

## AT235 Technical Specifications

<b>Medical CE-mark:</b>	The CE-mark indicates that Interacoustics A/S meets the requirements of Annex II of the Medical Device Directive 93/42/EEC. Approval of the quality system is made by TÜV – identification no. 0123.		
<b>Standards:</b>	<b>Safety:</b>	EN 60601-1, Class I, Type B	
	<b>EMC:</b>	EN 60601-1-2	
	<b>Impedance:</b>	EN 61027/ANSI S3.39, Type 2	
	<b>Audiometer:</b>	EN 60645-1/ANSI S3.6, Type 4 Tone audiometer	
<b>Power, UPS400:</b>	<b>Consumption:</b>	15 W (Max 60W)– See separate service manual	
	<b>Mains voltages and fuses:</b>	T1 A (Voltage)	
<b>Operation environment:</b>	<b>Temperature:</b>	15 – 35 °C	
	<b>Rel. Humidity:</b>	30 – 90%	
<b>Storing/handling:</b>	Temperatures below 0°C and above 50°C may cause permanent damage on the instrument and its accessories.		
<b>Warm up time:</b>	10 minutes at room temperature (20 °C).		

### Impedance Measuring System

<b>Probe tone:</b>	<b>Frequency:</b>	226 Hz	
	<b>Level:</b>	85 dB SPL with AGC, assuring constant level at different volume.	
<b>Air pressure:</b>	<b>Control:</b>	Automatic.	
	<b>Indicator:</b>	Measured value is displayed on the graphical display.	
	<b>Range:</b>	-600 to +300 daPa.	
	<b>Pressure limitation:</b>	-800 daPa and +600 daPa.	
	<b>Pressure change rate:</b>	Minimum (50 daPa/s), medium, maximum or automatic with minimum speed at compliance peak. Selectable in the set-up.	
<b>Compliance:</b>	<b>Range:</b>	0.1 to 6.0 ml (Ear volume: 0.1 to 8.0 ml).	
<b>Test types:</b>	<b>Tympanometry</b>	Automatic, where the start and stop pressure can be user-programmed in the set-up function.	
	<b>Eustachian Tube Function</b>	Williams test (automatic function).	
<b>Indicators:</b>	<b>Graphical display</b>	Compliance is indicated as ml and pressure as daPa. Stimulus level is indicated as dB Hearing Level.	
<b>Memory:</b>	<b>Tympanometry:</b>	1 curve per ear.	
	<b>Eustachian Tube Function:</b>	3 curves per ear.	

### Reflex and Audiometer Functions

<b>Signal sources:</b>	<b>Tone - Contra, Reflex:</b>	250, 500, 1000, 2000, 3000, 4000, 6000, 8000 Hz.	
	<b>Tone , Audiometry:</b>	125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000 HZ.	
	<b>Tone - Ipsi, Reflex:</b>	500, 1000, 2000, 3000, 4000 Hz.	
	<b>Noise - Contra, Reflex:</b>	Wide Band, High Pass, Low Pass.	
	<b>Noise - Ipsi, Reflex:</b>	Wide Band, High Pass, Low Pass.	
<b>Inputs:</b>	<b>Patient Response:</b>	Connection for patient response switch.	
<b>Outputs:</b>	<b>Earphone Right/ Left</b>	Can be selected to be either standard earphones or insert phones by pressing <i>shift</i> Right/Left	
	<b>Contra Earphone:</b>	TDH39 earphone for Reflex or Audiometry measurements.	
	<b>Ipsi Earphone:</b>	Probe earphone incorporated in the probe system for Reflex measurements.	
	<b>Air:</b>	Connection of the air system to the probe.	
	<b>USB:</b>	Input/output for computer communication. An external PC can be made to both monitor and control the instrument. The control actions can be followed on the display and operation panel. Online communication can be selected, where the measured data will be sent to an external PC. See separate section in Service Manual for programming details.	
<b>Attenuator:</b>	<b>Keyboard:</b>	Connection for external keyboard, standard PC type.	
	<b>Range:</b>	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	
<b>Test types:</b>	<b>Manual Audiometry</b>	Manual control of all functions.	
	<b>Automatic Audiometry</b>	Auto threshold according to ISO 8253-1 (Patient controlled Hughson-Westlake). The threshold is determined by the activation of the patient response.	

<b>Test types:</b>	<b>Manual Reflex</b>	Manual control of all functions.
	<b>Reflex Decay:</b>	Manually controlled with stimulus duration of 10 s.
<b>Memory:</b>		6 ipsi and 6 contra graphs/curves. Each can have up to 6 pulses. There is additional capacity for 6 manual tests.
<b>Printer (Optional):</b>	<b>Type:</b>	Thermal printer with recording paper in rolls.
	<b>Paper width:</b>	112 mm
	<b>Printing time:</b>	21 s for worst case (2 tympanograms + 16 reflexes + 2 audiograms)

**Table 1: Frequencies and intensity ranges**

Frequency	Reflex				Audiometry	
	Contralateral		Ipsilateral		TDH39	
	Min	Max*	Min	Max*	Min	Max
Hz	dB HL	dB HL	dB HL	DB HL	dB HL	dB HL
250	10	110	-	-	-10	110
500	10	120	10	105	-10	120
1000	10	120	10	110	-10	120
2000	10	120	10	105	-10	120
3000	10	120	10	100	-10	120
4000	10	120	10	100	-10	120
6000	10	120	-	-	-10	120
8000	10	110	-	-	-10	110
WB noise	10	120	10	105		
LP noise	10	120	10	105		
HP noise	10	120	10	105		

\* Note: Max values are obtainable by selecting "Ext. Range" in the set-up.

### Specification of input/output connections

Inputs	Connector type	Electrical properties
Patient response	Jack, 6.3mm stereo	Handheld switch: 5V through 10kΩ is forced to gnd. level when activated.
Keyboard	DIN, 5 pole	Pin 1: NC Pin 2: (Grey) RXA1 Pin 3: (Violet) Sync clk. Pin 4: (White) VDD, 5V Pin 5: (Black) Gnd.
<b>Outputs:</b>		
Phones, Left/ Right	Jack, 6.3mm mono	Voltage: Up to 5.5V rms. by 10Ω load Min. load impedance: 5Ω
Phones, Contralateral	Jack, 6.3mm mono	Voltage: Up to 5.5V rms. by 10Ω load Min. load impedance: 5Ω
Transducer	CANON, 15 pole	Pin 1: Press. 1 signal Pin 2: 12V Pin 3: -12V Pin 4: Remote key Pin 5: Probe tone Pin 6: Mic. signal Pin 7: LED blue Pin 8: Press. 2 signal Pin 9: LED green Pin 10: Ipsi Stim. Gnd. Pin 11: Ipsi Stim. Signal Pin 12: Probe tone Gnd. Pin 13: Gnd. Pin 14: Vref., 5V Pin 15: LED red
<b>Data I/O:</b>		
USB	USB type"B"	USB port for communication See appendix A in service manual for detailed information

## Calibration properties

<b>Calibrated Transducers:</b>	Contralateral Earphone:	Telephonics TDH39 with a static force of 4.5N ±0.5N
	Probe system:	Ipsilateral Earphone: is integrated in the probe system 226 Hz transmitter and receiver and pressure transducer is integrated in the probe system
<b>Accuracy:</b>	Audiometry headset:	Telephonics TDH39 with a static force of 4.5N ±0.5N
	General	Generally the instrument is made and calibrated to be within and better than the tolerances required in the specified standards:
	Audiometer and Reflex Frequencies:	±3%
	Contralateral Reflex and Audiometer Tone Levels:	±3 dB for 250 to 4000Hz and ±5 dB for 6000 to 8000Hz
	Ipsilateral Reflex Tone Levels:	±5 dB for 500 to 2000Hz and +5/-10 dB for 3000 to 4000Hz
	Pressure measurement :	±5% or ±10 daPa, whichever is greater
	Compliance measurement:	±5% or ±0.1 ml, whichever is greater

### Impedance calibration properties

Probe tone	Frequency:	226 Hz ±1%
	Level:	85 dB SPL ±1.5 dB measured in an IEC 126 acoustic coupler. The level is constant for all volumes in the measurement range.
Compliance	Distortion:	Max 5% THD
	Range:	0.1 to 6.0 ml
	Temperature dependence:	-0.003 ml/°C
	Pressure dependence:	-0.00020 ml/daPa
	Reflex sensitivity:	0.001 ml is the lowest detectable volume change
	Temporal reflex characteristics:	Initial latency = 10 ms (±5 ms) Rise time = 75 ms (±5 ms) Terminal latency = 10ms (±5 ms) Fall time = 75 ms (±5 ms) Overshoot = max. 8% Undershoot = max 10%
Pressure	Range:	Values between -600 to +300 daPa can be selected in the set-up.
	Safety limits:	-700 daPa and +500 daPa, ±100 daPa

### Reflex/audiometer calibration standards and spectral properties:

General	Specifications for stimulus and audiometer signals are made to follow EN 60645-1	
Contralateral Earphone	Pure tone:	ISO 389-1 for TDH39.
	Wide Band noise (WB):	Interacoustics Standard
	– Spectral properties:	As “Broad band noise” specified in EN 61027, 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	
Ipsilateral Earphone	High Pass noise (HP):	Interacoustics Standard
	– Spectral properties:	Uniform from 1600 Hz to 10KHz, ±5 dB re. 1000 Hz level
	Pure tone:	Interacoustics Standard.
	Wide Band noise (WB):	Interacoustics Standard
– Spectral properties:	As “Broad band noise” specified in EN 61027, 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	
High Pass noise (HP):	Interacoustics Standard	
– Spectral properties:	Uniform from 1600 Hz to 4000 Hz, ±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 for details.	

**Table 2**

Freq.	Reference values for stimulus and audiometer calibration				Variation of ipsi stimulus levels for different volumes of the ear canal		Sound attenuation values for TDH39 earphones using MX41/AR or PN51 cushion
	ISO 389-1		ISO 389-2		Interacoustics Standard		
	TDH39	IPSI EAR3A (CIR22)	TDH39	Ipsi	0.5 ml	1 ml	
[Hz]	[dB re. 20 µPa]	[dB re. 20 µPa]	[dB re. 20 µPa]	[dB re. 20 µPa]	[dB]	[dB]	[dB]
125	45						3
250	25,5						5
500	11,5	5,5			9.7	5.3	7
1000	7	0			9.7	5.3	15
1500	6,5						21 (1600 Hz)
2000	9	3,0			11.7	3.9	26
3000	10	3,5			-0.8	-0.5	31 (3150 Hz)
4000	9,5	5,5			-1.6	-0.8	32
6000	15,5						26 (6300 Hz)
8000	13						24
WB			-8.0	-5.0	7.5	3.2	
LP			-6.0	-7.0	8.0	3.6	
HP			-10.0	-8.0	3.9	1.4	

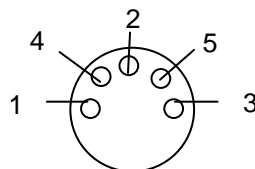
### Coupler types used by calibration

TDH39 is calibrated using a 6cc acoustic coupler made in accordance to IEC 303

Ipsilateral earphone and probe tone are calibrated using a 2cc acoustic coupler made in accordance to IEC 126

### Output voltages (regulated):

Pin no.	Voltage	Cont. current A	Peak current A
1	Gnd.	-	-
2	Gnd.	-	-
3	+5	0.5	1.0
4	-12	0.7	3.0
5	+12	0.5	1.5



View on output pins

## General about specifications

Interacoustics continuously strive to improve the products and their performance. Therefore the specifications can be subject to change without notice.

The performance and specifications of the instrument can only be guaranteed if it is subject to a technical maintenance at least once a year. This should be made by a workshop, authorised by Interacoustics.

Questions about representatives and products may be sent to:

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