Technical Specifications

AA222

Audio Traveller

Interacoustics

Item No. 8107028-1 – 07/2014

Included and Optional Parts

Parts

Included Parts:

Audiometric headphone Single contralateral headset
CIR33 Insert earphones
B71 Bone conductor
APS2 Patient Signal
ATP-AT235U Universal probe system with shoulder strap and wrist strap (tubing 360mm Ø1.3xØ3.3 transparent silicone)
TPR26 3 rolls of recording paper
Power cable
Dust cover
Operation Manual.
Multilingual CE instructions for use

Additional Parts:

EARtone 5A Audiometric Insert Phones
50250 Peltor noise exclosures
21925 Amplivox noise exclosures
ACC400 carrying case
CAT50 calibration unit 0.2-0.5-2.0-5.0 ml
IES impedance ear simulator
GSE10 RS232 Galbanic isolation adapter
USB cable 2m black

General Technical Specifications

Standards:

Safety:	IEC60601-1, Class 1, Type B
EMC:	IEC60601-1-2
Impedance:	IEC60645-5/ANSI S3.39, Type 2
Audiometer:	IEC60645-1/ANSI S3.6, Tone Type 2, Speech Type B-E

Power:

Consumption:	15VA
Mains voltage/fuses:	100-240V~, 50-60Hz, 0.5A max.

The AA222 is delivered with a power cord for the relevant national mains socket. But AA222 can be powered by any national AC voltage - Before use, the correct attachment plug/mains cable must be identified and installed.

Operation Environment:

Temperature:	15 – 35 °C / 65 – 95 °F
Rel. Humidity:	30 – 90%

Temperatures below 0°C / 32°F and above 50°C / 122°F may cause permanent damage to the instrument and accessories.

Warm up time:	10min at room temperature (20°C / 68°F)

Printer (Optional)

Type:	Thermal printer with recording paper in rolls.
Printing Time:	Depending on the test printed.

Paper Rolls:

Width:	112 (+/- 0.5) mm
Diameter:	45 (+2.0) mm
Basis weight:	58.5 +/- 3g/m2
Thickness:	62 +/- 3 u
Tensile:	Min. 3.2 kN/m

Impedance Measuring System

Probe tone:

Frequency:	226 Hz.
Level :	85 dB SPL with AGC, assuring constant level at different volumes.

Air Pressure

Control:	Automatic.
Indicator:	Measured value is displayed on the graphical display.
Range:	-600 to +300 daPa.
Pressure Limitations:	-800 daPa and +600 daPa.
Pressure Change Rate:	Minimum (50 daPa/s), medium, maximum or automatic with minimum speed at compliance peak. Selectable in the setup.

Compliance

Range:	0.1 to 6.0 ml (Ear volume: 0.1 to 8.0 ml). No difference is measured in the recorded values between static and dynamic measuring mode.

Types

Tympanometry:	Automatic, where the start and stop pressure can be user-programmed from the setup menu**.**
Eustachian Tube Function:	Williams test (automatic function).

Indicators

Graphical display:	Compliance is indicated as ml and pressure as daPa. Stimulus level is indicated as dB Hearing Level.

Memory

Tympanometry:	1 curve per ear.
Eustachian Tube Function:	3 curves per ear.

Impedance calibration properties

Probe tone

Frequencies:	226 Hz ± 1%, 678 Hz ± 1%, 800 ± 1%,
Level:	85 dB SPL ± 1.5 dB measured in an IEC 60318-5 acoustic coupler. The level is constant for all volumes in the measurement range.
Distortion:	Max 3% THD

Calibrated transducers

Audiometry headset:	Telephonics TDH/DD45 with a static force of 4.5N ±0.5N
Bone conductor:	Radioear B71 with a static force of 5.4N±0.5N

Definition of units

1 ml at 226 Hz = 1 acoustic mmho,

1 acoustics mho = $10^{-8} m^3/Pa \cdot s$

1 daPa = 10 Pascal

Reflex and Audiometer Functions

Signal Sources

Tone – Contra, Reflex:	250, 500, 1000, 2000, 3000, 4000, 6000 and 8000Hz.
Tone – Contra, Audiometry:	125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000 and 8000Hz
Tone – Ipsi, Reflex:	500, 1000, 2000, 3000 and 4000Hz.
Noise – Contra, Reflex:	Wide Band, High Pass, Low Pass
Noise – Ipsi, Reflex:	Wide Band, High Pass, Low Pass.
Noise – Audiometry:	Narrow Band (IEC60645-1) White Noise

Inputs

CD1/2:	Connection for CD player or tape recorder.
Mic:	Connection for external microphone for live speech.
Talk Back:	Connection for talk back microphone.
Patient Response:	Patient response switch connection.

Output

Audiometry Earphones:	Audiometric headphone, left and right.
Bone Conduction:	B71 bone conductor.
Free Field 1 and 2:	Electrical output for external 2 channel power amplifier (AP12 and AP70).
Monitor:	Monitor earphone disconnects the internal monitor loudspeaker when inserted. Operator can monitor signal when presented to the patient as well as the talk back signal from the patient's microphone.
Contra Earphone:	Audiometric headphones for reflex and audiometry measurements.
Ipsi Earphone:	Probe earphone incorporated in probe system for reflex measurements.
Reflex sensitivity:	0.001 ml is the lowest detectable volume change.
Reflex detection:	The risk of artefacts at higher stimulus levels in reflex measurements are minor and will not activate the reflex detection system.
Air:	Connection for air system to probe.
USB:	Input/output for PC connection. An external PC can be setup to both monitor and control the instrument. The control actions can be followed on the display and the operation panel. Online communication can be selected, where the measured data will be sent to an external PC.
Keyboard:	Connection for external keyboard, standard PC type.

Tolerance

Probe tone:	frequency accuracy better than 2%
Insert earphones:	frequency accuracy better than 3%
Super-aural earphone:	frequency accuracy better than 3%

THD

Probe tone:	THD is less than 3%
Insert earphones:	THD is less than 5%
Super-aural earphone:	THD is less than 2.5%

Attenuator

Range:	0 to 130 dB in 1 or 5 dB steps. Typical range is –10 to 120 dB HL. Range is individual for different modes – see table 1.

Test Types

Manual Audiometry:	Manual control of all functions.
Automatic Audiometry:	Auto threshold according to ISO 8253-1 (Patient controlled Hughson Westlake). Threshold is determined by the activation of the patient response.
Manual Reflex:	Manual control of all functions.
Reflex Decay:	Manually controlled with stimulus duration of 10 seconds.
SISI:	With automatic scoring calculation (5 dB included for familiarisation.
Warble:	5 Hz sine, +/-5 % modulation.
Stenger:	Binaural pure tone or speech stimulation.
ABLB :	Automatic loudness balance test (Fowler).

Memory

6 ipsilateral and 6 contralateral graphs / curves, which each can hold up to 6 pulses. There is an additional capacity for 6 manual tests.

Properties of stimuli

General

Specifications for stimulus and audiometer signals are made to follow IEC 60645-1

Contralateral Earphone

Pure tone:	ISO 389-1 for audiometric headphone
Wide Band noise (WB):	Interacoustics standard
- spectral properties:	As “Broad band noise” specified in IEC 60645-5, but with 500 Hz as lower cut-off frequency.
Low pass noise (LP):	Interacoustics standard
- spectral properties:	Uniform from 500 Hz to 1600 Hz, ±5 dB re. 1000 Hz level
Hign pass noise (HP):	Uniform from 1600 Hz to 10 kHz, ±5 dB re. 1000 Hz level

Ipsilateral Earphone

Pure tone:	Interacoustics standard
Wide Band noise (WB):	Interacoustics standard
- spectral properties:	As “Broad band noise” specified in IEC 60645-5, but with 500 Hz as lower cut-off frequency.
Low pass noise (LP):	Interacoustics standard
- spectral properties:	Uniform from 500 Hz to 1600 Hz, ±10 dB re. 1000 Hz level
Hign pass noise (HP):	Uniform from 1600 Hz to 10 kHz, ±10 dB re. 1000 Hz level
General about levels:	The actual sound pressure level at the eardrum will depend on the volume of the ear. See table 2.

Electrical output properties

Initial Latency:	44.2 (+5/-0) mS
Rise Time:	44.2 (+5/-0) mS
Terminal latency:	44.2 (+5/-0) mS
Fall time:	44.2 (+5/-0) mS
Overshoot:	5 % (± 2%)
Undershoot:	5 % (± 2%)

Table 1: Frequencies and intensity ranges

Frequency	Reflex							
	Contralateral						Ipsilateral	
	Audiometric headphone		EAR-Tone 3A		Insert/CIR33			
	Min	Max*	Min	Max*	Min	Max*	Min	Max*
Hz	dB HL	dB HL	dB HL	dB HL	dB HL	dB HL	dB HL	DB HL
250	-10	110	-10	105	0	100	-	-
500	-10	120	-10	110	0	105	10	105
1000	-10	120	-10	120	0	110	10	110
2000	-10	120	-10	120	0	105	10	105
3000	-10	120	-10	120	0	100	10	100
4000	-10	120	-10	115	0	95	10	100
6000	-10	120	-10	100	-	-	-	-
8000	-10	110	-10	95	-	-	-	-
WB noise	-10	120	-10	120	0	100	10	105
LP noise	-10	120	-10	120	0	100	10	105
HP noise	-10	120	-10	120	0	100	10	105

Minimum level step size 5 dB
Maximum difference error between tow steps is less than **±3 dB**
Residual noise is less than 25 dB (A)
Signal to noise ratio is larger than 80 dB (A)
ON-OFF ration is larger than 80 dB (A)
Rise-/fall time: 35 ms (±10 ms)

Table 2: Variation of ipsi stimulus levels for different volumes of the ear canal

Freq.	Variation of ipsi stimulus levels for different volumes of the ear canal Relative to the calibration performed on an IEC 126 coupler	
	0.5 ml	**1 ml**
[Hz]	[dB]	[dB]
500	9.7	5.3
1000	9.7	5.3
2000	11.7	3.9
3000	-0.8	-0.5
4000	-1.6	-0.8
WB	7.5	3.2
LP	8.0	3.6
HP	3.9	1.4

Table 3: General properties for earphones

Sound attenuation values for earphones		
Freq.	Attenuation	
[Hz]	Audiometric headphone with MX41/AR or PN 51 cushion [dB]	EAR-Tone 3A [dB]
125	3	32.5
160	4	-
200	5	-
250	5	36
315	5	-
400	6	-
500	7	37.5
630	9	-
750	-	-
800	11	-
1000	15	36.5
1250	18	-
1500	-	-
1600	21	-
2000	26	33
2500	28	-
3000	-	-
3150	31	-
4000	32	39.5
5000	29	-
6000	-	-
6300	26	-
8000	24	42.5

Difference between free field and coupler sensitivity levels. Used by Free Field equivalent earphone output (Type A-E or B-E)	
Freq.	Correction values
[Hz]	Audiometric headphone with MX41/AR or PN 51 cushion using IEC 303 coupler [dB]
125	-17.5
160	-14.5
200	-12
250	-9.5
315	-6.5
400	-3.5
500	-0.5
630	0
750	-
800	-0.5
1000	-0.5
1250	-1
1500	-
1600	-4
2000	-6
2500	-7
3000	-
3150	-10.5
4000	-10.5
5000	-11
6000	-
6300	-10.5
8000	1.5

Table 4: Reference values for stimulus and audiometer calibration

Freq.	Reference values for stimulus and audiometer calibration										
	ISO 389-1 (TDH/ DD45)	ANSI S3.6 (TDH/DD 45)	ISO 389-4 (ISO 8798) (NB masking)	ISO 389-3 (ISO 7566) (BC)	ANSI S3.6 (BC)	ISO 389-2 (Insert)	ISO 389-7 Free field (FF)	ISO 389-7 Diffuse-field (FF)	Interacoustics Standard		
									TDH/DD 45	Insert	Ipsi
[Hz]	[dB re. 20 µPa]	[dB re. 20 µPa]	[dB re. 20 µPa]	[dB re. 1µN]	[dB re. 1µN]	[dB re. 20 µPa]	[dB re. 20 µPa]	[dB re. 20 µPa]	[dB re. 20 µPa]	[dB re. 20 µPa]	[dB re. 20 µPa]
125	45,0	45	4			26	22,0	22,0			
250	25,5	25,5	4	67	67	14	11,0	11,0			
500	11,5	11,5	4	58	58	5,5	4,0	3,5			
750	7,5	8	5	48,5	48,5	2	2,0	1,0			
1000	7	7	6	42,5	42,5	0	2,0	0,5			
1500	6,5	6,5	6	36,5	36,5	2	0,5	-1,0			
2000	9	9	6	31	31	3	-1,5	-1,5			
3000	10	10	6	30	30	3,5	-6,0	-4,0			
4000	9,5	9,5	5	35,5	35,5	5,5	-6,5	-5,0			
6000	15,5	15,5	5	40		2	2,5	-0,5			
8000	13	13	5	40		0	11,5	5,5			
WB									-8	-5	-5
LP									-6	-7	-7
HP									-10	-8	-8

ISO 389-3 / ANSI S3.6. Valid for placement on the human mastoid

Coupler types used by calibration

- TDH/DD45 is calibrated using a 6cc acoustic coupler made in accordance to IEC 60318-3
- Insert phones are calibrated using a 2cc acoustic coupler made in accordance to IEC 60318-5
- Bone Conductor is calibrated using a mechanical coupler made in accordance to IEC 60318-6

Tabe 5. Specification of input/output connections

Inputs	**Connector type**	**Electrical properties**	
Mains connector	IEC 60320-1 Type C6	2.5A/250V AC	
Patient response	Jack, 6.3mm stereo	Handheld switch:	Signal is forced to +5V level when activated.
CD 1 and 2	Jack, 3.5mm stereo	Sensitivity: Impedance: Freq. Response:	9 mV at max volume and 0 Vu 47.5 kΩ 75-12000 Hz ± 3dB
Microphone	Jack, 3.5 mm stereo	Type: Sensitivity: Impedance: Freq.Response: Electret bias:	Electret or 2000Ω dynamic microphone. 100 μV at max volume for 0 Vu reading 47.5 kΩ 90-20kHz 6.2V through 4.75 kΩ (1.3 mA)
Talk Back microphone	Jack, 6,3 mm stereo	As for Microphone	
Outputs:			
Phones, Left/ Right	Jack, 6.3mm mono	Voltage: Min. load impedance:	Up to 5.5V rms. by 10Ω load 5Ω
Bone conductor	Jack, 6.3mm mono	As for Phones, Left/Right	
Free Field 1, 2	Phono	Voltage: Min. load impedance: Freq. response: Output impedance:	Up to 8.0V rms. by 100Ω load 100Ω 75-12000 Hz +/-3dB 500 ohm
Monitor	Jack, 6.3mm mono	Voltage: Min. load impedance:	Up to 2.0V rms. by 8Ω load 0Ω
Phones, Contralateral (Insert masking)	Jack, 6.3mm mono	Voltage: Min. load impedance:	Up to 5.5V rms. by 10Ω load 5Ω
Transducer	CANON, 15 pole	Pin 1: Pin 2: Pin 3: Pin 4: Pin 5: Pin 6: Pin 7: Pin 8: Pin 9: Pin 10: Pin 11: Pin 12: Pin 13: Pin 14: Pin 15:	Press. 1 signal 12V -12V Remote key/detection Probe tone Mic. signal LED blue Press. 2 signal LED green Ipsi Stim. Gnd. Ipsi Stim. Signal Probe tone Gnd. Gnd. Vref., 5V LED red
Data I/O:			
USB	USB type"B"	USB port for communication	See appendix A in service manual for detailed information

Table 6: General properties for earphones.

Sound attenuation values for earphones			
Frequency	Attenuation		
[Hz]	TDH/DD45 with MX41/ AR or PN 51 cushion [dB]	EAR-Tone 3A EAR-Tone 5A [dB]	
125	3	33,5	
160	4		
200	5		
250	5	34,5	
315	5		
400	6		
500	7	34,5	
630	9		
750	-		
800	11		
1000	15	35,0	
1250	18		
1500	-		
1600	21		
2000	26	33,0	
2500	28		
3000	-		
3150	31		
4000	32	39,5	
5000	29		
6000	-		
6300	26		
8000	24	43,5	

Table 7: Audiometry frequencies and intensity ranges

Frequency	Audiometry									
	TDH/DD45		EAR-Tone 3A		Bone conduction B71		Insert Masking NB		Free Field	
	Min	Max*	Min	Max*	Min	Max*	Min	Max*	Min	Max*
Hz	dB HL	dB HL	dB HL	dB HL	dB HL	dB HL	dB HL	dB HL	dB HL	dB HL
125	-10	90	-10	90	-	--	-	-	-10	80
250	-10	110	-10	105	0	45	0	105	-10	90
500	-10	120	-10	110	0	65	0	110	-10	100
750	-10	120	-10	115	0	70	0	110	-10	100
1000	-10	120	-10	120	0	70	0	110	-10	100
1500	-10	120	-10	120	0	70	0	110	-10	100
2000	-10	120	-10	120	0	75	0	110	-10	100
3000	-10	120	-10	120	0	80	0	110	-10	100
4000	-10	120	-10	115	0	80	0	105	-10	100
6000	-10	120	-10	100	0	55	0	95	-10	95
8000	-10	110	-10	95	0	50	0	90	-10	90

Speech	Type B	-10	100	-10	90	-10	50	-	-	0	100
	Type B-E	-10	110	-10	90	-10	50	-	-	0	100
Speech Noise	Type B	-10	100	-10	90	-	-	0	90	0	90
	Type B-E	-10	110	-10	90	-	-	0	90	0	90

Note: Max values are obtainable by selecting “Ext. Range” on the instrument.