

Titan Technical Specifications

Medical CE-mark:	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		
Standards:	Safety:	IEC 60601-1, Class II, Type B	
	EMC:	IEC 60601-1-2	
	Impedance:	IEC 60645-5/ANSI S3.39, Type 1	
Power, ASA30M – 0301	Consumption:	0,8 – 0,4 A	
	Mains voltages and fuses:	90 – 265 VAC, 47 – 63 Hz	
Power, Titan	Fuses:	3 A (5 V)	
Power, Cradle	Fuses:	3 A (5 V) and 250 mA (5 V) on DC- output	
Operation environment:	Temperature:	15 – 35 °C	
	Rel. Humidity:	30 – 90%	
Storing/handling:	Temperatures below 0°C and above 50°C may cause permanent damage on the instrument and its accessories.		
Transport:	Temperature:	-20 – 50 °C	
	Rel. Humidity:	10 – 95%	

Impedance Measuring System

Probe tone:	Frequency:	226 Hz, 678 Hz, 800 Hz, 1000 Hz	
	Level:	69 dB HL with AGC, assuring constant level at different ear canal volumes.	
Air pressure:	Control:	Automatic.	
	Indicator:	Measured value is displayed on the graphical display.	
	Range:	-600 to +300 daPa.	
	Pressure limitation:	-750 daPa and +550 daPa.	
	Pressure change rate:	Minimum, medium, maximum or automatic with minimum speed at compliance peak. Selectable in the set-up. Range is 50-350daPa	
Compliance:	Range:	0.1 to 8.0 ml at 226 Hz probe tone (Ear volume: 0.1 to 8.0 ml) and 0.1 to 15 mmho at 678, 800 and 1000 Hz probe tone.	
Test types:	Tympanometry	Automatic, where the start and stop pressure can be user-programmed in the set-up function.	
		Manual control of all functions.	
	Eustachian tube function 1 – Non perforated eardrum	Williams test	
	Eustachian tube function 2 – Perforated eardrum	Toynbee test	
	Eustachian tube function 3 – Patulous Eustachian tube	Continuous sensitive impedance measurement for 30 up to 150 s.	
Indicators:	Graphical display	Compliance is indicated as ml and pressure as daPa. In PC controlled mode admittance, susceptance and conductance can be printed. Stimulus level is indicated as dB Hearing Level.	
Memory:	Tympanometry:	1 curve per ear per tympanometry test. 3 curves per ear per Eustachian tube function test. And theoretically an infinite number of tests per protocol.	

There is no deviation between static and dynamic mode.

Reflex Functions

Signal sources:	Tone - Contra, Reflex:	250, 500, 1000, 2000, 3000, 4000, 6000, 8000 Hz.
	Tone - Ipsi, Reflex:	500, 1000, 2000, 3000, 4000 Hz.
	NB noise - Contra, Reflex:	250, 500, 1000, 2000, 3000, 4000, 6000, 8000 Hz.
	NB noise - Ipsi, Reflex:	1000, 2000, 3000, 4000 Hz.
	Noise - Contra, Reflex:	Wide Band, High Pass, Low Pass.
	Noise - Ipsi, Reflex:	Wide Band, High Pass, Low Pass.
Outputs:	Contra Earphone:	TDH39 earphone and/or CIR55 insert for Reflex measurements.
	Ipsi Earphone:	Probe earphone incorporated in the probe system for Reflex measurements.
	Air:	Connection of the air system to the probe.
Test types:	Manual Reflex	Manual control of all functions.

Automated Reflex

Automatic reflexes:

- Single intensities
- Single reflex auto search
- Reflex growth

Reflex Decay

Automatic, 10 dB above threshold and manually controlled with stimulus durations of 10 and 30 s.

Reflex latency

Automated, first 300 ms from stimulus start.

General

PC control:

USB:

Input/output for computer communication. Titan can be fully operated from PC. The measurements can then be followed on PC screen.

Data can be sent to and saved on the PC and stored in OtoAccess™.

See separate section in Service Manual for programming details.

Memory:

Theoretically an infinite amount of test results can be stored on the PC. The Titan hand held unit is delivered with a 1 Gb memory card, enough for storing more than a quarter of a million tests.

Thermal printer (Optional):

Type:

Thermal (Bluetooth) printer with recording paper in rolls. Print on command through Bluetooth communication and through serial RS-232.

Paper width:

57.5 ± 0.5 mm on thermal printer

Printing time:

Printing time depends on the size of the used protocol. For 2 tympanograms and 8 reflexes the thermal printer uses approximately 6 s.

Table 1: Frequencies and intensity ranges

Titan Maximal's						
	TDH39		CIR55		IOW IPSI	
Center	Reading		Reading		Reading	
Freq.	Tone	NB	Tone	NB	Tone	NB
[Hz]	[dB HL]	[dB HL]	[dB HL]	[dB HL]	[dB HL]	[dB HL]
125	80,0	65,0	85,0	70,0	85,0	75,0
250	100,0	85,0	100,0	85,0	95,0	85,0
500	120,0	100,0	110,0	100,0	105,0	95,0
750	120,0	105,0	110,0	105,0	105,0	95,0
1000	120,0	105,0	115,0	105,0	110,0	95,0
1500	120,0	105,0	115,0	105,0	110,0	95,0
2000	120,0	105,0	115,0	105,0	110,0	95,0
3000	120,0	105,0	115,0	105,0	105,0	90,0
4000	120,0	105,0	110,0	100,0	100,0	85,0
6000	120,0	100,0	95,0	95,0	90,0	80,0
8000	105,0	95,0	80,0	85,0	80,0	70,0
WB	-	120,0	-	120,0	-	105
LP	-	120,0	-	120,0	-	105
HP	-	120,0	-	120,0	-	105

Specification of input/output connections

Inputs

Patient response

Connector type

Jack, 3,5mm 4-pole

Electrical properties

Handheld switch:

- Pin 1: GND
- Pin 2: Signal
- Pin 3: Future use I/O
- Pin 4: Future use I/O

3V through 10K Ω is forced to ground when activated

Outputs:

Phones, Left/ Right	Jack, 3,5mm 4-pole	Voltage: Min. load impedance: Pin 1: CH1 GND Pin 2: CH1 OUT (left) Pin 3: CH2 OUT (right) Pin 4: CH1 GND	Up to 3V rms. by 10Ω load 8Ω Pin 3:
Phones, Contralateral	Jack, 3,5mm 4-pole	Voltage: Min. load impedance: Pin 1: CH1 GND Pin 2: CH1 OUT (left) Pin 3: CH2 OUT (right) Pin 4: CH1 GND	Up to 3V rms. by 10Ω load 8Ω
Transducer	IA proprietary, 12-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:	CH1 out CH1 GND DGND GND A / GND Microphone Microphone – input / Analog balanced in Microphone + input / Analog balanced in Power supply +3/+5V CH2 out CH2 GND I2C CLK I2C DATA I2C Interrupt
Data I/O: USB	USB type"B"	USB port for communication	See appendix A in service manual for detailed information

Calibration properties

Calibrated Transducers:	Contralateral Earphone:	Telephonics TDH39 with a static force of 4.5N ±0.5N and/or CIR55 insert phone
	Probe system:	Ipsilateral Earphone: is integrated in the probe system Probe frequency transmitter and receiver and pressure transducer is integrated in the probe system
Accuracy:	General	Generally the instrument is made and calibrated to be within and better than the tolerances required in the specified standards:
	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	Frequencies:	226 Hz ± 1%, 678 Hz ± 1%, 800 Hz ± 1%, 1000 Hz ± 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.
Compliance	Distortion:	Max 5% THD
	Range:	0.1 to 8.0 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 = 35 ms (±5 ms) Rise time = 45 ms (±5 ms) Terminal latency = 35 ms (±5 ms) Fall time = 45 ms (±5 ms) Overshoot = max. 1% Undershoot = max 1%
Pressure	Range:	Values between -600 to +300 daPa can be selected in the setup.
	Safety limits:	-750 daPa and +550 daPa, ±50 daPa

Reflex calibration standards and spectral properties:

General	Specifications for stimulus and audiometer signals are made to follow IEC 60645-5
Contralateral Earphone	Pure tone: ISO 389-1 for TDH39 and ISO 389-2 for CIR 22.
	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
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 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
	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.

The risk of artifacts at higher stimulus levels in reflex measurements are minor and will not activate the reflex detection system

Table 2: Reference values for stimulus calibration

Freq.	Reference values for stimulus 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 [dB]
	[dB re. 20 μ Pa]				Relative to the calibration performed on an IEC 126 coupler [dB]		
	ISO 389-1	ISO 389-2	Interacoustics Standard	ISO 389-4 (ISO 8798)	0.5 ml	1 ml	
[Hz]	TDH39	IPSI EAR3A CIR55	TDH39	IPSI NB stimulus TDH39 & CIR55			
125	45	26		4			3
250	25.5	14		4			5
500	11.5	5.5		4	9.7	5.3	7
1000	7	0		6	9.7	5.3	15
1500	6.5	2.0		6			21 (1600 Hz)
2000	9	3.0		6	11.7	3.9	26
3000	10	3.5		6	-0.8	-0.5	31 (3150 Hz)
4000	9.5	5.5		5	-1.6	-0.8	32
6000	15.5	2.0		5			26 (6300 Hz)
8000	13	0		5			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 60318-5

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, authorized by Interacoustics. Questions about representatives and products may be sent to:

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