

Chapter I: Specifications

HEARLab™ ACA device consists of a hardware platform (HEARLab) and a software platform that work together to perform acoustically evoked cortical response measurements.

1.1 Hardware platform

1.1.1 Computer

Physical configuration	Standalone desktop base unit
Base unit dimensions	H, W, D : 4.5", 15.7", 13.9": 11.4cm, 39.9cm, 35.3cm
Base unit weight	10.4 kg
Display	Standalone 17" LCD monitor
Keyboard	Standard 104-key PC keyboard
Mouse	Standard optical mouse

1.1.2 Electronics for acoustic presentation & monitoring

Physical configuration	Standalone Stimulus Controller (SC) box
SC dimensions	H, W, D: 4.7", 12.6", 11.5": 12cm, 32cm, 29cm
SC weight	2.7kg
Sound Field Speaker	8 Ohms 5 Watts
Speaker dimension	H, W, D: 5.7", 5.3", 3.2": 14.5cm, 13.5cm, 8.0cm
Insert earphones	ER3A 50 Ohms Left and Right
Bone vibrator	B71 Bone oscillator 50 Ohms
Monitoring microphone	0.55" diameter, 1.0" length

1.1.3 Electrode interface

Physical configuration	Standalone Electrode Processor (EP) box
EP dimensions	H, W, D: 2.2", 4.2", 9.0": 5.5cm, 10.5cm, 23cm
EP weight	0.5kg
Electrode cables	60" (150cm) cable with amplifier integrated in connector button
Signal cable	1, yellow
Reference	1, blue
Ground	1, black
Electronic amplification	Analogue differential amplification of 1210 times

Low pass filter
High pass filter

Analogue, 12 dB/octave from 4kHz
Analogue, 6dB/octave below 0.3 Hz

1.2 Software platform

Operating system
Data management

Windows XP
Embedded MySQL

1.2.1 HEARLab ACA Software

Hearing tests available

Aided Cortical Assessment (ACA)
Cortical Threshold Estimate (CTE)

Utilities

Check electrode impedance
Quick check stimulus presentation
Monitor ambient noise level in 1/3 octave spectrum

1.2.2 Acoustic stimulation ACA

Stimuli type

Speech sounds extracted from running speech

Duration

/m/ 30mS
/g/ 20mS
/t/ 30mS

Repetition rate

1125mS

Number of stimulus

User select

Polarity

Alternating

Levels

55 or 65 or 75 dB SPL* user selectable

Transducer

Free field loudspeaker

Masking

Nil, non target ear may be blocked with ear-plugs

1.2.3 Acoustic Stimulation CTE

Stimuli type

Short duration pure tone burst

Burst duration

40 mS

Rise time

10 mS

Fall time

10 mS

Tone frequencies

500, 1k, 2k, 3k, 4k Hz

Repetition rate

1125 mS

Number of stimulus

User select

Polarity

Alternating

Transducer

Bone vibration: B71 or
Insert earphones: EARTone 3A

Levels - bone

0 – 70 dB HL, 1k – 4k Hz, 5 dB steps
0 - 60 dB HL, 500 Hz

Levels – earphones

0 – 110 dB HL, 5 dB step size

Masking signal	Narrow band noise, insert phones only
Masking levels	0dB to -40dB user selectable relative to test level

1.2.4 Response Acquisition: ACA & CTE

Recording channels	2; response waveform, stimulus waveform
Time window	-200mS to +700mS relative stimulus start
Sampling rate	1000 Hz
A/D resolution	16 bits
Number of epochs	User selectable and interruptible
Signal to noise indicator	A red or yellow or green dot indicating good or satisfactory or poor strength of signal relative to overall level of noise
User controls on testing	Start, pause, stop and volume of acoustic monitoring
Other test status	Test level, number of epochs accepted or rejected, time elapsed and latest P values

1.2.5 Evoked cortical response processing

Latency	Time marking responses to stimuli: +/- 5mS
Amplitude	Response voltage: +/- 0.5 μ V
Response extraction	Averaging of responses time locked to stimuli
Response detection	Hotellings-t2 statistic, probability that the trace observed was caused the subject detecting the stimulus
Response differentiation	MANOVA statistic, probability that responses to the different speech sounds are different from each other, ACA only
Signal and noise quality	Displays status on the level of residual noise

1.2.6 Test results screen

Grand averages	Waveform(s) of final averaged cortical response(s)
Stacked traces	For CTE only. Waveforms of final average responses to the same tone burst frequency presented at different levels
Detection statistical analysis	Final P values and their history
Difference statistical analysis	Final P values and their history, ACA only
Summary of test conditions	Ear tested, aided or unaided, electrode condition, stimulus, masking, transducer, test duration and number of accepted epochs.
Comment	Space for user to add comments (recording keeping)

1.2.7 Test records

Test information	All information in the test results screen
Subject information	Name and test of birth
User controls	Store, recall, selection of records

1.2.8 Information displayed during response acquisition

EEG	Trace showing the most recent 9 epochs
Latest response	Waveform of the latest epoch
Averaged responses	Waveform(s) of time locked cumulative average(s) of response(s)
Detection statistics	Trace(s) of P value(s) resulting from detection statistical analysis
Differentiation statistics	Trace(s) of P value(s) resulting from MANOVA, ACA only
Signal to noise indicator	A red or yellow or green dot indicating good or satisfactory or poor strength of signal relative to overall level of acquired noise
Other test status	Test level, number of epochs accepted or rejected, time elapsed and latest P values

1.2.9 User test controls during response acquisition

Soft buttons	Start, pause and stop and volume of acoustic monitoring
Volume control	Vary the monitoring level of acoustics in the test space

1.2.10 Environmental

Operating temperature	15 to 30 degrees C (60 to 85 degrees F)
Operating humidity	20% to 80% (non-condensing)
Permissible ambient SPL, CTE	In accordance with ISO 8253-1
Permissible ambient SPL, ACA	< 30dBSPL, 1/3 octave spectrum, 200 Hz to 6300 Hz (measureable with software tool provided)
EMC specifications	Radiated and conducted emissions CISPR11 Electrostatic Discharge Immunity: IEC61000-4-2 Radiated RF Immunity: IEC 61000-4-3 Fast Transient/Burst Immunity: IEC 61000-4-4 Surge Immunity: IEC 61000-4-5

1.2.11 Power supply

AC input voltage range	100~240Vac
AC input frequency	47~63Hz
AC input current	8.0/4.0A (PC 5.0 + LCD 1.2 + SC 1.35)

1.2.12 Safety

Type of protection	Class 1
Degree of protection	Type BF
Mode of operation	Continuous