whirlwind
Qbox-aes
AES/Analog Signal Tester

The Whirlwind Qbox-aes is a multipurpose testing device for troubleshooting digital AES-3, S/PDIF and analog audio signals. It is composed of two sections; a Send section and a Receive/Monitor section. A Test Mode switch selects Analog or AES testing operation. Audio is decoded and output through the built-in speaker or the 3.5mm jack. Test signals can be generated from multiple sources. In Line monitoring of an AES data stream is also possible with no alteration of the signal passing through.

Warranty

This product is guaranteed for 5 years from the date of purchase against manufacturing defects. For warranty service, return the unit, along with the original sales receipt, to: whirlwind, 99 Ling Road, Rochester, NY 14612, postage prepaid. We will repair or replace the unit at our option and pay the return postage.

whirlwind

99 Ling Road . Rochester, NY 14612
Phone 585 663-8820 . Fax 585 865-8930
Email: sales@whirlwindusa.com
http://www.whirlwindusa.com

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Theory of Operation

AES/EBU TEST MODE
The Qbox-aes is designed to provide a portable means of testing various aspects of AES-3 and S/PDIF digital audio systems. With the Test Mode switch in the AES/EBU (IN) position, it is able to generate AES-3 or S/PDIF output signals at sample frequencies of 48 kHz, 96 kHz and 192 kHz. Audio sources for the Send function include a built-in microphone, a pair of tone generators (440 Hz for the left channel, 660 Hz for the right), and a 3.5mm, unbalanced stereo input, for an MP3 or CD player, computer sound card, etc. A Send Level control adjusts the selected source level into the digital encoder for output through the Send jacks.The Qbox-aes is capable of decoding professional and consumer AES-3 or S/PDIF signals, displaying sample frequencies from 44.1 kHz to 192 kHz and monitoring the audio content via the built-in speaker or Line/Phones Monitor jack. There are two digital operating modes available: Send/Receive Test and In Line Monitor as selected by the AES Function switch. Each of these modes is described in detail in the following paragraphs.

Send/Receive Test function
When using Send/Receive Test mode, the internal digital receiver will lock to useable AES-3 or S/PDIF signals applied to the input connectors. When locked, the appropriate Receive Sample Rate LED will indicate the detected sample rate. The Non AES Input LED illuminates anytime that the digital input signal is a non-PCM format, and cannot be decoded as audio or when the input is analog. The digital audio is decoded and presented to both the speaker and the Line/Phones Monitor jack. The digital Send section will convert the selected test signal (mic, aux or tone) to digital format and output it from the digital Send jacks at the sample rate set by the S/R Test Sample Rate switch (48, 96 or 192 kHz). The Send Level control adjusts the amount of output signal delivered to the Send jacks. There are two green LEDS that illuminate when the analog input to the A/D converter reaches +4 dB. This results in a digital output of approximately -12 dBfs. With the level control at full clockwise the digital output is equal to 0.6 dBfs when using the internal oscillators as a signal source.

Send/Receive Test mode can be used for cable testing. The selected test signal is driven out of the digital Send at the sample rate selected by the sample rate switch. If a good cable is connected between the Send and Receive, the Sample Rate indicators will display the detected sample rate and the selected test signal will be heard over the speaker and the line output. When testing a cable to determine if it has high-frequency problems, select the highest sample rate. If the digital receiver is able to lock to the signal, chances are that the cable is good. If the cable has integrity problems, it may not lock at a rate of 192kHz, but may lock at a lower sample rate. Connecting a short cable between Send and Receive also provides an excellent means of performing an end-to-end test of the Qbox-aes itself, allowing the operator to test the functionality of all the internal components.

In line Monitor Only function
In Line Monitor mode is used to monitor a digital audio signal without interrupting its destination, essentially acting as a wiretap. The digital audio input signal is decoded and the serial data stream is fed to the digital-to-analog converter for analog monitoring and to the digital output encoder for re-transmission without passing through the analog domain. To use this mode, the signal source cable is connected to one of the digital Receive connectors, and the signal destination cable is connected to one of the digital Send connectors. When the input signal is present, the appropriate Sample Rate indicator will illuminate and the input signal will be present on the digital output connector. The input signal, in analog format, is available at the speaker and the Line/Phones Monitor jack. Any analog input sources are ignored, as well as the S/R Test Sample Rate switch.
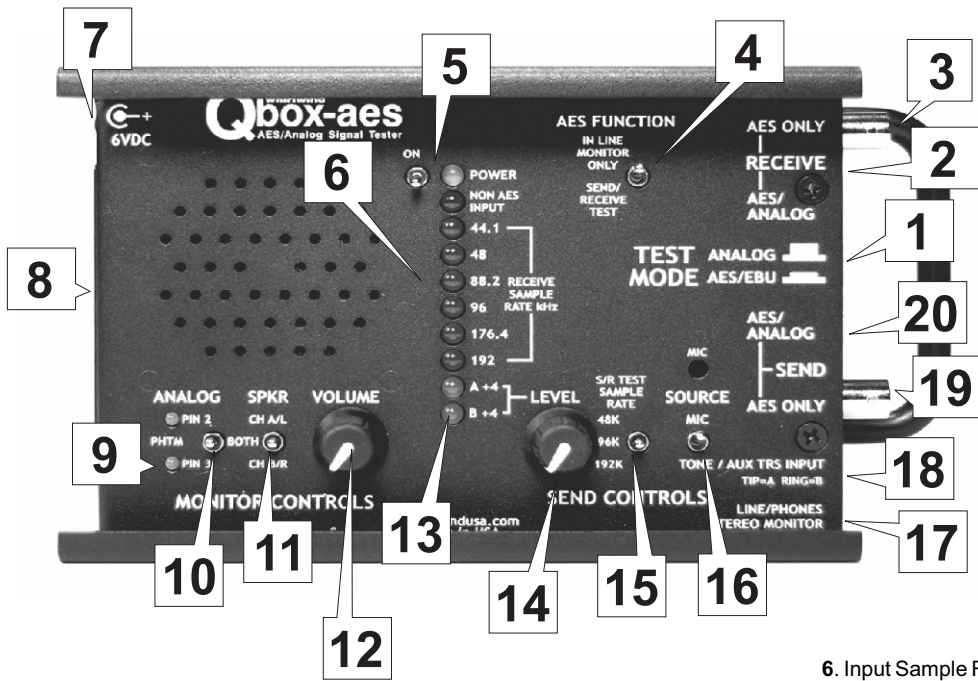
Receive/Monitor Section
The Receive Sample Rate LEDs indicate the detected sample rate when they are locked to the digital input. Only one LED will be illuminated at a time, except during the Power-On Self-Test. Displayed sample rates are 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz, and 192kHz. The Qbox-aes can detect both versions of the AES-3 bitstream; professional and consumer.

Analog monitoring of the digital input signal is done through the internal speaker or externally by connecting an amplifier or headphones to the Line/Phones Monitor jack. Peak output level is +5 dBv, and the output is capable of driving headphones from 32 to 100 Ohms impedance. This output and the speaker are controlled by the Monitor Volume level control. A three position Speaker switch allows individual monitoring of Channel A (left) or the Channel B (right) signal from the digital stream. In the center position, the A and B signals are both fed to the speaker simultaneously. Using the Line/Phones Monitor jack mutes the speaker and is always in stereo.

ANALOG TEST MODE
The Qbox-aes provides testing of balanced and unbalanced analog audio signals. With the Test Mode switch in the Analog (OUT) position, the Send and Receive XLR connectors bypass the digital circuitry. The Mic, Oscillator and Aux signals are controlled by the Send level control and output through the male Send XLR. The female Receive XLR accepts analog input and delivers it to the Speaker and Line/Phones Monitor jack through the Volume control. A three position switch allows the selection of a balanced input or unbalanced pin 2 or pin 3 to be monitored separately and Phantom LEDS indicate the presence of phantom power at the male XLR. The Non AES Input LED will be lit continuously.

The Qbox-aes is powered by a 6 volt DC wall power supply (model # PS6) or four "AA" cells. Peak power requirement is 6 Watts. Average power requirement is 2.2 Watts. The largest factor in power draw is the setting of the speaker volume.

4. AES Function switch chooses the manner of digital testing to be performed by the Qbox-aes. In Line Monitor Only mode is used to listen to a digital audio signal without interrupting its destination. The unit bridges the data stream for monitoring and passes it through without alteration. With a digital input signal present and locked, the digital output sample rate will mimic the sample rate of the digital input and the Sample Rate switch has no effect. Send/Receive Test mode configures the Send and Receive sections to work independently. The selected test signal is driven out of the digital Send at the sample rate selected by the sample rate switch. When an AES input is received and locked the appropriate Receive Sample Rate LED will indicate the detected sample rate. The digital audio is decoded and presented to both the speaker and the Line/Phones Monitor jack.

5. Power Switch applies power from the external supply or the batteries and the blue LED illuminates when the Power switch is ON. The Qbox-aes performs a self test when first turned on, indicated by the sample rate LEDs. It is recommended that the unit complete it's self test before connecting to the device to be tested. All connections should be removed before turning the unit off.

12. Monitor Volume adjusts the volume of the built-in speaker and the level of the signal at the Line/Phones Monitor jack.

13. Green A and B Send LEDS display the amount of analog signal sent to the A/D converter in AES Test mode and at the Send Xlr in Analog Test mode. They illuminate when the when the analog input to the A/D converter reaches +4 dBv. This results in a digital output of approximately -12 dBfs. The send level in Analog mode is -10.4 dBv.

14. Send Level controls the analog level presented to the A/D Converter input. The mic, tone oscillators, and aux input are affected by this control, typically adjusted to a level where the +4 green LEDs begin to turn on. With the level control at full clockwise the digital output is equal to 0.6 dBfs when using the internal oscillators as a signal source. Maximum analog signal Send output level is 4.7 dBv.

15. S/R Test Sample Rate switch sets the sample rate of the digital AES stream output from the Send jacks in Send/Receive Test mode.. It is able to generate AES-3 or S/PDIF output signals at sample frequencies of 48 kHz, 96 kHz and 192 kHz. In line Monitor mode bypasses any setting of this switch and the Send sample rate matches that of the input at the Receive jacks.

16. Send Source switch selects the audio source for the Send function. The Mic position selects the built-in microphone, the Tone/Aux position connects a pair of tone generators (440 Hz for the left channel, 660 Hz for the right). Plugging into the Aux TRS Input disconnects the dual oscillators and accepts an external unbalanced stereo source. In Analog Test mode both oscillator frequencies are summed together and sent out the balanced Send XLR.

17. Line/Phones Stereo Monitor Jack provides a high-quality output of any audio source received. Peak output level is +4dB, and the output is capable of driving headphones from 32 to 100 Ohms impedance. The left channel is connected to the tip, the right to the ring, and the sleeve to common of the unbalanced 3.5mm TRS jack. Volume is controlled by the Monitor Volume control. Connecting to this jack mutes the speaker and is always stereo in AES Test mode.

18. Aux TRS Input jack allows the operator to connect any analog source to the unit. The maximum input level is +5 dBv. This is an unbalanced 3.5mm TRS jack with the left channel connected to the tip, the right to the ring, and the sleeve to common.

19. Send BNC outputs standard S/PDIF digital audio signals over 75 Ohm coaxial cable at 5V p-p. In AES Test mode with the unit off, the XLR and BNC can also be used as a loop thru balun. This jack is not used for Analog Test mode.

20. Send XLR outputs standard AES-3 digital audio signals over 110 Ohm balanced shielded cable at 5V p-p in AES Test mode, and with the unit off the XLR and BNC can be used as a loop thru balun. In Analog Test mode the output is balanced and the max level is 4.7 dBv with the Send Volume control turned fully clockwise.

Controls and Functions

1. Test Mode switch selects the type of signal that the Qbox-aes will analyze. The Out position is for testing analog signals and the In position is for AES digital types. It is recommended that the operator turn the unit on and set the proper mode before connecting to the device being tested.

2. Receive female XLR connector is used as an input for standard AES-3 digital audio signals over 110 Ohm balanced shielded cable and balanced or unbalanced analog signals, corresponding to the position of the Test Mode switch.

3. Receive BNC jack accepts standard unbalanced AES or S/PDIF digital inputs only over 75 Ohm coaxial cable. This jack is disconnected in the analog Test Mode. Input levels for both jacks may be as high as 5 V p-p and as low as 360 mV p-p. Input sample rates may range from 44.1 kHz to 192 kHz. The two jacks are transformer isolated and may be used as a loop thru balun for converting from 110 Ohm to 75 Ohm transmission lines in AES test mode.

6. Input Sample Rate LEDs indicate the detected sample rate when locked to a digital audio input. Only one will be illuminated at a time, except during the Power-On Self-Test. The Non-AES Input LED illuminates anytime a valid AES signal is not present.

7. 6VDC external power jack is a 5.5mm x 2.1mm size with the center contact wired positive and the barrel contact negative. A 6VDC 1000mA plug-in power supply (model # PS6) with the correct mating connector is supplied with the unit.

8. Battery Compartment is a slide out drawer that accepts four "AA" cells. New alkaline batteries will last approx. 6 hours, but battery life reduces to about 1 hour with the speaker at full volume.

9. Analog Pin 2 and Pin 3 green LEDs sense the presence of phantom or intercom power at the male Send XLR when the unit is in Analog test mode. Connect to the female XLR to monitor intercom audio.

10. Analog Pin 2 and Pin 3 switch has three positions for listening to balanced or unbalanced analog signals connected to the Receive XLR. The center position is for balanced inputs and the Pin 2 and Pin 3 positions provide individual monitoring of each pin separately.

11. Speaker Monitor A/B switch controls which of the two available digital audio channels is presented to the speaker for monitoring. In the center position, the A and B signals are both on and is the proper position when using Analog Test mode. Changing the switch position in Analog mode will vary the volume but not the source signal.