off.
- Should also have two cursors crossed at the highest point of the curve.

**If the two conduction velocities have a difference greater than 10 m/s, check quality of responses and/or stimulation location measurement. You need to re-do the test if the difference remains >10 m/s.**

**Printouts vs. saved responses**

- **Be sure to print out both whole and ‘clipped’ curves** The size of the curve should be increased 2-3 blocks.
- **Be sure to save full curve.** If you have increased the size of the curve for printing, then you may need to reduce the size of the curve before saving. **Once you save, you cannot manipulate the curve.**