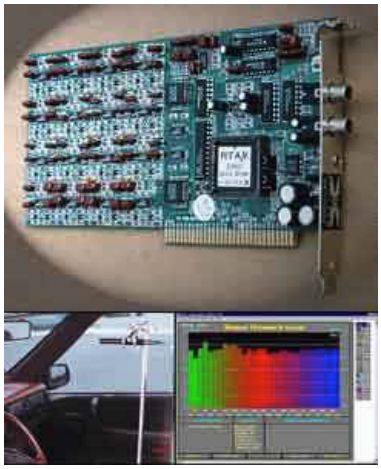
RTA*jr*

32-Band Real Time Analyzer

LINEARX SYSTEMS

The RTA*jr* is a low cost precision 1/3 octave real time analyzer for PC computers, and provides a new level of powerful capabilities never before possible with conventional bench top analyzers. The complete system consists of an ISA half length PC slot card, and the Windows based operating software. Users may choose from 4 different calibrated microphones (M31, M51, M52, M53) with maximum SPLs ranging from 125dB to 170dB.



The system features built in scoring systems popular with car stereo applications for both IASCA and USAC, as well as a host of different post processing and display capabilities, only possible in a PC based analyzer.

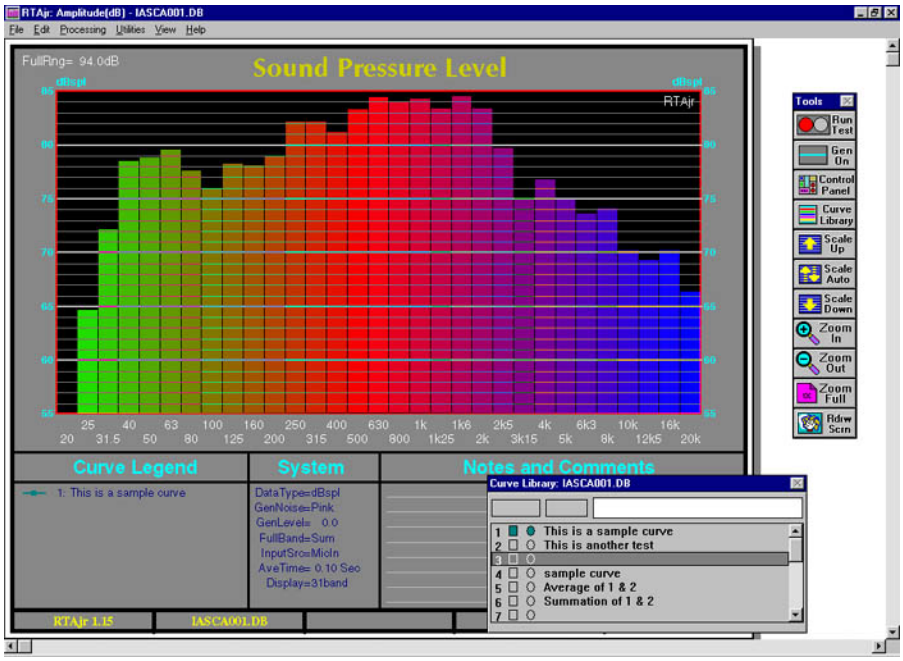
In addition to measuring maximum SPL and 1/3 octave RTA response, the RTA*jr* also includes built in ANSI A, B, C weighting filters, and provides a unique feature of *Impedance* measurement capability. This is a very handy feature for checking speakers and crossovers for defective components or connections.

The RTA*jr* is the ideal choice where high performance, large capabilities, and low cost are key requirements. The RTA*jr* provides an impressive array of powerful features designed to cover a wide range of general audio applications.

Main Screen

The RTA*jr* can display measured data in a variety of different formats including: bar graph, text chart, and line graph.

Each display graph has user definable characteristics such as color, fonts, and fully adjustable scales- both absolute and relative. The user can easily custom design any graph for screen display or printing.



Graphs

In addition to the standard 1/3 octave displays, data can be displayed in a 1 octave format, and also in a single band format. Any band can be selected for display individually.

Each graph also contains automatic record keeping data sections for the data, time, library curve names, analyzer control panel settings, and even user notes.

Moreover, any and all graphs can be printed through any standard Windows printer driver to virtually any printer in full color or black & white.

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Multiple Curve Display

A common requirement in the course of performing measurements is to compare the differences between various changes in the system or environment.

The RTA*jr* provides a curve library architecture which is used to save different measurements as curve entries.

The software provides the capability to display multiple curve entries simultaneously, for direct comparison.

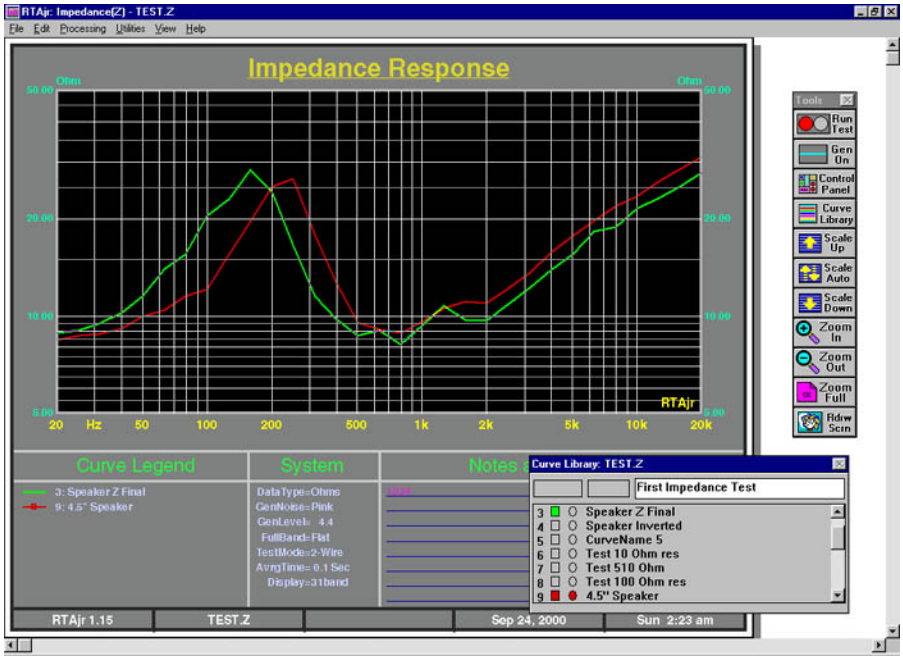
Impedance Measurements

The Impedance mode is provided for general speaker or passive crossover measurements. This gives a 31 point response curve for the impedance characteristics of a transducer or component. The data is given in ohms. Since an RTA has only 31 bands, the resolution of the impedance curve is limited to 31 points. Moreover the test signal is noise averaged in 1/3 octave bands.

This is not enough resolution for producing speaker parameters, which require extremely high detail and accuracy. A swept sine wave analyzer such as LMS is ideal for this purpose.

However, even the ability to measure rough impedance curves can be very useful if no other means is available. This enables transducers or passive crossovers to be checked for shorts, opens, or other major defects very quickly.

These problems may show up under AC testing, but may not be visible under DC testing with a DMM.

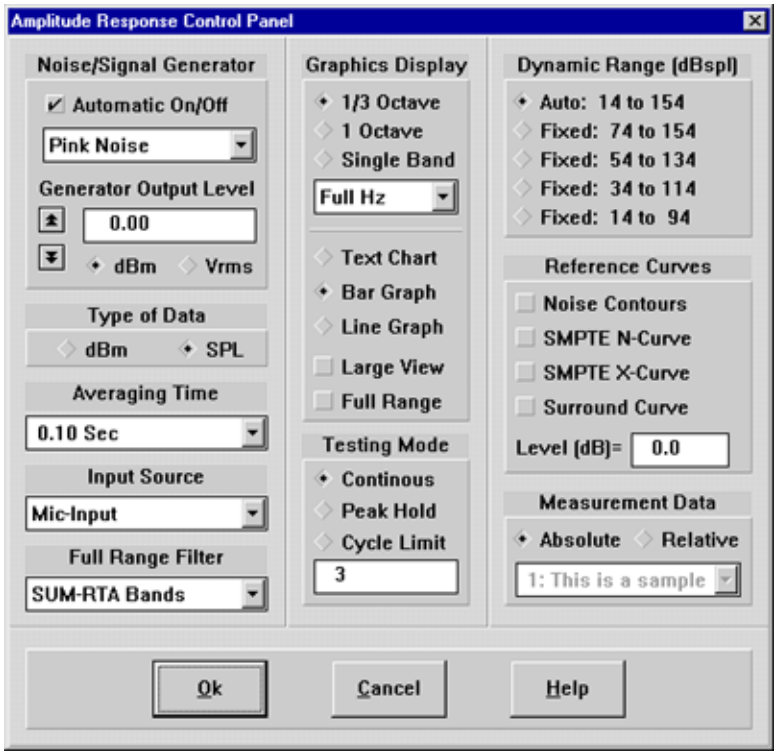


Amplitude Control Panel

All of the analyzer's controls and variables are accessed from the software control panels. Different control panels are provided in the program with features dictated by the type of measurement mode currently in use. Many of the controls also handle the display of data, formatting, and other details.

The advantage of a software based system is that many of the analyzer's hardware features are extended and enhanced through the computer system.

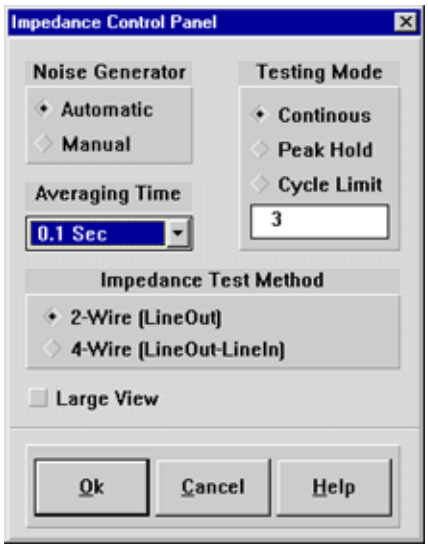
An example of this is the wide selection range of averaging times from 50mS to 50 seconds. Several testing methods can be selected including continuous, peak hold, or cycle limited. The software also enables a continuous averaged measurement to be *frozen* without the need of peak hold behavior.



Impedance Control Panel

This dialog will appear when the current library type and measurement mode is Impedance. This control panel handles virtually all aspects of the analyzer and software for standard impedance measurements.

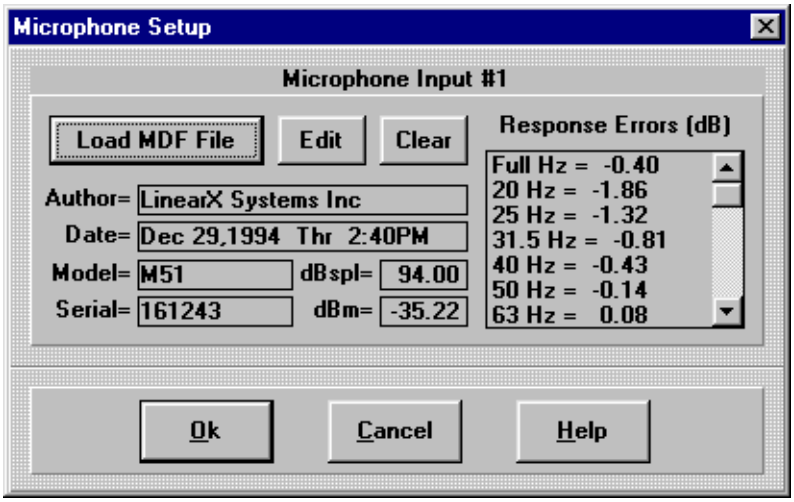
For measuring impedance, two different test methods are provided: 2-wire, and 4-wire. The 2-wire mode only uses the Line Output. The 4-wire mode uses the Line Output and Line Input. The 4-wire mode is more accurate and useful for measuring low impedance, and removes the cable resistance from the measurement.



Microphone Setup

The RTA*jr* system provides a very effective means of universal microphone calibration and setup for precision measurements. MDF (Microphone Data Format) files are used to provide the necessary sensitivity and response curve information about a given microphone.

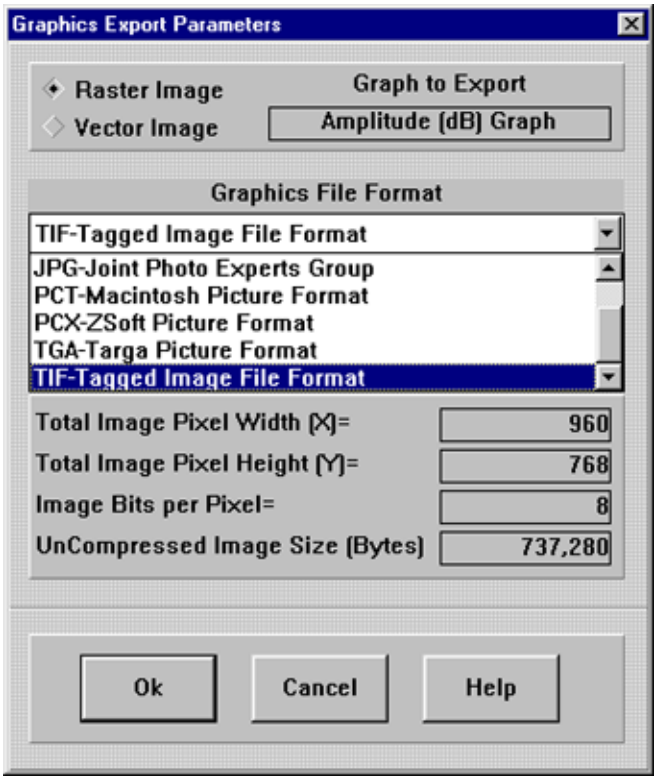
The RTA*jr* analyzer has two inputs: a Mic Input and a Line Input. Each of these inputs can be configured for an individual MDF file. Since every microphone has unique characteristics which differ from others of the same model, this feature provides consistency between microphones on separate analyzers.



Data & Graphics Export

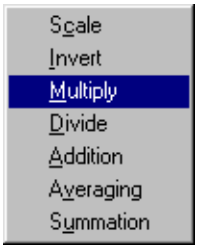
The RTA*jr* software provides the capability for exporting and importing the measurement data in ASCII file format.

In addition, full support is included for graphics export through discrete files or the clipboard. Both raster and vector industry standard formats are provided for maximum compatibility in other desktop publishing applications.



Processing Operations

One of the fundamental advantages to computer based measured data is the ability to perform processing on the actual data. The RTA*jr* software provides many mathematical functions which can be applied to the curves. Producing transfer functions, summations, or composite curves is as easy as clicking the mouse button.

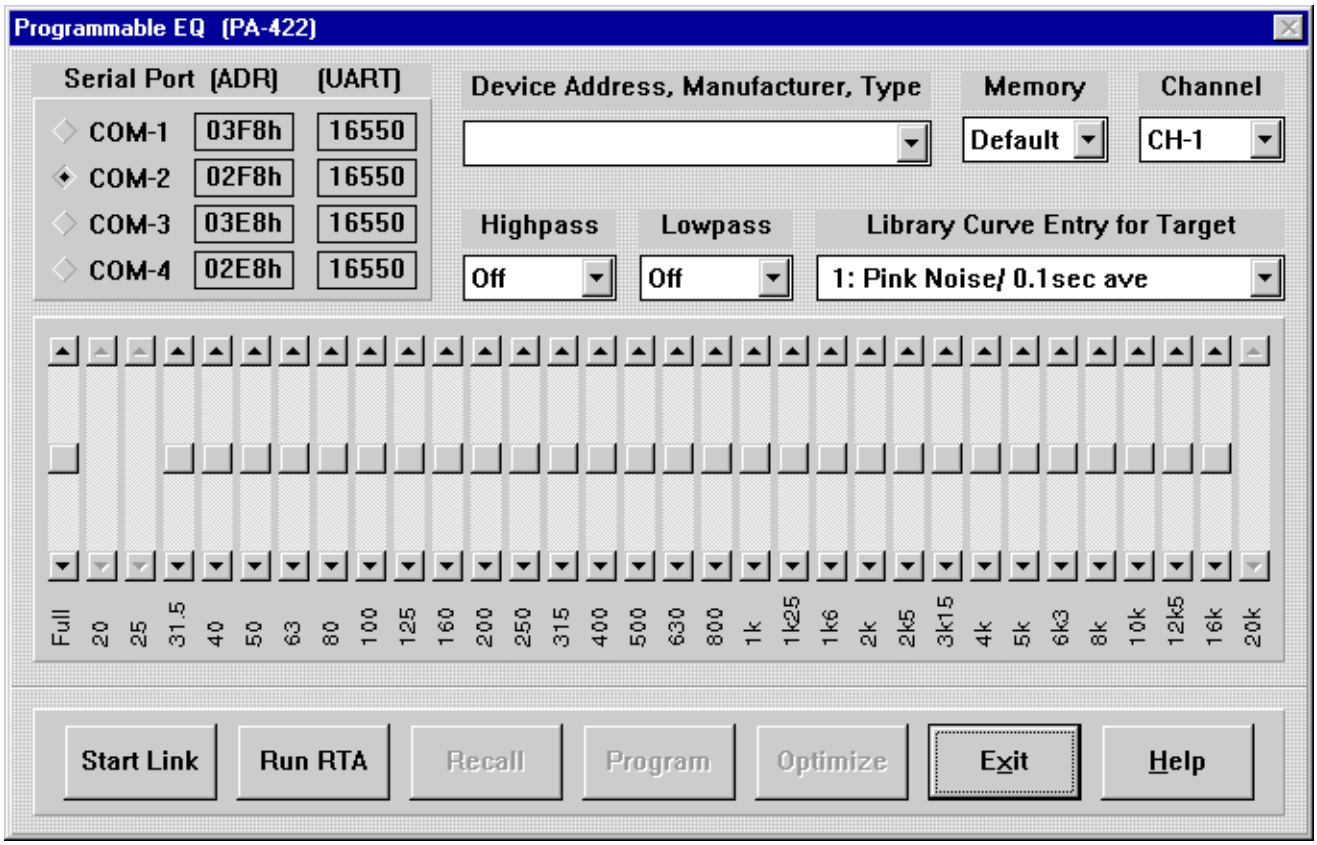


Programmable EQ Control

This dialog box provides the means to remotely control many of the functions of 1/3 octave equalizers, and also provides automatic control and optimization of the equalizer bands to achieve a predetermined target response curve. Manual control of the EQ is also possible, as well as manual operation of the RTAjr analyzer.

The RTAjr can be used to automatically adjust the EQ band levels to match the response measurement to a previously defined target curve entry. The curve entry to be used as the target is selected in the Library Curve Entry for Target list box. This could be a flat line, or any other shape desired.

The PA-422 interface is a serial port protocol standard which is used by several different audio manufacturers for their programmable signal processing equipment. This routine was characterized with the MicroAudio 2.2CQ and White 4700-2 1/3 octave stereo equalizer units. While the PA-422 spec defines the protocol of communication, most PA-422 equalizers will generally still require specific configuration due to their unique parameter tables. The Rane RW-232 is also supported.

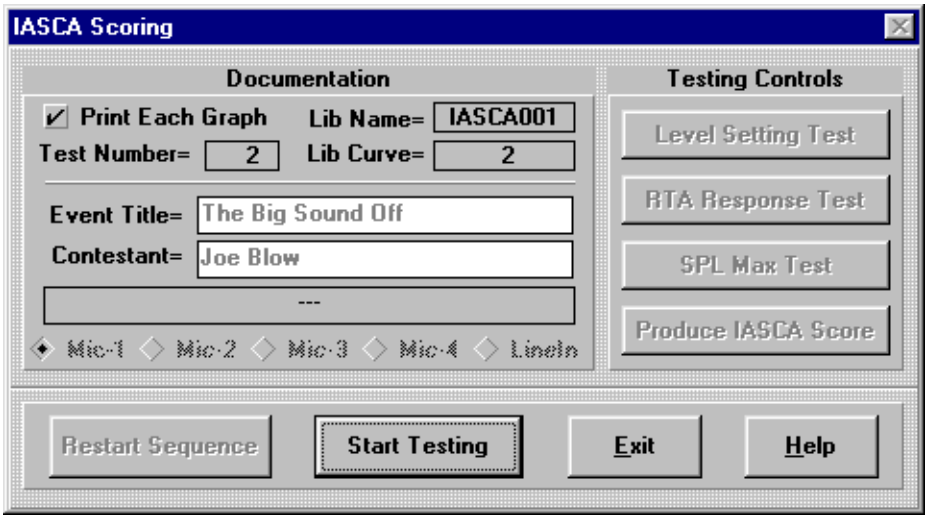


Car Audio Scoring

The RTA*jr* is ideally suited to car audio system measurement, and also provides built in scoring routines for competition systems.

Since the analyzer is PC based, printed color graphs can be easily obtained for documentation. The graph display formats allow for text, bar, or line graph display.

The system software provides built in routines for IASCA, USAC, CMAA, Outlaw SPL, and True Sound Quality (TSQ).



True Sound Quality Scoring

This scoring utility provides a special automated algorithm for producing a comparison score reflecting the true sound quality of a car audio system. This routine was developed by LinearX during August of 1996 to solve some of the present problems associated with existing car audio scoring formulas. There are two principal problems which this scoring system resolves: (1) the score will more accurately reflect the true sound quality of the system, and (2) there are no hard threshold ranges which cause scoring variability.

It is well known that car audio systems scored under existing methods can have a wide range of system frequency response, while all may be producing nearly identical scores. This is due to the 3dB band/pair minor deviation requirement. Many systems using these older scoring formulas could have response characteristics with substantial differences in level between the low and high frequency ends of the spectrum. While the actual difference between any band/pair may be less than 3dB, producing a relatively high score, the overall system frequency response is extremely poor. In spite of these systems producing a seemingly high score, there was very little correlation between the score and actual real listening quality.

The second problem has to do with the repeatability of the scoring process itself. In the old scoring formulas, if a band/pair is less than 3dB no point is deducted, and a difference of greater than 3dB causes a whole point deduction. Any particular measurement of a given system can produce a number of band/pair differences which are right on the edge of the 3dB threshold. For example, the difference between a given band/pair may be 2.9dB on one measurement. During another measurement of the same system, the difference on the same band/pair may be 3.1dB. Even though the measurement changed by only 0.2dB, the score changes by one whole point. It is very possible that there may be several band/pairs in a system which are right on the edge of the 3dB threshold. This can cause the score to change by several points during repeated measurements due to the various band/pairs toggling at the 3dB thresholds.

The TSQ formula solves both of these serious problems, but also goes further. Many of the old scoring formulas use bands from 25Hz to 20kHz in the scoring computation. The pink noise source generally used for scoring is generated from a CD. The CD process cannot record frequencies above 20kHz. A bandpass filter centered at 20kHz has one-half of its effective pass band above 20kHz. Any measurement using pink noise from a CD will show about a 2dB loss in the 20kHz band, solely from the CD-DSP processing itself. For this reason the TSQ scoring formula does not use the 20kHz band.

Many of the competitors utilize 1/3 octave graphic equalizers with 28 bands, ranging from 31.5Hz to 16kHz. To match this equalization range the TSQ formula also only uses low frequency bands down to 31.5Hz.

TSQ Scoring Formula

The TSQ scoring formula is straight forward and easy to compute. Essentially the response of the system is scored based on its relative flatness, or reproduction quality. The scoring computation steps are:

(1) Find the median level. Add the dB levels of the 28 bands from 31.5Hz to 16kHz, and divide by 28.

(2) Find the total deviation. Add the 28 absolute value differences between each of the band's level and the median level.

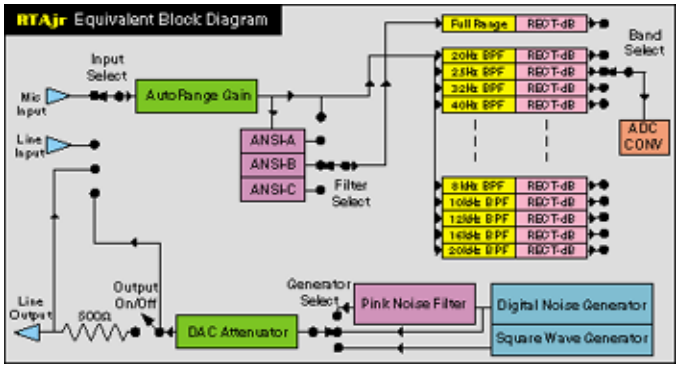
(3) Find the total score. Score is equal to 40 minus the total deviation divided by 6. Round to whole number.

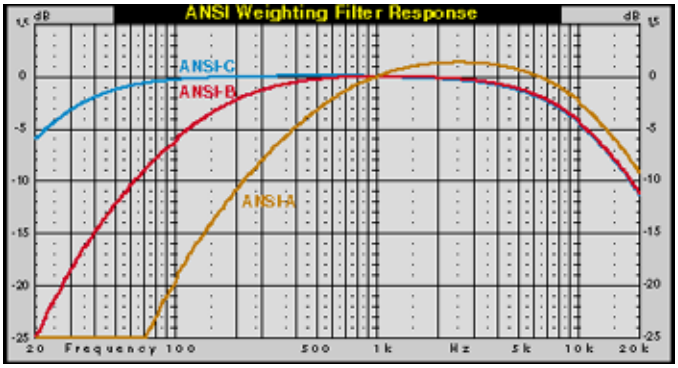
For the maximum SPL test, simply subtract 100 from the maximum SPL reached, and round to the nearest whole number.

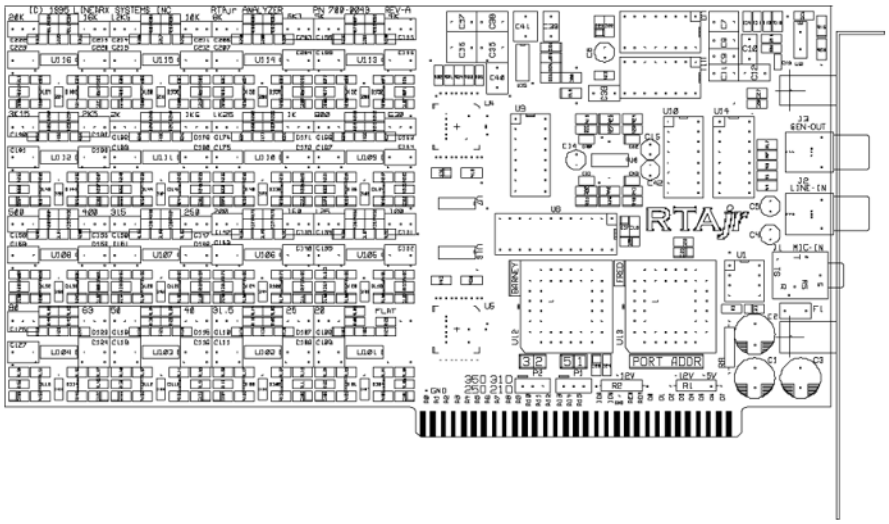
For user information purposes, the computed median level is displayed, along with a list of the bands which deviate by more than 3dB, 6dB, 9dB, or 12dB from the median level.

Specifications

Physical	
Format	ISA 8-bit PC slot card
ISA Bus Speed	4MHz-32MHz
PC card Size	8.2 x 4.0 inches
Connector Interface	RCA Output, RCA Input, 3.5mm Mic Input
Power Requirements	
DC Voltages	+12V, -12V, +5V
DC Currents	100mA, 100mA, 130mA
Microphone Supply	+10.0Vdc @ 50mA (4)
Total Power (No Mics)	3 Watts
Noise Generator	
Noise Spectrums	White, Pink
Digital Sequencer	19-bit MLS
Cycle Time	2.0 seconds
Pink Noise Filter	6-stage, ±0.5dB 10Hz-40kHz
Maximum Output	+2.6dBm Pink, +8.6dBm White
Output Impedance	500 Ohms
Output Attenuator	12-bit DAC
Square Wave Generator	
Output Frequencies	31 @ 20Hz-20kHz, ISO centers
Frequency Accuracy	±0.5%
Maximum Output	+9.6dBm (RMS)
Output Impedance	500 Ohms
Output Attenuator	12-bit DAC
Input Sources	
Types	Mic In, Line In
Maximum Input Level	+20dBm
Input Impedance	100k Ohms
Full Band Freq. Response	-3dB @ 0.6Hz-150kHz
Full Band Noise Floor	-91dBm (shorted input)
20Hz 1/3Oct Band Noise Floor	-120dBm (shorted input)
20kHz 1/3Oct Band Noise Floor	-100dBm (shorted input)
Auto Ranging Gain	
Gain Blocks	4
Gain Range	0 to +60dB
Step Size	15dB steps
ANSI Weighting Filters	
Filter Types	A, B, C
Design Standard Criteria	ANSI S1.42-1986 ASA 64-1986 IEC 537-1976 ASA 51, 575-601 1972
Band Filters	
Fractional Band	1/3 Octave
Dynamic Range	>100dB
Detection Method	Linear Averaging
Averaging Time	Selectable: 50mS to 50 seconds
Filter Topology	Multiple Inverting Feedback (BPF)
Filter Order/Class	2-Pole, 1st Order Bandpass Class I
Design Criteria	ANSI S1.11-1986, ASA 65-1986


RTAjr Equivalent Block Diagram
Input Select
Mic Input
Line Input
AutoRange Gain
ANSI-A
ANSI-B
ANSI-C
Filter Select
Full Range
20Hz BPF
25Hz BPF
32Hz BPF
40Hz BPF
8kHz BPF
10kHz BPF
12kHz BPF
16kHz BPF
20kHz BPF
RBDT-dB
Band Select
ADC CONV
Line Output
Output On/Off
600Ω
DAC Attenuator
Generator Select
Pink Noise Filter
Digital Noise Generator
Square Wave Generator


ANSI Weighting Filter Response
dB
ANSI-C
ANSI-B
ANSI-A
Frequency
20
100
500
1k
Hz
5k
10k
20k


RTAjr
PORT ADDR