Efficient Use of the ICS Chartr EP 200

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Housekeeping

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- Exam for CEU credit
  - Must be taken within 7 days if viewing live presentation
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Course Outline

- Setting Up for Success
- Preparing the Patient
- Optimizing Protocols
- Data Collection
- Organizing Collected Data
- Efficient Reporting
- Troubleshooting
- Improving ASSR Efficiency

The EP 200 System

Setting Up for Success

Test Environment—Test Room

- Turn off unnecessary computer monitors.
- If possible use a designated outlet.
- Electronic patient beds should be unplugged.
- Assure wall outlet is grounded.
- Do not use cellular phones during testing.
- Turn off florescent light(s). Do not have dimmer switch set in the middle position.

Test Environment—Equipment Placement

- Preamp should not be near or on the isolation transformer.
- Do not have preamp in front of monitor.
- Keep the patient at least 3 feet away from the computer.
- Keep the transducers and the red/blue tubing separate from the electrode leads

Test Environment—Patient Details

- How comfortable is your chair or table?
- Patient should feel secure.
- Have blankets and pillows to assist with comfort.
- Pillow under the knees help support the lower back.
- Explain the test procedure before placing the earphones.
- Send patient to the restroom before testing.
- Instruct patient before placing eartips.

Application of Electrodes

Non-Disposable Electrodes & Disposable Electrodes

Skin Prep

Application of Electrodes—All Types

- Tape or braid the electrodes together
- Do not mix electrode metal types.
- **Plan Ahead**: If doing bone conduction ABR, place electrode on FRONT of earlobe.
- Gently clean the electrode site (do not abrade skin).
- Electrodes on the earlobes or mastoids should be symmetrical.
- All electrode leads should run toward the top of the patient's head.
- Do not turn equipment on/off with patient connected.

Application of Electrodes-Reusable

- Electrodes should be clean (use child toothbrush and warm water to remove paste residue).
- Electrodes will not last forever. Bad electrodes can result in high impedance, trending of the waveform and noisy recordings.
- **Good impedance does not mean the electrode is in good condition!!!**
- Apply the electrodes firmly.
- Wait a minute for the electrodes to settle.
- Silver chloride electrodes need maintenance–To re-chloride the electrodes, place only the cup of the electrode into a small amount of chlorine bleach. Soak for 20 minutes. Do not let the wires touch the bleach.

Vertex/Cz Placement

- If using Cz, alcohol pad will help dissolve hair product and will help reduce impedance.
- If using Cz, use an Q-tip to clean the site and a dab of paste to mark the spot.
- Use a cup electrode.
- Use a cotton ball to help electrodes adhere for Cz placement.
- Remember to use the same metal type.
- Alcohol will dissolve electrode paste afterwards.

A Final Word

- Disposable electrodes are Silver Chloride
- If the EP requires Cz placement, use cup electrodes of the same metal type.
- For Ecog, **TipTrodes are gold foil so use gold cup electrode for ground and/or high forehead**.

Preparing the Patient

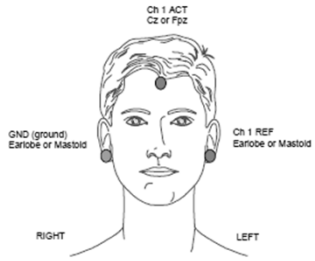
Montage Terminology

- **Active = Positive=Non-Inverting= High Forehead/Cz**
- **Reference = Negative = Inverting = Test Ear**
- **Ground = Common**

One Channel Recording with Electrode Switching On

AUDITORY BRAINSTEM RESPONSE MONTAGES

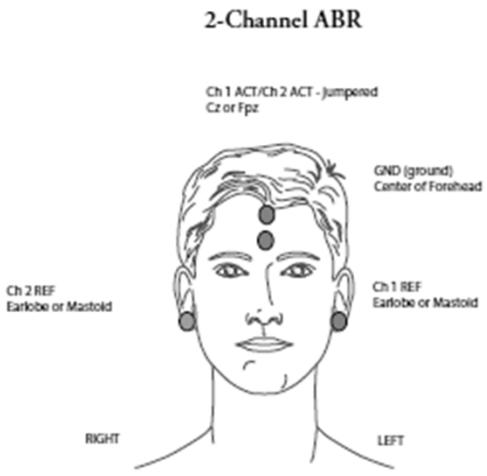
1-Channel ABR
ELECTRODE SWITCHING ON



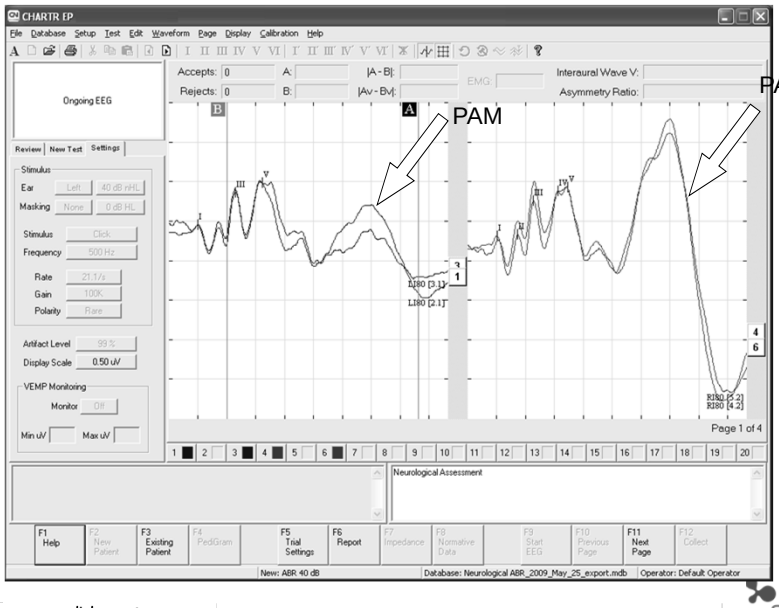
When performing bone conduction ABR, always place the refrence electrode and the ground on the front of the earlobe.

Caution - *If an alternate montage is used with Electrode Switching ON, the data collected will be inaccurate.*

Two Channel Recording



Post-Auricular Muscle Artifact (PAM)



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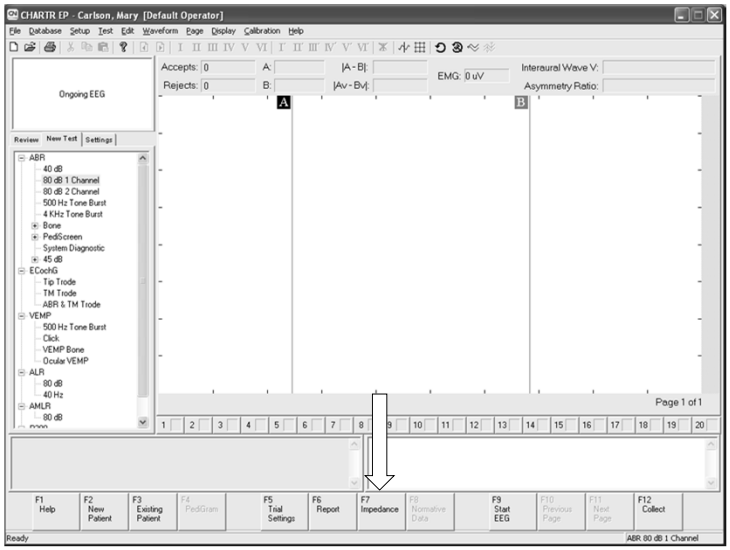
Application of Earphones and Cable Position

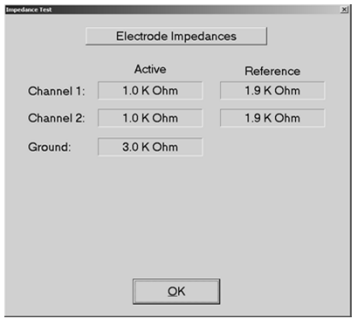
- Always choose the largest size of ear tip to reduce the risk of stimulus leakage. Leakage can cause a reduction of dB SPL in the ear canal.
- Compress foam tip, insert completely (no foam should be in the concha) and hold in place until expanded.
- **Separate** the patient cable from the transducer cable using the patient's body.
- Do not let tubing of the transducer touch the electrode wires.

Patient Setup with Table

Impedance



Checking Electrode Impedance



Goal: Low electrode readings of **<5K** Ohms each balanced with no more than **<2K** Ohms difference between electrodes

Inter-electrode impedance is the most important (common mode rejection does not work well if inter-electrode impedance unbalanced)

Impedance Range

- EP200 range is 0-80 kOhm
- **OPEN reading means impedance is greater than 80kOhm**
- (Old EP Tower system was 0-40 kOhm)

Optimizing Protocols

Selecting a Protocol

Procedure

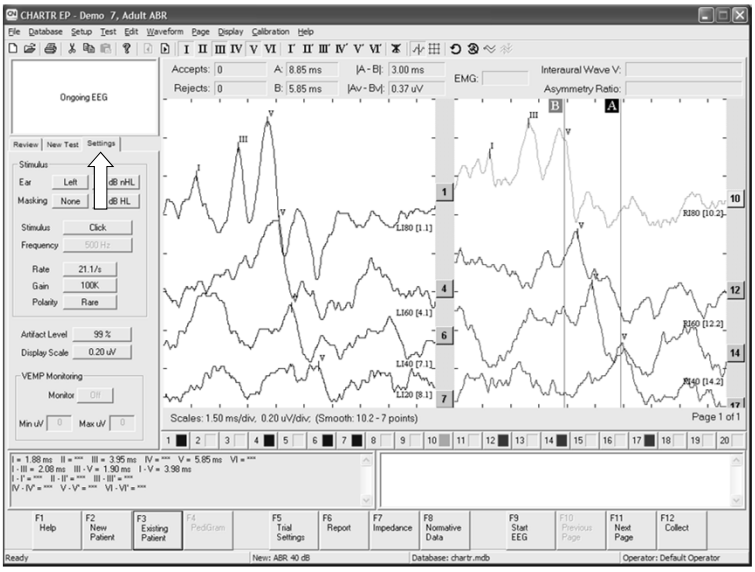
Selected Protocol

The CHARTR EP default procedures are:
ABR (Auditory Brainstem Response)
ASSR (Auditory Steady State Response) ***(optional)***
ECochG (Electrocochleography)
ALR (Auditory Late Response)
AMLR (Auditory Middle Latency Response)
P300 ***(optional)***

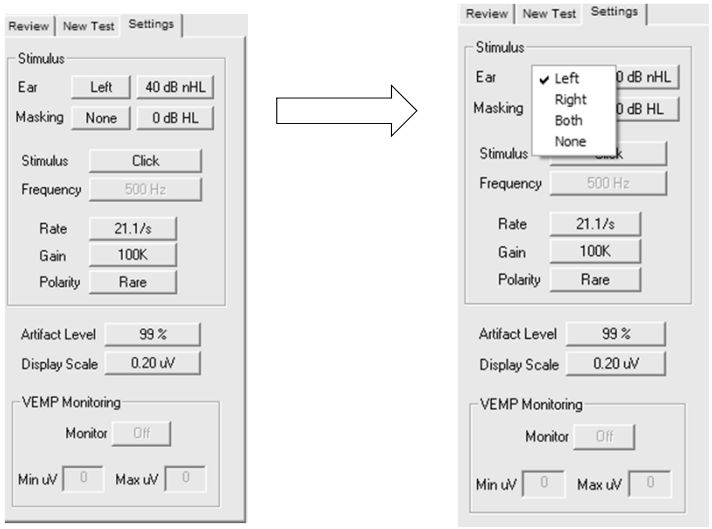
Changing/Reviewing Protocol Parameters

- **Settings Tab**
- **Click on Trial Settings Menu**
- **Going to Set Up→Edit Protocol**

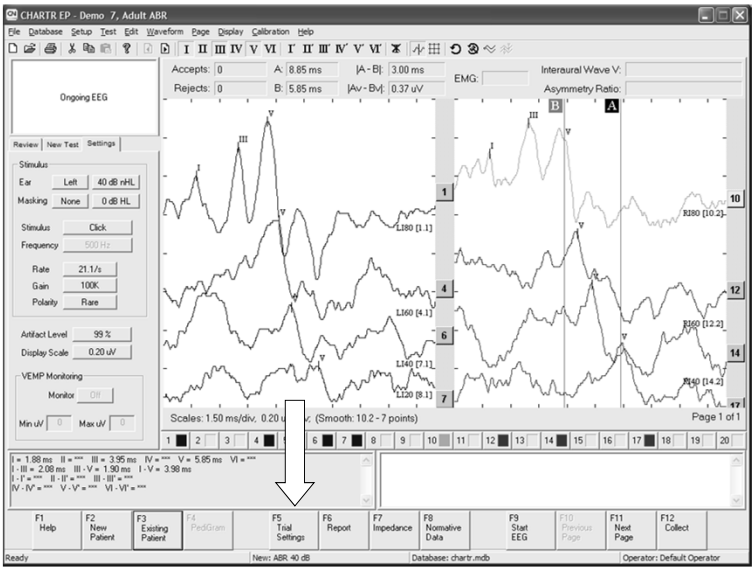
Quick settings & Trial settings



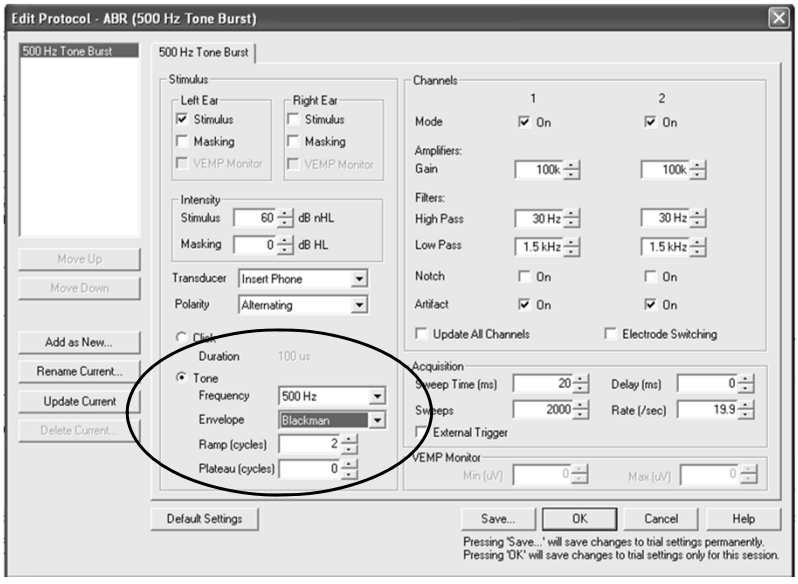
Settings Tab

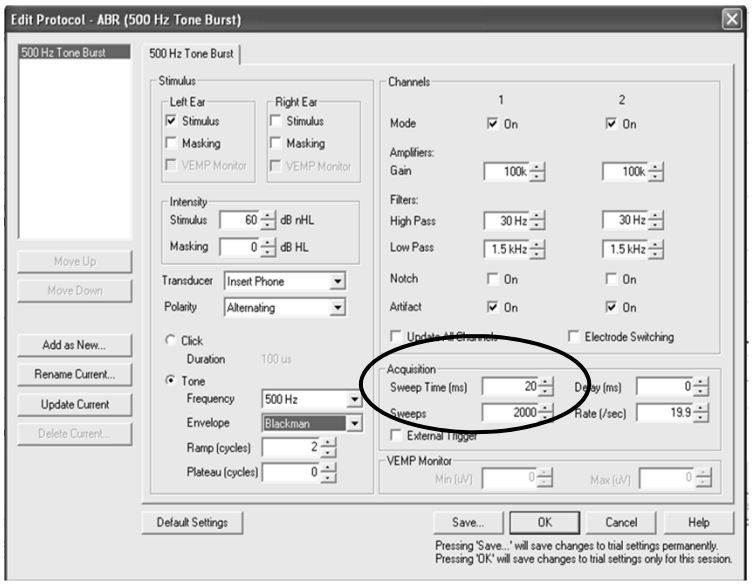


Trial settings



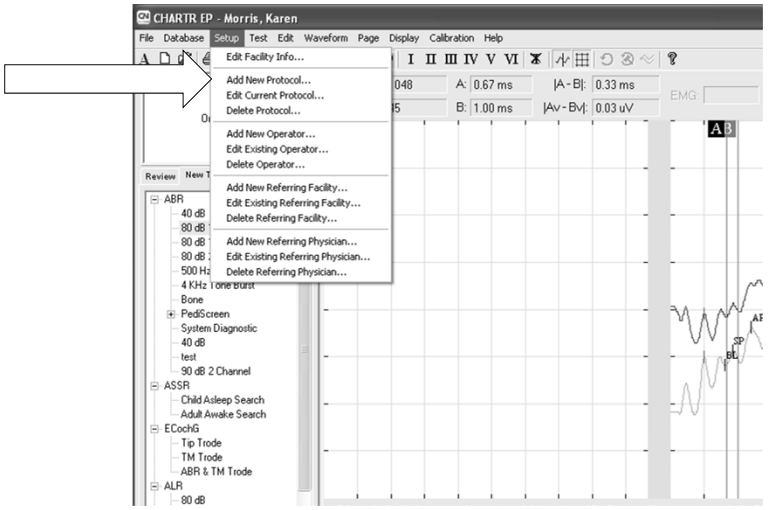
Trial Setting Parameters

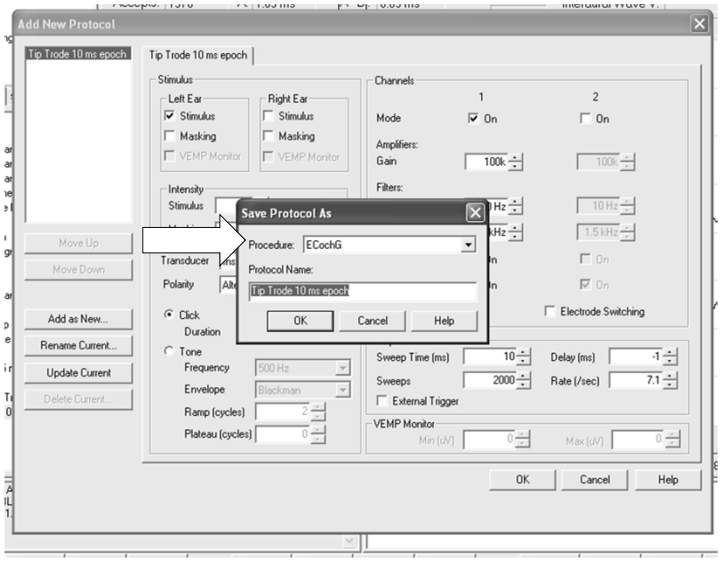


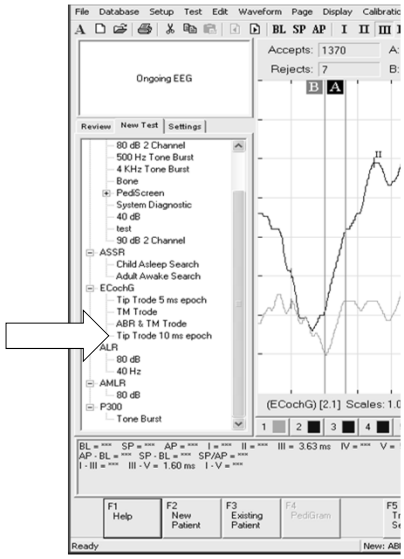


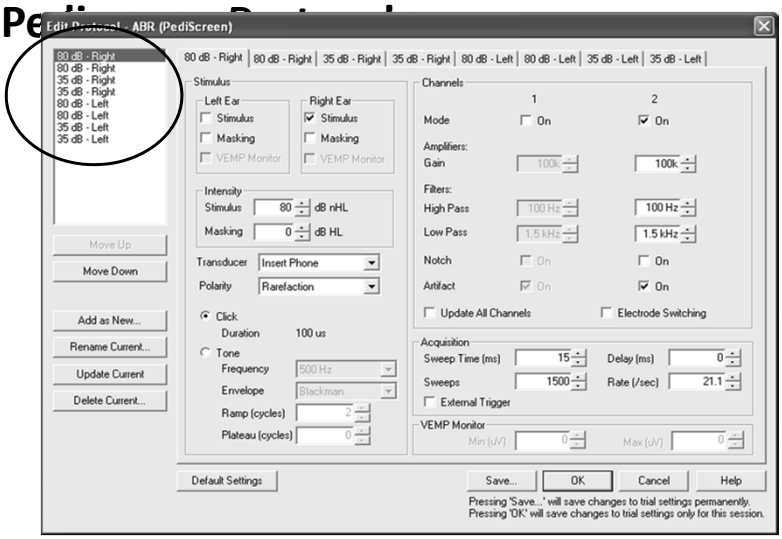
Create a New Protocol

1. Select a protocol from the New Test tab that closely matches the protocol you are creating
2. Go to Setup→**Add New** Protocol
3. Make the changes and Click **OK**
4. The **procedure should match the test type** so labels are correct.
5. Give new protocol a **unique name** and click OK
6. The new protocol will appear in the new test tab


CHARTR EP - Morris, Karen
File Database Setup Test Edit Waveform Page Display Calibration Help
Edit Facility Info...
Add New Protocol...
Edit Current Protocol...
Delete Protocol...
Add New Operator...
Edit Existing Operator...
Delete Operator...
Add New Referring Facility...
Edit Existing Referring Facility...
Delete Referring Facility...
Add New Referring Physician...
Edit Existing Referring Physician...
Delete Referring Physician...
A: 0.67 ms
B: 1.00 ms
|A - B|: 0.33 ms
|Av - Bv|: 0.03 uV
EMG:
ABR
40 dB
80 dB
80 dB
80 dB
500 Hz
4 KHz Tone Burst
Bone
PediScreen
System Diagnostic
40 dB
test
90 dB 2 Channel
ASSR
Child Asleep Search
Adult Awake Search
ECochG
Tip Trode
TM Trode
ABR & TM Trode
ALR
80 dB


Add New Protocol
Tip Trode 10 ms epoch
Tip Trode 10 ms epoch
Stimulus
Left Ear
Stimulus
Masking
VEMP Monitor
Right Ear
Stimulus
Masking
VEMP Monitor
Intensity
Stimulus
Transducer
Polarity
Click
Duration
Tone
Frequency
500 Hz
Envelope
Blackman
Ramp (cycles)
Plateau (cycles)
Channels
1
2
Mode
On
On
Amplifiers:
Gain
100k
Filters:
10 Hz
1.5 kHz
Electrode Switching
Sweep Time (ms)
10
Delay (ms)
-1
Sweeps
2000
Rate (/sec)
7.1
External Trigger
VEMP Monitor
Min (uV)
Max (uV)
Move Up
Move Down
Add as New...
Rename Current...
Update Current
Delete Current...
OK
Cancel
Help
Save Protocol As
Procedure:
ECochG
Protocol Name:
Tip Trode 10 ms epoch
OK
Cancel
Help


File Database Setup Test Edit Waveform Page Display Calibratic
BL SP AP I II III
Ongoing EEG
Accepts: 1370
Rejects: 7
Review New Test Settings
80 dB 2 Channel
500 Hz Tone Burst
4 KHz Tone Burst
Bone
PediScreen
System Diagnostic
40 dB
test
90 dB 2 Channel
ASSR
Child Asleep Search
Adult Awake Search
ECochG
Tip Trode 5 ms epoch
TM Trode
ABR & TM Trode
Tip Trode 10 ms epoch
ALR
80 dB
40 Hz
AMLR
80 dB
P300
Tone Burst
(ECochG) [2.1] Scales: 1.0
F1 Help
F2 New Patient
F3 Existing Patient
F4 PediGram
Ready

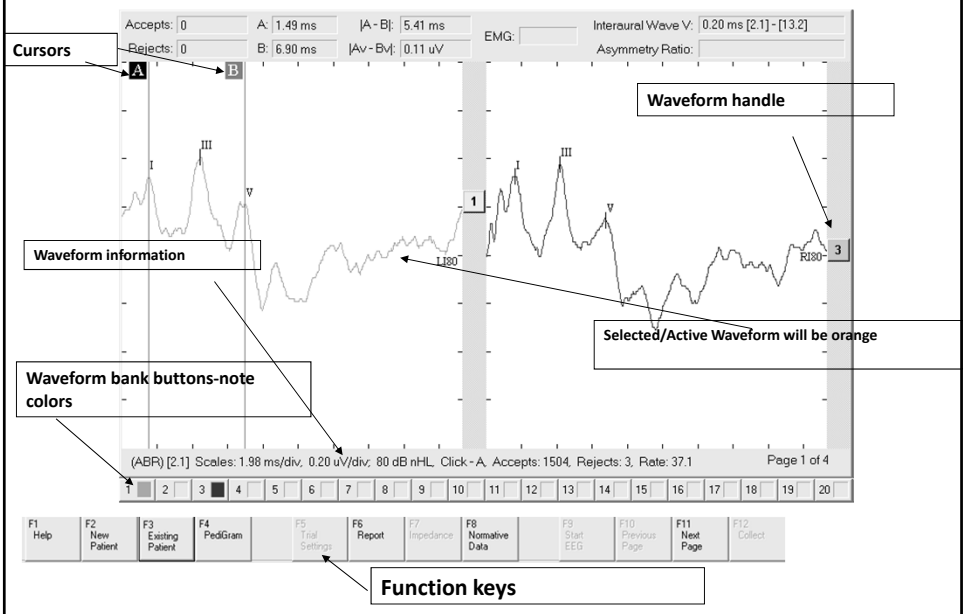

Edit Protocol - ABR (PediScreen)
80 dB - Right
80 dB - Right
35 dB - Right
35 dB - Right
80 dB - Left
80 dB - Left
35 dB - Left
35 dB - Left
Move Up
Move Down
Add as New...
Rename Current...
Update Current
Delete Current...
80 dB - Right | 80 dB - Right | 35 dB - Right | 35 dB - Right | 80 dB - Left | 80 dB - Left | 35 dB - Left | 35 dB - Left
Stimulus
Left Ear
Stimulus
Masking
VEMP Monitor
Right Ear
Stimulus
Masking
VEMP Monitor
Intensity
Stimulus 80 dB nHL
Masking 0 dB HL
Transducer Insert Phone
Polarity Rarefaction
Click
Duration 100 us
Tone
Frequency 500 Hz
Envelope Blackman
Ramp (cycles) 2
Plateau (cycles) 0
Channels
1
2
Mode On On
Amplifiers:
Gain 100k 100k
Filters:
High Pass 100 Hz 100 Hz
Low Pass 1.5 kHz 1.5 kHz
Notch On On
Artifact On On
Update All Channels
Electrode Switching
Acquisition
Sweep Time (ms) 15
Delay (ms) 0
Sweeps 1500
Rate (/sec) 21.1
External Trigger
VEMP Monitor
Min (uV) 0
Max (uV) 0
Default Settings
Save...
OK
Cancel
Help
Pressing 'Save...' will save changes to trial settings permanently.
Pressing 'OK' will save changes to trial settings only for this session.

Data Collection

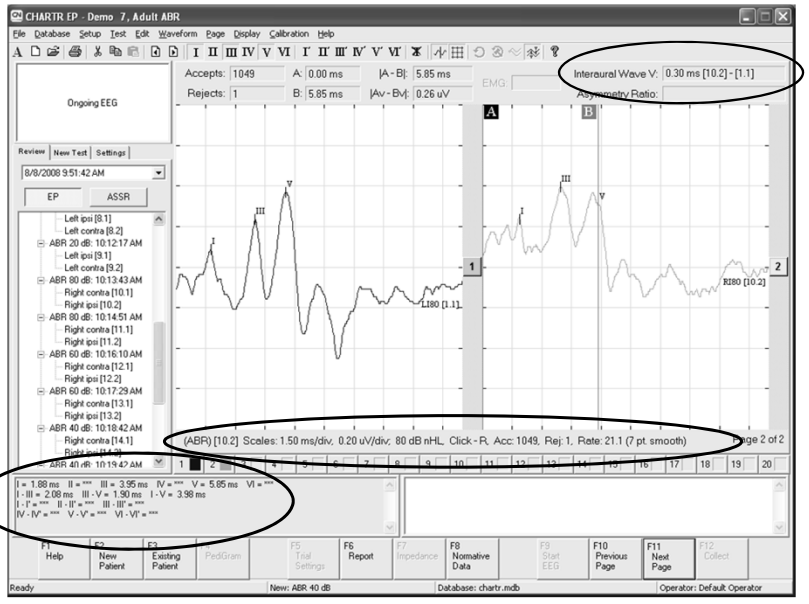
Waveform Colors

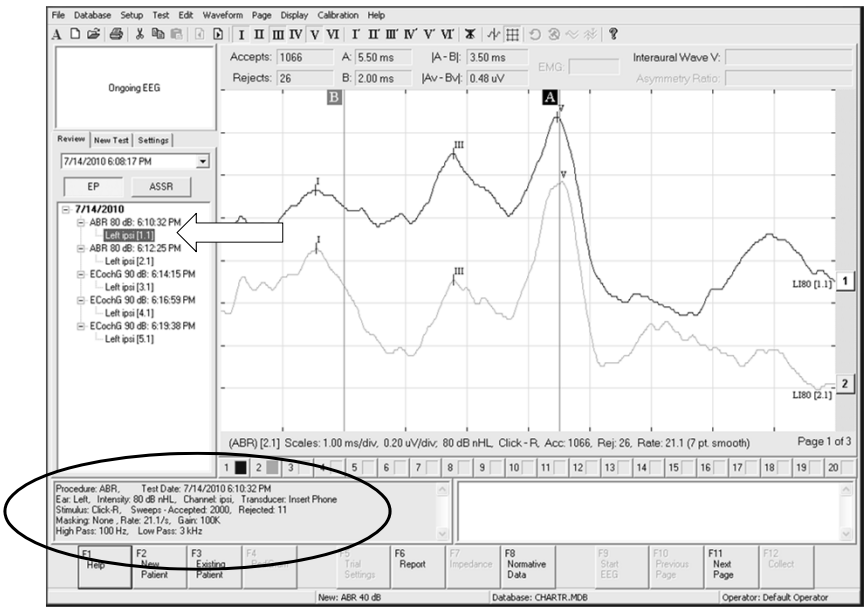
Stimulated Left Ear	-- Blue
Stimulated Right Ear	-- Red
Stimulated Binaural	-- Green
Selected	-- Orange
Collecting/Active	-- Pink

Monitor Data Collection

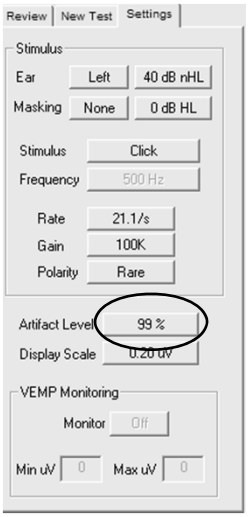


Monitor Data Collection





Artifact Rejection and Averaging



The lower the number the more rejected sweeps will occur.
99% is the default setting
With the data set at 99%

With gain set at 100k = 45.4uV peak to peak will be accepted

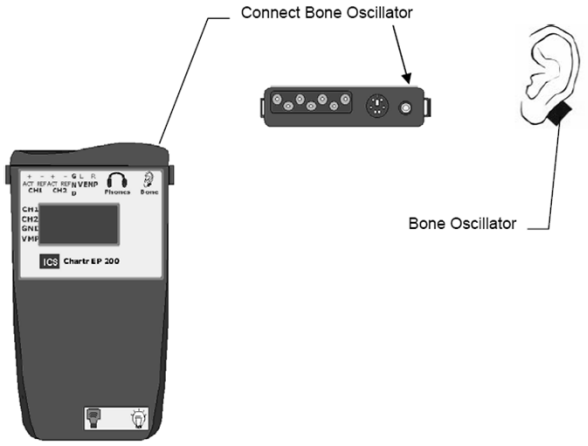
With gain set at 200k = 24.7uV peak to peak will be accepted

Data larger than this value will be rejected.

Data smaller than this value will be accepted.

Averaging reduces the amount of noise and extracts the signal by 1 divided by the square root of N (number of sweeps) or 4 times as many sweeps averaged will reduce the noise by half. Longer you average, the less noise in your recording
Can turn off if the EP you are collecting is large like ENOG

Connecting the Bone Transducer



Connect Bone Oscillator to Preamp

Bone Conduction Before You Start

- Perform a listening check!!!
- Dynamic range of oscillator is limited.
- To artificially extend the range, obtain nHL thresholds with insert earphones in place!
- For infants, may have to use hand-held placement . Firmly hold the oscillator to the infant's mastoid with 1 index finger. Push the oscillator on the mastoid until you could almost push the child's head away from you.
- Transducer placement should be consistent to reduce variability. Never use 2 fingers to hold it as this can dampen the output.

Bone Conduction ABR

- Bone Oscillator should be placed on the **mastoid**. (using forehead can reduce output as much as 15dB ANSI S3.6 1996)
- **Electrode placement** is key to obtaining good responses.
- Keep the oscillator separated from the electrode.
- Use an alternating polarity stimulus to reduce artifact.

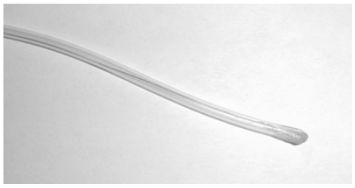
Obtaining a Clearer Response

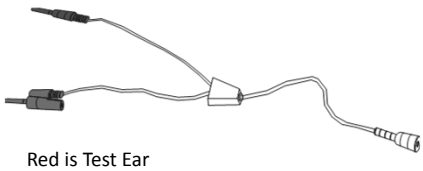
- Increase sweeps.
- Increase the stimulus level.
- If wave I is obscured-use a TMtrode or a gold foil Tiptrode.
- If Wave V is obscured-record from the nape of the neck.
- Slow down the stimulus rate.

Electrocochleography

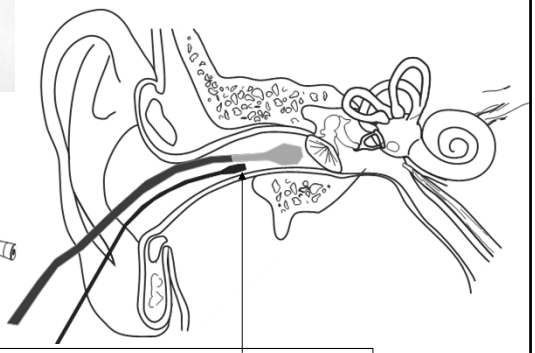
- Select your electrode type
- Closer you are to the cochlea, the larger the response
- Do not mix metals

Extra tympanic electrode – TM ECochGtrode





Red is Test Ear
Green is Ground



Tymptrode and insert earphone in earcanal. Closer to the neural generator gives a more robust response.

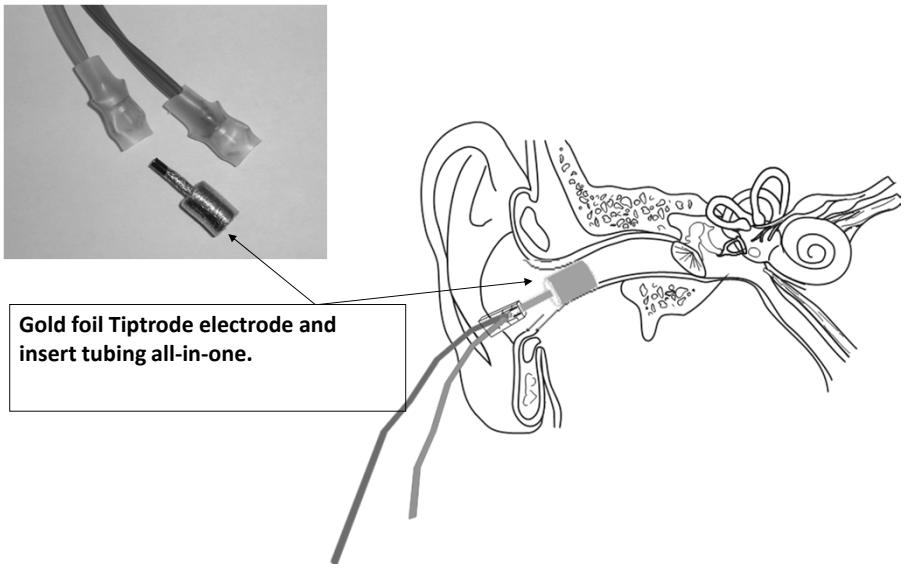
Application of TM ECochGtrode

- Perform Otoscopic exam first. Remove cerumen before placing the TM ECochGtrode.
- Do not place if there is a TM perforation.
- Place a small amount of conductive gel on the cover of the hydrogel (blue) end of the electrode. *Too much gel can occlude the insert earphone.*
- Gel eases insertion
- Gently slide the electrode down the ear canal until you feel resistance.
- Patient may report hearing a "thud" or that their voice sounds funny.

Application of TM ECochGtrode

- Gently insert the EARphone in the ear canal along side the electrode.
- You can also secure the electrode with tape to prevent the cable from moving.
- Electrode impedance may be high (>20K ohms).
- Might need to disable artifact rejection to collect the response.
- After testing, carefully remove insert eartip and electrode. TM may be red but inflammation will go away within a few hours.

Types of Electrodes - Tiptrode



Application of TipTrodes

- The ear canal must be scrubbed in order to obtain lower impedances. NOTE: conductive paste may remove the gold.
- Electrode is further away from the generator site and results in less pronounced SP/AP ratio.
- Attach the metal clip making good contact with the gold foil near the base of the foam tip.
- Be careful when compressing the foam tip as not to remove the gold foil layer.
- Make sure to remove the red and blue tubing of the insert phones. Do not double the length of the tubing. Attach the tubing from the Tiptrodes to the insert transducer boxes.
- Advantage: can be used for ABR and ECoG

Enhancing the ECoG

- Use a TM electrode
- Use a horizontal montage. (Active is NTE, Ref is TE, Fpz is ground)
- Use a slow click rate.
- Shorten the epoch (time window) to 5msec.

Organizing Data and Efficient Reporting

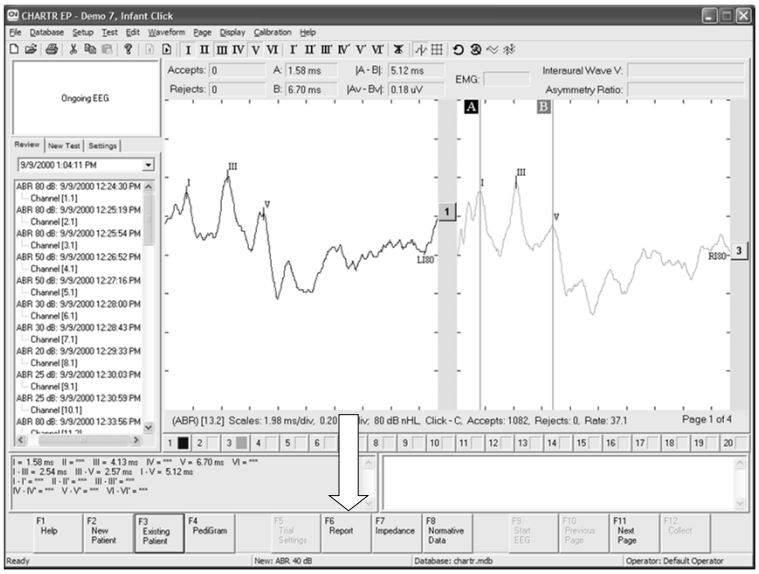
Data Organization

- Is optimized by using "**pages**"
- Pages are unlimited
- Example 1 Pediatric Report: Click results can be displayed on page 1
- Tone Burst results on page 2
- Bone conduction results on page 3
- **Report will include one printed page for every page of data.**
- Pages are permanent.

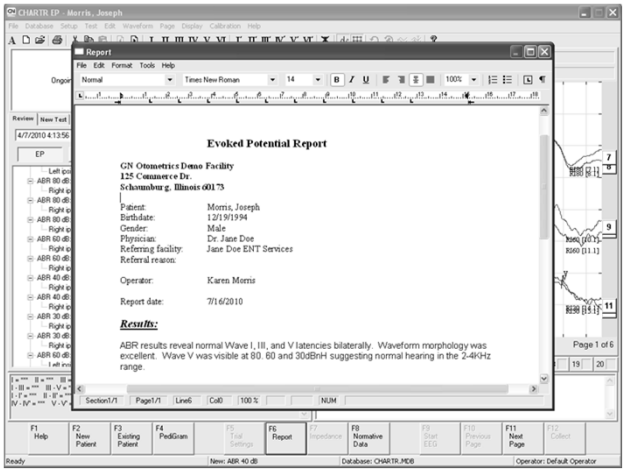
ABR and Ecog Report

- Page 1 display Click results
- Page 2 display Ecog results

Generating a Patient Report



Reporting

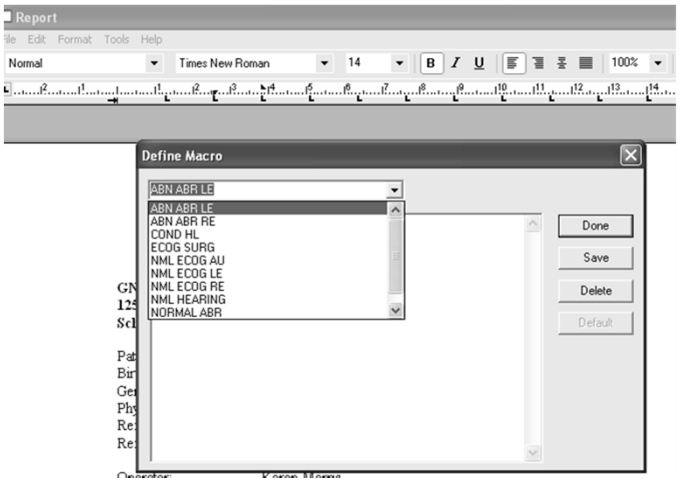


What is a Macro??

Operator-defined shortcut used to insert a string of text within a patient report.

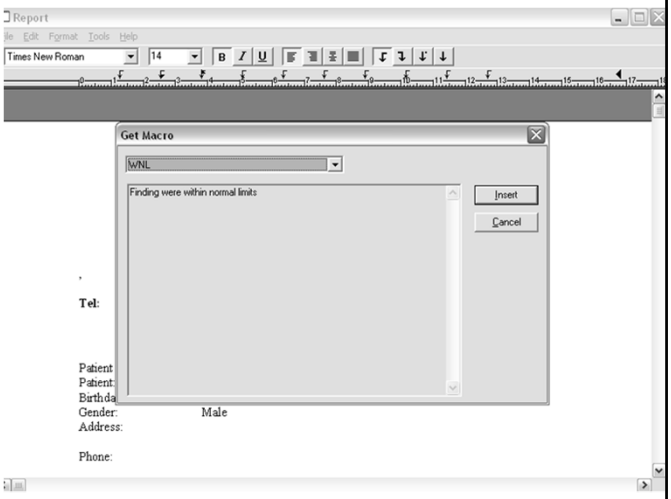
Create or Define Macros

- Access Report
- Go to Tools
- Define Macro
- Type in Macro name and text



Inserting Macro into Report

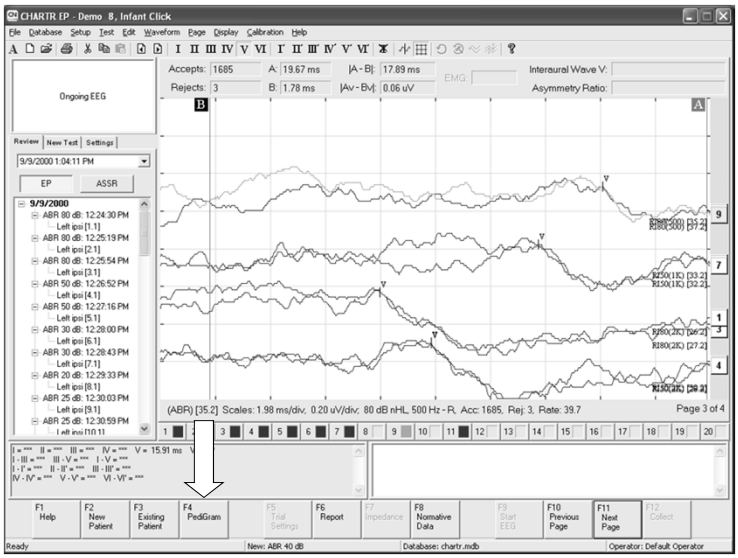
- Place cursor where you want macro to insert
- Click Tools
- Click Get Macro
- Select macro from drop down
- Click Insert



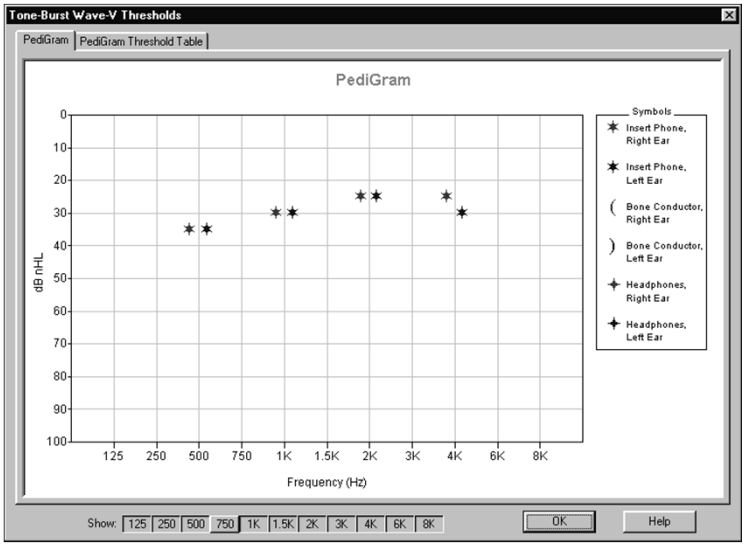
Why use macros?

- Saves time
- Standardizes reports
- Can be used for detailed reporting
- Can be used for specific clinician or physician reports

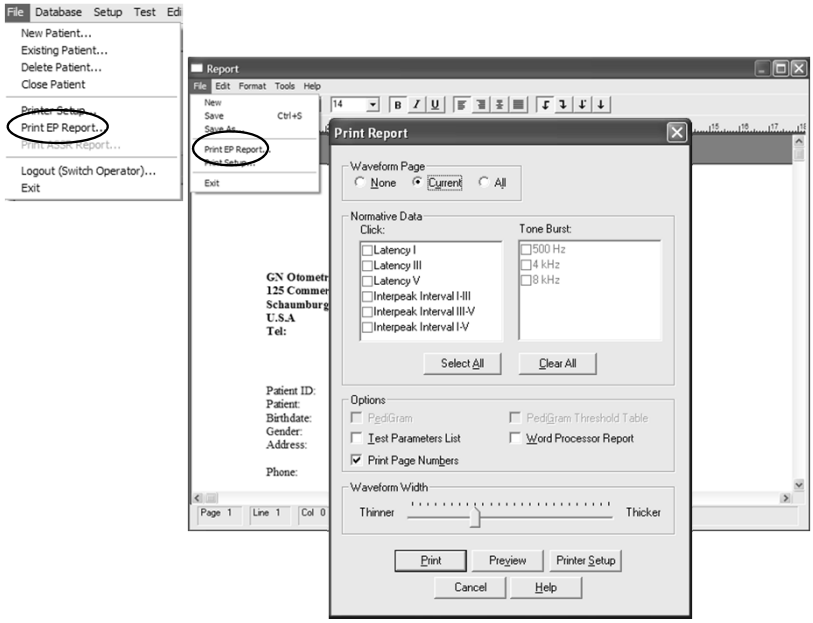
PediGram—Tone Burst "Audiogram"



PediGram Graph



Printing/Setting up the Report



Troubleshooting

Setting Up for Success

- Test Room
- Equipment placement
- Patient details-comfort
- Electrodes

Noisy Recordings

- Inspect orientation of the electrodes relative to the transducers, pre-amp. Reposition.
- Inspect the patient—is he comfortable, clenching teeth, eyes open. Re-position.
- Review your protocol—changing click rate slightly ie. 21.1 to 21.7, restrict filter settings if possible.

Noisy Recordings

- Can be caused by old or dirty electrode leads
- Can be caused by a faulty jumper cable
- Dangling jumper cable
- Missing electrode!

Poor Waveform Morphology

Number one cause of poor morphology: Electrodes plugged into wrong position on pre-amp.

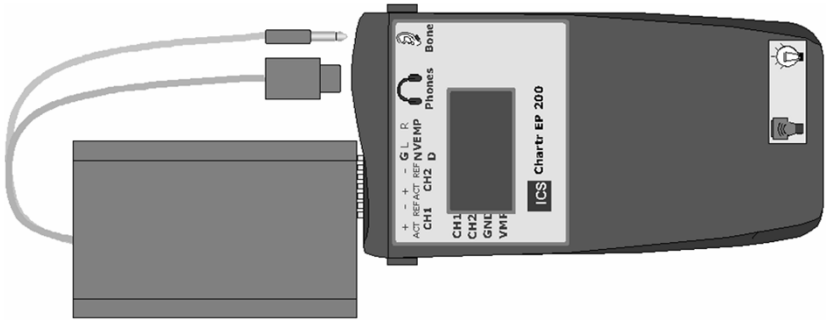
Electrode Troubleshooting

- Can cause noisy recordings even with good impedance
- Reusable electrodes must be thoroughly cleaned
- Electrodes must remain in place during testing

System Check

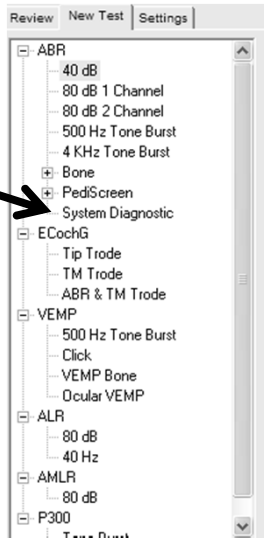
- System diagnostic protocol
- Is a stimulus board and data collection board check
- **Requires test fixture**

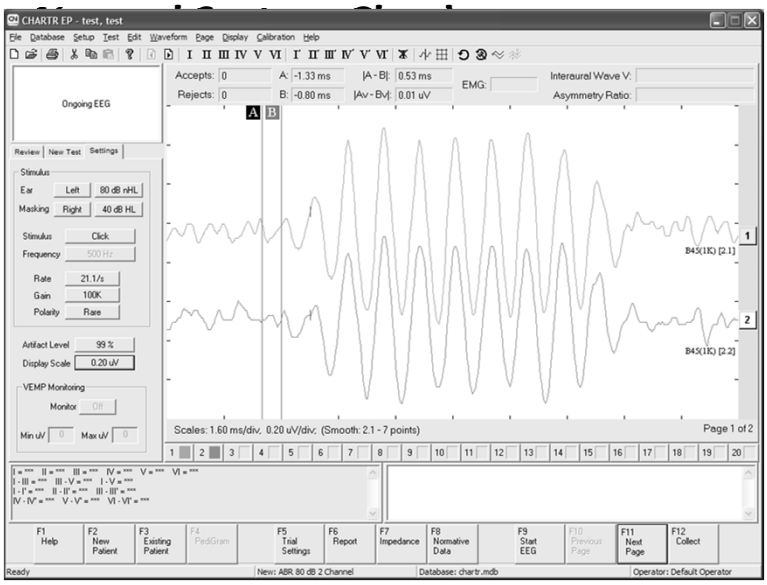
Test Fixture



Troubleshooting

System Diagnostic Test




CHARTR EP - test, test
File Database Setup Test Edit Waveform Page Display Calibration Help
Ongoing EEG
Review New Test Settings
Stimulus
Ear Left 80 dB nHL
Masking Right 40 dB HL
Stimulus Click
Frequency 500 Hz
Rate 21.1/s
Gain 100K
Polarity Rare
Artifact Level 99 %
Display Scale 0.20 uV
VEMP Monitoring
Monitor Off
Min uV 0 Max uV 0
Accepts: 0
Rejects: 0
A: -1.33 ms
B: -0.80 ms
|A - B|: 0.53 ms
|Av - Bv|: 0.01 uV
EMG:
Interaural Wave V:
Asymmetry Ratio:
A B
B45(1K) [2.1]
B45(1K) [2.2]
Scales: 1.60 ms/div, 0.20 uV/div, (Smooth: 2.1 - 7 points)
Page 1 of 2
F1 Help
F2 New Patient
F3 Existing Patient
F4 PedGram
F5 Trial Settings
F6 Report
F7 Impedance
F8 Normative Data
F9 Start EEG
F10 Previous Page
F11 Next Page
F12 Collect
Ready
New: ABR 80 dB 2 Channel
Database: chartr.mdb
Operator: Default Operator

Questions?