

Helmet Tester

The XABH-9000 Helmet Tester is a hand-held, battery powered instrument for verifying the proper operation of aviation-type speakers and microphones, individually or as part of complete headsets.

FEATURES & SPECIFIC ACTIONS

- The case size is 4.3" w x 9.5" H x 2.25" Thick.
- Operating temperature 0°C to 55°C (32°F-130°F)
- The unit is compatible with dynamic microphones ranging from 5 to 600 ohms, "amplified" electret microphones (commonly used for carbon mic replacement), and polarized electrets condenser microphones. It is designed for speakers and speaker systems ranging from 4 to 600 ohms, however it can measure speakers up to 1700 ohms with diminished output level.
- A 2-line 20-character backlit LCD shows microphone type and current (for electret types) or ohms (for dynamic types), speaker ohms, and relative microphone output level in response to input sound.



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PN: XABH-9000

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PRODUCT DESCRIPTION AND OPERATION

The unit simulates an intercom system for verifying proper operation by wearing the headset and speaking into the communications microphone. Includes a built-in microphone and a speaker for testing individual speakers and microphones and for trouble-shooting in the event normal loop-back testing fails. The internal microphone has automatic gain control so that it can be used up close or sitting on a table picking up ambient noise. A six-position rotary switch selects the operating mode...

Normal - headset microphone is connected to the headset speakers.

Mic test- headset microphone is connected to the headset speakers and the internal speaker.

Spkr test - internal microphone is connected to the headset speakers.

Preset A, B, C - same as normal mode but compares readings to stored values to display error messages should the readings deviate significantly. Presets are programmed by connecting a known-good headset and depressing the recessed programming switch on the top of the tester.

The volume control sets the output level of both the headset speakers and the internal speaker.

A 13-pin connector permits interfacing with various types of headset connectors and individual speaker and microphone elements. Custom adapters can be provided for specific applications. The connector includes power lines and access to the processor for field code updates if needed, and to permit the construction of specialized adapters that take over the display.

The unit is powered by 3 AA cells, typical battery lifetime is about 30 hours of actual usage and about 90 hours turned on but not being used. Current drain is about 65ma to 90ma while operating with the LCD back-light on and connected to a microphone. After a few minutes the LCD back-light is turned off to conserve power, idle current without a headset connected is about 25ma. The back-light is restored when a headset is connected or the mode switch is operated. Remove the batteries when the unit is stored for more than a month. Recommended battery type is Duracell MN1500.

The unit automatically detects the microphone type and engages the appropriate pre-amplifier and bias. Dynamic microphones are measured by applying a current of about

0.5ma (5V source with 10K series resistance), microphones with a resistance of less than 25 ohms are considered low-impedance and engage a higher gain preamp. Polarized condenser microphones are measured by biasing from a 5V source with 5K series resistance (1ma max). Amplified microphones are measured by biasing from a 10V source with 560 ohms series resistance. Speakers are measured by applying a current of about 0.45ma (0.45V source with 1K series resistance). Output impedance is roughly 15 ohms to minimize the volume differences between low and medium impedance headsets.

OPERATION

When a microphone is connected, the unit detects the mic type and selects an appropriate

Type L = dynamic microphone under about 25 ohms, 54db-gain preamp, 150 ohm input-Z

Type H = dynamic microphone over about 25 ohms, 46db-gain preamp, 150 ohm input-Z

Type P = polarized electret condenser microphone, 5V/5K bias, 12db-gain preamp

Type E = amplified electret microphone assembly, 10V/560 ohm bias, 3db-gain preamp

LCD display shows mic/speaker data and mic signal output

On power-up the unit briefly displays the battery voltage. "LB" appears in the lower right corner if the battery voltage is below about 3.6V, and the back-light is disabled if the battery voltage is under about 3.1V. In normal operation the back-light is turned off after a few minutes of non-use.

TECHNICAL NOTES

The tester uses three commonly-available alkaline AA-type batteries, such as the Duracell type MN1500 or MX1500, or the Energizer E91. Carefully inspect the batteries before installing, do not use if the case shows any sign of damage or if there is any corrosion on the terminals. Periodically inspect the battery holder terminals for corrosion, if any corrosion or discoloration is noted, then clean the terminals using alcohol and a swap. Batteries must be installed correctly with the springs contacting the flat minus terminal. Remove the batteries when the tester is not being used for a period of more than one month.

Rechargeable NiMh or NiCd batteries may be used, however the LB (low battery) indicator will be shown early, and the unit must be turned off when the back-light remains off to avoid damage to the batteries. Leaving the unit on past the point where the back-light no longer comes on will damage rechargeable batteries due to polarity reversal effects.

The display shows OPEN if microphone and/or speaker is not connected. If the microphone type cannot be determined then displays UNKN (unknown). The speaker and microphone readings are updated roughly twice a second. Speaker and dynamic microphone resistance is shown in ohms.

Electric microphones are given a rating number based on current drain:

Unit displays $ma \times 100$ for type P microphones (i.e. $Mi=P50$ means 0.5ma),

Unit displays $ma \times 10$ for type E microphones (i.e. $Mi=E115$ means 11.5ma).

Measurement accuracy is about +/-3% after stabilizing and with no audio signal.

The 2nd line shows the relative output of the microphone preamp, with the peak held for roughly a second to make it easier to visualize the microphone output level in response to speech.

Function Switch

Position 1 - normal manual operation

Position 2 - microphone test mode (turns on internal speaker)

Position 3 - speaker test mode (turns on internal microphone)

In all modes, the signal from the headset mic is delivered to the headset speaker. In microphone test mode, the signal from the headset mic is also delivered to an internal speaker. In speaker test mode, a signal from an internal microphone is delivered to the headset speaker and the signal from the headset microphone is attenuated by about 10db. The internal microphone has automatic gain control to adapt to the peak sound level.

In preset modes, program the unit by connecting a good headset and pressing the pushbutton switch located behind an access hole on the top of the unit.

After programming, the following messages are displayed after connecting a headset:

OK - no errors detected

Mic Open - microphone is disconnected, bad mic or disconnected cable or connector wiring

Mic Shorted - microphone resistance is less than 2 ohms, likely shorted cable or connector

Mic Wrong - not the expected microphone type

Mic Ohms Bad - dynamic microphone ohms deviates more than +/-30% from expected

Mic Current Bad - electret microphone current deviates more than +/-70% from expected

(note - polarized electret mics vary widely and may produce false errors in preset modes)

Mic Unknown - cannot determine microphone type

Spkr Open - speaker is disconnected, likely disconnected cable or connector wiring

Spkr Shorted - speaker resistance is less than 2 ohms, likely shorted cable or connector

Spkr Ohms Bad - speaker resistance deviates more than +/-20% from expected

(note - if headset has a volume control make sure it is all the way up)

One Spkr Bad - speaker resistance is twice the expected value, likely one speaker bad or disconnected

Lines Shorted - both speaker and microphone read less than 2 ohms, likely bad cable or connector

Lines Bad - one line shorted, one line open, likely bad cable or connector

Mic & Spkr Bad - some other error involving both the microphone and speakers

The unit beeps if the value deviates too much from the programmed values. The programmed values are saved in internal memory permanently until programmed again. When switching to a preset, the display briefly shows the values programmed for that preset.

When testing headsets with a volume control, turn the headset's volume control all the way up or the tester will add the volume control resistance to the displayed reading.

It is normal for the current of type P microphones to vary widely over time and in response to sound. Type P microphones require that the + and - wires be connected correctly or they will read UNKN.

The unit is not designed for carbon-type microphones. They should detect as high impedance dynamic and the measurement bias might permit some level of testing, but the readings and the microphone output level and quality will vary widely.

The measured speaker ohms will fluctuate somewhat in response to loud audio signals.

Higher impedance headsets will have less speaker output volume; adjust the volume control as needed.

The output signal becomes slightly distorted with increased microphone sound level, this is intentional and helps differentiate the speaker signal from the operator's natural voice.

This unit measures DC resistance, not the true AC impedance. Any electronics between the tester and the speaker or microphone (transformers, capacitors, etc) will result in incorrect measurement. Typically the DC resistance will be about 5%-15% less than the actual AC impedance at 1Khz, and produce the same reading (within tolerance) as would be obtained using a common multimeter. If true AC impedance measurement is required then a custom adapter can be devised.

CONNECTOR SPECIFICATIONS

The 13-pin side connector permits connecting adapters for interfacing to different headset connectors and test leads for testing individual microphone and speaker elements. The unit comes with an adapter for headsets that use a common 4-pin NEXUS-type connector, and a standard U173/U pin-type connector for testing microphones. Adapters for other types of connectors can be devised as needed, contact us for assistance.

In addition to speaker and microphone lines, the connector also includes power and ground connections for powering low-current external circuitry, extra audio inputs for connecting a music player or other audio source, and connections for interfacing with the headset tester's processor for reprogramming and other custom uses. The stock processor code for the unit does not support user-level programming, rather these lines make it possible to deliver code updates in the form of an adapter and so that custom adapters can reprogram the processor with the needed protocol.

User-constructed adapters should only connect to the microphone and speaker lines, the audio input lines, and must draw no more than 20ma from the +5V power line. Do Not make any connections to the processor lines. Damage caused by improper adapters is not covered under warranty!

The auxiliary audio input lines have an input impedance of about 10K and are designed for signal levels of about 1 to 2 volts RMS (the typical output level of a music player). The signal is mixed with the microphone preamp signal before the volume control.

The connector pins are as follows:

Pin 1 - headset microphone +

Pin 2 - headset microphone - (ground)

Pin 3 - headset speaker - (ground)

Pin 4 - headset speaker +

Pin 5 - aux audio input 1

Pin 6 - aux audio input 2

Pin 7 - aux audio ground

Pin 8 - 5V power source (20ma maximum!)

Pin 9 - power ground

Pins 10-13 - processor lines, do not connect.