

ECochG with TM Wick Electrodes

using SmartEP

What is Electrocochleography?

Electrocochleography, ECochG, is a method to acquire auditory evoked potential responses from cochlear and auditory nerves by providing sound stimulation to the patient's ear. The averaged activity of the potentials on the auditory nerve is known as the action potential (AP, or ABR wave I).

The response of the cochlea to the stimulation is known as the summing potential (SP). The amplitudes, latencies and relationship of AP and SP can be used to diagnose certain pathological conditions. Due to the intensity of these evoked potentials, surface electrodes are not suitable for this application; Tip-Trodes, Tympanic Membrane or Transtympanic electrodes must be used for acquisition. Note that the ratio of the amplitude of the AP and SP will change based on the type of electrode used.

Why acquire ECochG?

Electrocochleography may be used to diagnose some vestibular and auditory conditions like:

- Meniere's disease is a potentially disabling condition that may cause episodes of hearing loss, fluctuating tinnitus, vertigo and aural fullness.
- Perilymphatic fistula is an abnormal communication between the fluid filled inner ear and the air filled middle ear resulting in hearing loss and/or vestibular symptoms.
- The procedure will help identify wave I of the ABR in patients with profound hearing loss. This wave may not be detected on standard ABR testing in patients with such condition.

Patient Preparation Procedure

The patient must be placed in a comfortable and quiet environment, preferably a sound booth where the patient lies down on a comfortable bed. It is recommended to inform the patient about the expected sensation when the electrode touches the tympanic membrane.

- Read and follow the directions specified on the package of the TM-Wick electrode.

Those recommendations supersede any instructions given in this document.

- Examine both ears otoscopically to get a feel for the Tympanic Membrane (TM) and to remove impacted or large pieces of Cerumen.
- Do a tympanogram to test TM integrity.
- Place the contralateral mastoid and forehead electrodes in the following configuration for a waveform with positive peaks, reverse the (+) and (-) for a waveform as shown in Fig.3:

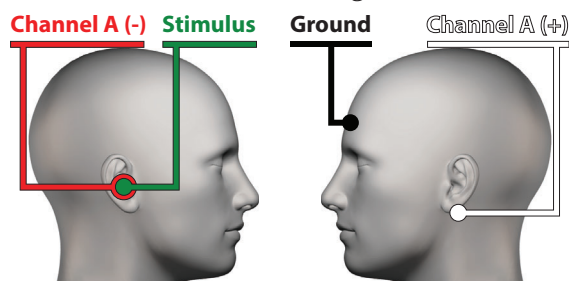


Fig.1 - Horizontal array (right ear) for Duet

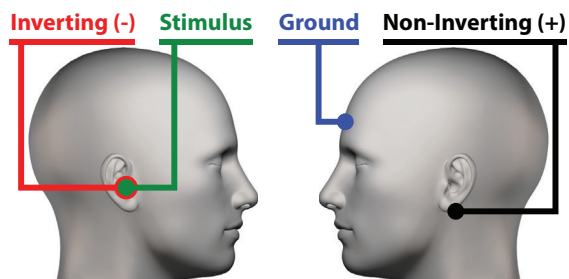


Fig.2 - Horizontal array (right ear) for USB

- Let the patient lie down on his side and irrigate the patient's external auditory meatus with saline at body temperature using a syringe.
- Let the saline float any debris (1 minute minimum)
- Place a gauze pad over the ear and have the patient roll onto the opposite side to drain the ear.
- Check the rayon wick on the electrode to make sure it's soaked in saline and gel solution.
- Lower the wick into the ear canal carefully.
- Anchor the shaft of the wick against the tympanic membrane using a foam ear plug, careful not to shift the wick.
- Tape the silicone tube to the cheek using a piece of surgical tape.
- Connect the wick to the amplifier. Connect the test lead into the corresponding

ear socket, and the black shield attachment between the ground socket and the ground electrode lead.

- Connect the far end of the silicon tube from the foam plug into the insert earphones transducer phones.

Setting up SmartEP

SmartEP from Intelligent Hearing Systems has built in functionality to acquire ECochG. Complete the following steps in the order outlined, use the test setting that best fit your testing requirements or use the recommended settings shown on the next page:

1. Under **[PROTOCOL > MODALITY]** in the main menu, make sure **[AUDITORY > ECochG]** is selected.
2. Set the stimulus, click on **[STIM]** from the control panel and set the stimulus type, duration, frequency, window, masking and transducer, as necessary.
3. Click on the **[AMPLIFIER]** button on the side panel and set the filters, notch filter, artifact rejection ratio and region and desired amplification.
4. On the control panel, set rate, polarity, intensity and the number of sweeps.
5. Press the **[ACQUIRE]** button to start recording ECochG responses

SmartEP allows automation of the acquisition process; consult your user's manual to learn how to create your own automated testing protocol or how to save your settings for future use.

Recommended Test Settings

This list shows the settings that have been proven to work well for ECochG acquisition. Acquire three or four recordings with the exact same settings for more accurate diagnosis.

- **Stimulus:** 0.1 milliseconds Click
- **Rate:** 7.1/sec or 99.9/sec. Use slow rates to enhance the AP component and fast rates to differentiate the SP (still robust) from the AP (now deteriorated).
- **Polarity:** alternating.
- **Transducers:** insert earphones.
- **Intensity:** 90 to 95 dB HL .
- **Filters:** 10 – 1500 Hz, or 1 to 1500 Hz.
- **Notch Filter:** OFF. ON, only if there is excessive electrical line noise present.
- **Amplification:** 75K or 100K.
- **Analysis Time Window:** 0 to 5 milliseconds.
- **Sweeps:** 250 to 500.
- **Electrode Montage:** horizontal array (see figure in previous page).

Marking Peaks

To label an ECochG recording:

- Label the Base of the SP (0.3 to 0.5 from onset).
- Move the Base amplitude marker (triangle) to the other side of the SP-AP complex. Make the amplitude 0 uV. You may use cursors for help with positioning.
- Mark the SP peak, then move its amplitude marker to the position of the base amplitude marker.
- Mark the AP peak, then move its amplitude marker to the position of the other two.

The SP-AP ratio is calculated automatically. To show the area calculation, right-click on the recording and select **[MARK OTHER PEAK]** then in the window, check the box labeled "Area Ratio" then exit the window.

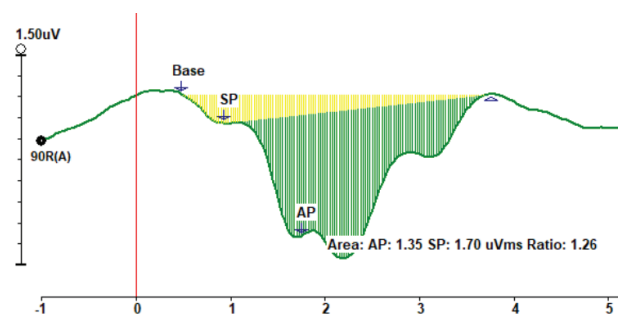


Fig.3 - Sample labeling on ECochG recording

Label placement buttons can be found on the tool bar, just above the waveform display area; click the button, then click the desired location on the selected waveform; drag the markers into place as needed. The right click menu can also be used to place labels at the click location. Fig.3 shows suggested label placement for an acquired response.

Analysis

Once the waveform is marked, the software will calculate the SP-AP amplitude ratio automatically, and its value will be shown on the printout, or PDF report; it can also be displayed on the screen by using one of the "Show Text" options from the recording right-click menu.

All results must be evaluated by a medical professional trained in ECochG techniques. The amplitude ratios considered to be pathological depend on the type of electrodes used. Consult your SmartEP manual for additional sources.