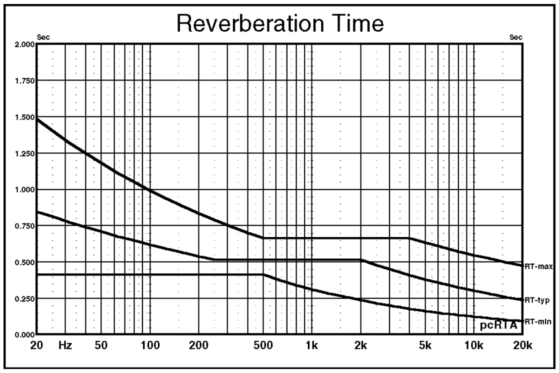
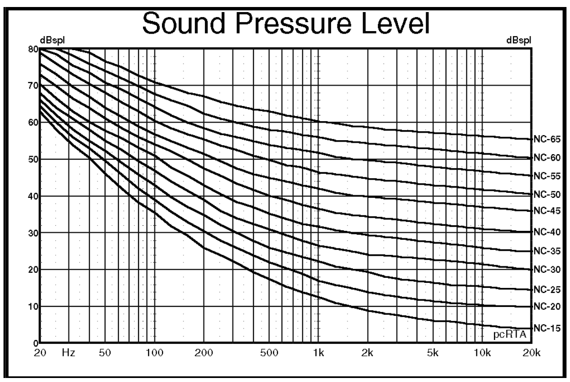
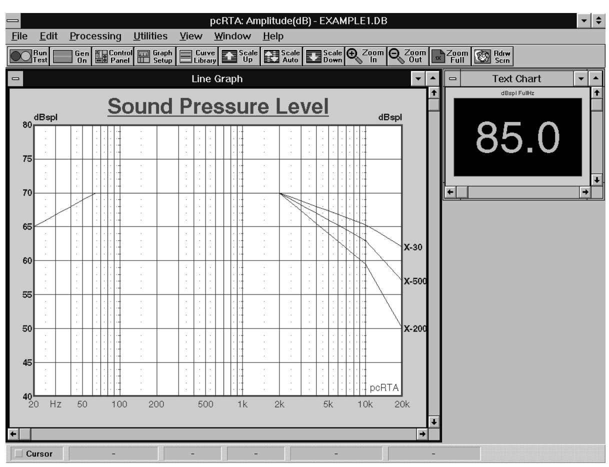
Cinema Applications

Addendum







1: Introduction

This booklet covers the measurement and adjustment of commercial cinema surround sound systems. The information is presented in a way that allows the installer/service technician to perform a specific procedure without reading the entire text in detail. Every effort has been made to minimize the time spent reading the manual.

The information is generic, meaning that it should be useful no matter which cinema processor is being used.

Some of the steps shown for each type of measurement will not need to be completed each time a measurement is made. For example, each procedure shows the process of creating a new curve library. Since each curve library can hold 20 data curves, the amplitude measurements (A-chain alignment, B-chain alignment, Noise Criteria) could all be saved to a single amplitude library. This would eliminate the first step in most of the procedures. Reverb Time measurements require a separate library.

Organization

The sections of this booklet that deal with the various types of measurements have a common structure. The first part of each section shows the setup of the software. Next, there is a generalized procedure for measurement and adjustment. Finally, each section contains some notes about issues that pertain to that type of measurement and how the settings in the software will affect the results.

Control Panel Settings and Graph Display Settings

Given the broad range of applications that pcRTA can perform, it is not surprising that there are many, many features and functions in the software that must be taken into account when setting up for measurements. This has led to the development of what we call *settings* files. These are files that 'remember' the control panel settings and the graph display settings that were in use for a particular test. Several of these files are provided with the software as templates to allow for quick setups when taking measurements.

This booklet will make extensive use of these settings files. After the files have been loaded, you can make changes to the control panel and graph display parameters and then simply save new files so that you can always recall the exact settings used for any given test. (It is recommended that you keep copies of the default files.)

Here is a quick guide to the information in this booklet.

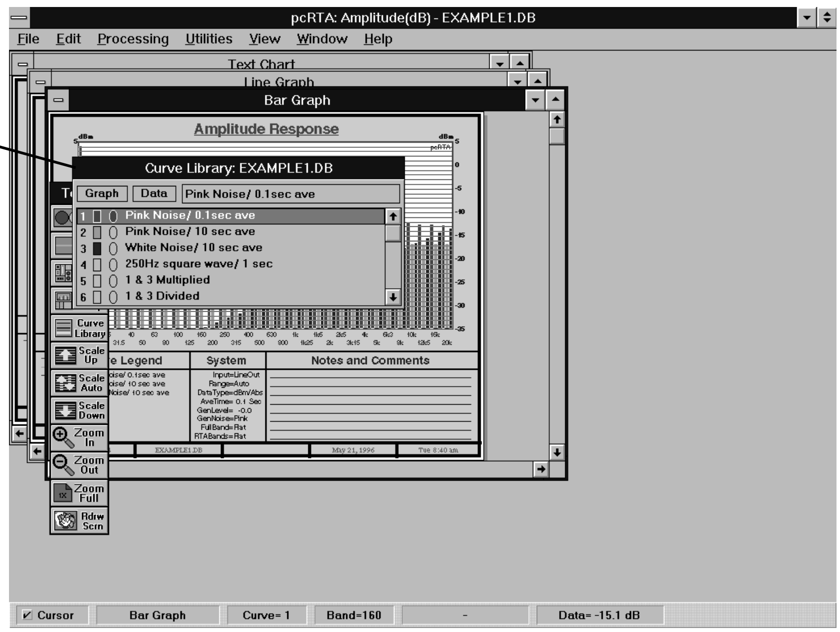
A figure showing the Control Panel and Graph Setup dialog boxes along with a chart of the settings in the CPS and GDS files will be found on the first and second pages of the notes section for each type of measurement.

It is very important to go through the information in the General Setup and Microphone sections the first time you use the pcRTA. If you do not get the microphones setup properly in the software, your measurements could have significant errors.

2: General Setup

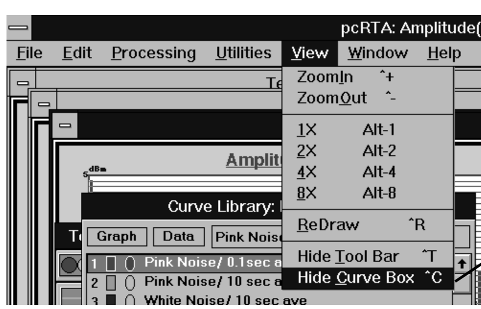
The figure below is the opening screen of the pcRTA. This is what you will see when you first open the program.

Curve Box



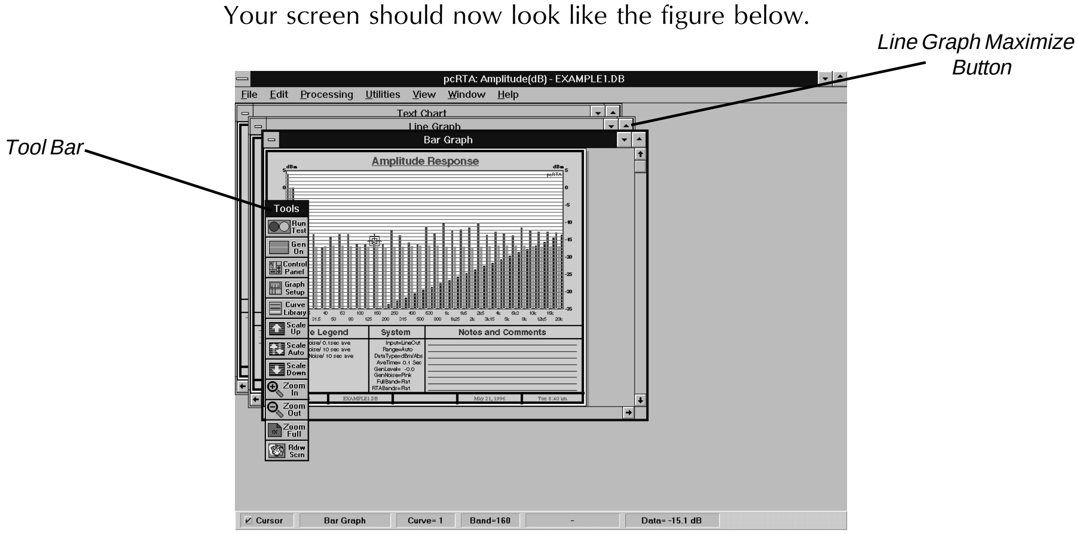
There are some things you can do now to clarify the information shown on the screen.

First, hide the **Curve Box**. Go to the View menu and click on **Hide Curve Box**.



Click here to hide the Curve Box

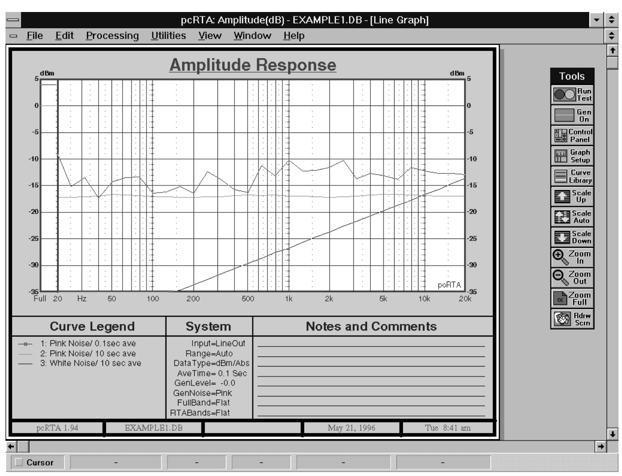
Your screen should now look like the figure below.



Now, move the **Tool Bar** to the right side of the screen. To move the **Tool Bar**, drag it by the blue title bar and release the mouse button when it is in place.

The **Line Graph** will be used to display the data for frequency response measurements in this text. Click on the **Line Graph** Maximize button.

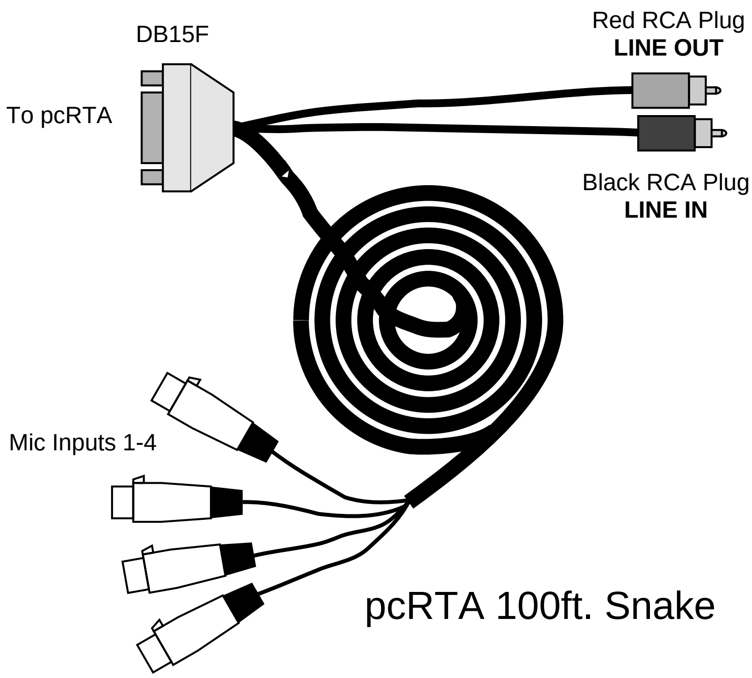
Your screen should look like this.



Connecting to the pcRTA

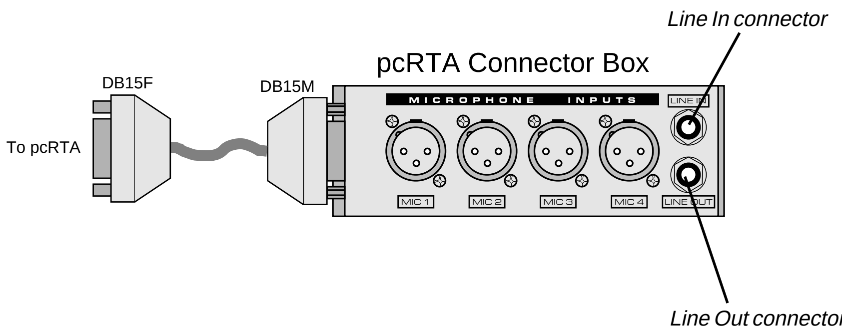
You will be using the **LINE IN** of the pcRTA to perform A-chain measurements. You may also need the **LINE OUT** to inject pink noise into the processor for B-chain measurements. These are unbalanced connections, and shielded cable must be used to connect to them.

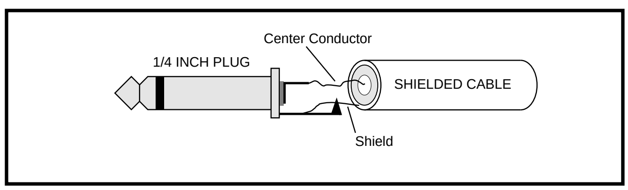
The pcRTA 100 ft. snake was developed specifically for cinema installers. It provides a means to bring the signals of four discrete microphones from the floor of the house up to the projection booth through a single cable. If you have the pcRTA Snake (as shown in the figure below), you will use the black RCA plug to connect to the **LINE IN** of the pcRTA and the red RCA plug to connect to the **LINE OUT** of the pcRTA.



pcRTA 100ft. Snake

If you do not have the pcRTA 100ft. Snake, you will use the pcRTA connector box as shown in the figure below. To connect to the **LINE IN** and **LINE OUT** on this box, you will need 1/4 inch Phone plugs.





3: Microphones

The microphones that are designed to function with pcRTA are all calibrated to a single reference microphone for frequency response correction in the range from 10Hz to 40kHz. This correction is applied to the measured response by the pcRTA during measurements. This technique results in a microphone response accuracy of ±1dB from 10Hz to 40kHZ.

Each LinearX microphone is provided with a calibration file on a 3.5" floppy known as an MDF (Microphone Data File). The pcRTA system uses MDF's to obtain the necessary sensitivity and response curve information about a given microphone. The MDF consists of an ASCII text file with 552 data points arranged in four columns; index, frequency, magnitude and phase. The open format of this file allows the user to easily edit an existing MDF, or create their own MDF for mics made by other manufacturers.

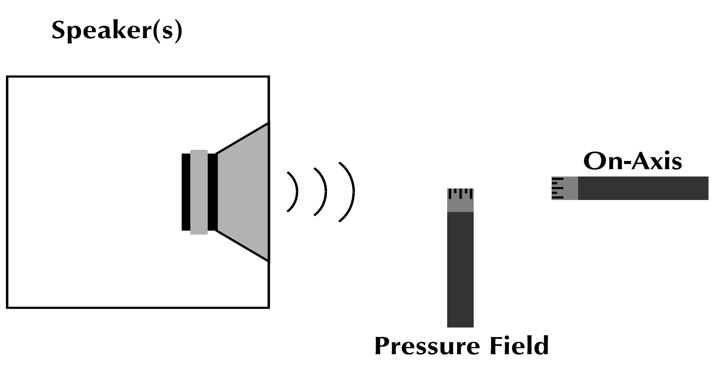
It is very important that the MDF files for each microphone are loaded correctly and that the microphones are connected to the proper inputs. If this is not done correctly, it can introduce errors in the measurements.

Microphone Mounting

When choosing a mounting method for the mics, it is important to keep reflecting surfaces to a minimum. Some mic clips have flat surfaces which can cause measurement artifacts in the high frequencies. The best possible shape to have near the mic is a small cylinder, because the reflections are directed away from the mic capsule.

One technique that has been used successfully to reduce early reflections at high frequencies is to mount the microphone inside a hollow tube or pipe with a diameter slightly larger than the mic. This provides an extension that does not significantly impact the acoustic signature of the microphone's body. Care must be taken not to obstruct the capsule in any way.

The microphones should be pointed at the ceiling because of the non-directional nature of the source, and the reverberant quality of the larger rooms that are typical of cinemas. This type of mounting requires the MDF files to be converted from the on-axis type to the random pressure field type as discussed in later paragraphs.



On-axis vs. Pressure Field

Microphone Placement

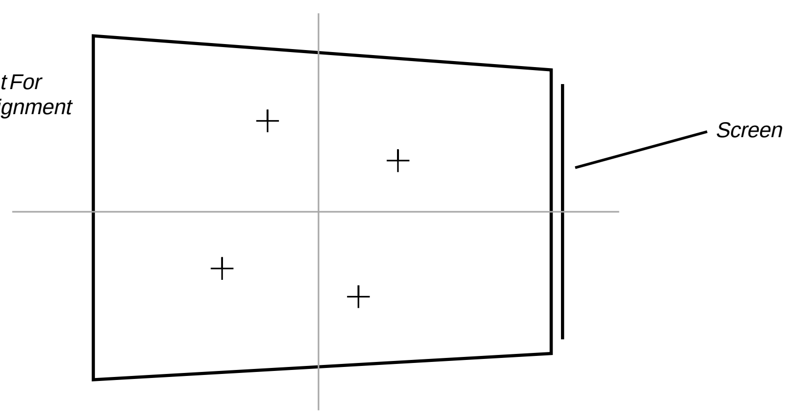
Microphones should not be placed directly on the center lines of the cinema. The mics should be in an asymmetrical pattern. They should also be at least 6 inches above the top of the seats to avoid any grazing effects.

According to ANSI/SMPTE 202M-1991:

"It is recommended that measurements be made at a normal seated ear height between 1.0 m and 1.2 m (3.3 ft. and 4.0 ft.), but not closer than 150 mm (6 in) from the top of a seat, and not closer than 1.5 m (4.9 ft.) to any wall and 5.0 m (16.4 ft.) from the loudspeaker(s)."

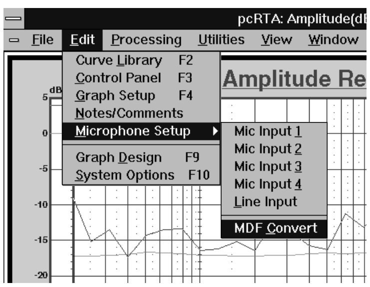
"Microphone positions employed in a spatial average shall be distributed among a range of positions in lateral and transverse directions to minimize the influence of any particular room mode. The minimum spacing of the microphones in an average shall be 1.0 m (3.3 ft.)."

Microphone Placement For RT60, NC, and B-chain Alignment



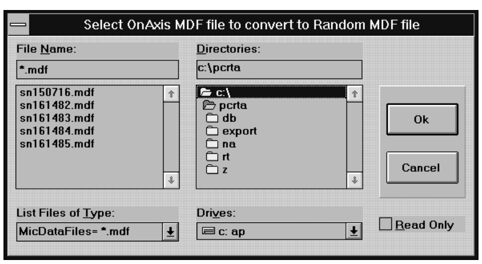
On-Axis vs. Random Pressure Field Calibration and Conversion

By default, all MDF files produced by LinearX are calibrated for on-axis free field response. This type of calibration is utilized when the mic is directly on-axis with the sound source. However, for reverberant fields such as large cinemas where the sound source is not localized, a random pressure field measurement is typically performed. In this case the mic is generally pointed upwards, and the calibration data is referenced to a 90 degree off-axis measurement. The MDF Convert option provides the means to convert the default on-axis MDF microphone response files into their equivalent random pressure field response files.



Go to the **Edit** menu and choose **Microphone Setup**, then choose **MDF Convert**.

A dialog box opens with the title: **Select OnAxis MDF file to convert to Random MDF file**. This box allows you to browse for the MDF file you wish to convert. The default path is the program sub-directory, where the MDF files are typically located. The source MDF file will be of the form "**SNnnnnnn.MDF**", where **nnnnnn** is the six digit serial number of the mic.



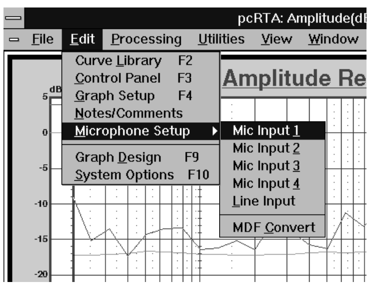
The converted output file will be placed into the same sub-directory and have a new name of the form "**SRnnnnnn.MDF**", where the **SN** has been replaced by **SR** (meaning random calibration). This makes it easy to tell the original on-axis MDF file from the new random MDF file of the same serial number.

After you have converted the MDF file(s), you can load them into the mic inputs as shown on the next page.

The MDF Convert option can only be used with MDF files generated for LinearX microphones. The convert routine checks the model name (M31, M51, M52, M53) and appropriately applies the correct transfer function to produce the new random pressure field calibration data. This function will not work for MDF files created by the user to represent other 3rd party microphones.

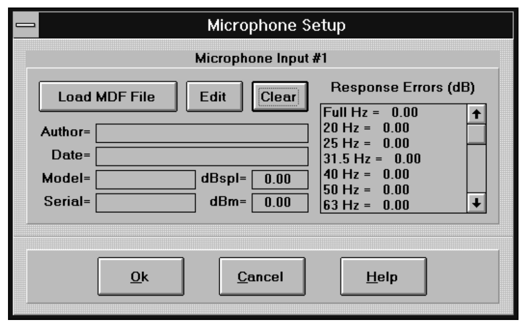
Installing the MDF Files

You may have already completed this procedure when installing the pcRTA. If so, you can skip this step. However, before measuring you should verify that the MDF's for each input match the microphones connected to that input. Failure to do so can result in significant errors in the measured data.

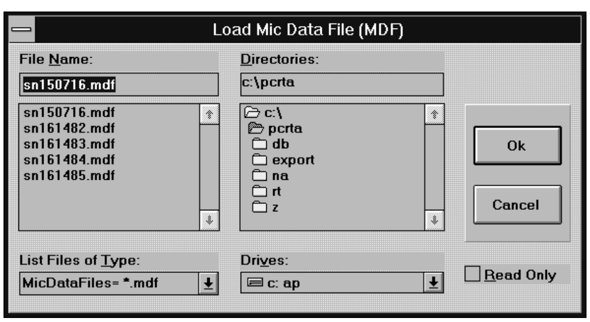


Go to the **Edit** menu and choose **Microphone Setup**, then choose **Mic Input 1.** The **Microphone Setup** dialog box opens which shows the current parameters assigned to mic input 1. The parameters at this time will be blank, or zero.

Press the **Load MDF File** button in the **Microphone Setup** dialog box.

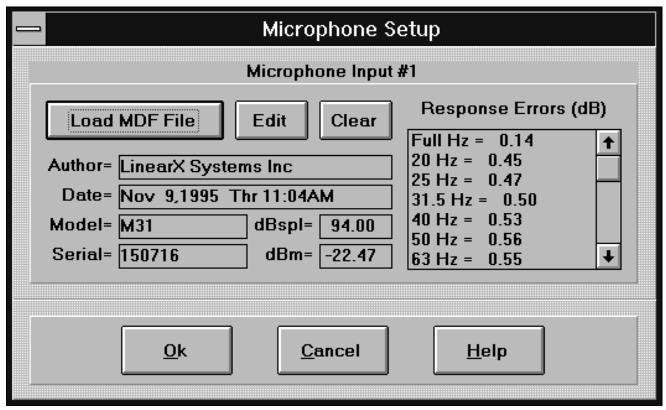


The **Load Mic Data** dialog box will appear. This dialog box allows you to browse for MDF files. When you have selected a file, click **OK**.



NOTE: *If you do not see any files with the MDF extension in the* ***pcrta*** *directory, you should copy them from the 3.5" floppy disks provided with the mics into the* ***pcrta*** *directory on the hard drive using Windows File Manager or an equivalent program before proceeding.*

The system will then read the file and derive the necessary parameters. When completed, the setup parameter fields will be filled in as shown in the dialog box below.



Close the **Microphone Setup** dialog box by pressing **OK**. If you use **Cancel** to close this box, the MDF information will be discarded and you will have to load it again.

Repeat the above process for the other inputs. Since each input is configured for a specific mic, you will need to keep track of which mics have been setup for which inputs. If you ever forget which mics are setup for which inputs, just check the **Microphone Setup** dialog box for each input. The parameter fields include a serial number that shows what MDF file was loaded for that input.

4: A-chain Alignment

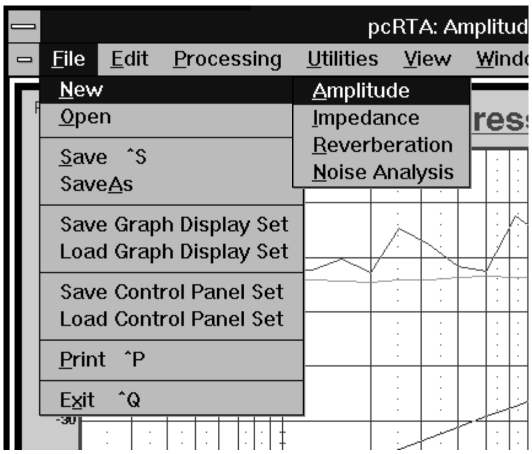
The A-chain is the source side of the system. The audio signal that is recorded in the dubbing studio is first reproduced thru the A-chain. It may consist of an optical preamplifier using a soundtrack recorded on the film, or it may be a magnetic preamplifier playing a tape that syncs to the film.

Alignment of the A-chain normally involves the use of an oscilloscope and a real time analyzer. This procedure shows the use of the pcRTA to measure the frequency response of the optical preamplifier during the adjustment process.

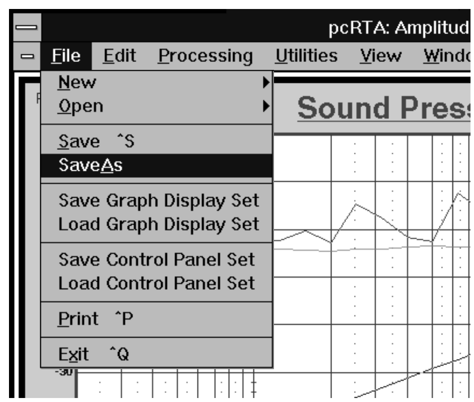
There is a description in the notes portion of this section of an alternative method for measuring azimuth adjustment that elimanates the need for an oscilloscope.

STEP 1 ***Open an new AMPLITUDE MODE curve library.***

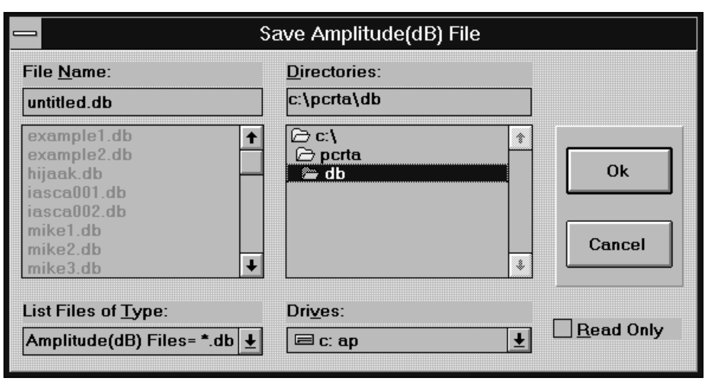
Go to the **File** menu and choose **New**, then choose **Amplitude**. The program creates a new amplitude library with the name: **Untitled.db**.



To give it a different name, go to the **File** menu and choose **SaveAs**.

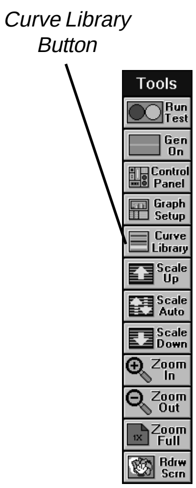


A dialog box with the title **Save Amplitude(dB) File** opens. Type in the name you want to give the file and click **OK**.



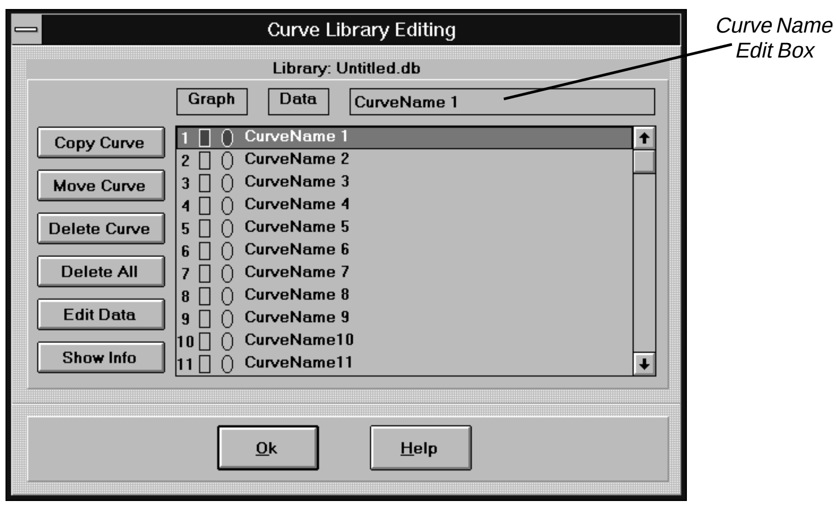
You now have a new amplitude curve library with 20 blank entries ready to receive data.

STEP 2 ***Select and name a curve to receive the measured A-chain data.***



Click on the **Curve Library** button on the **Tool Bar**. The **Curve Library** dialog box opens.

In the figure below, curve 1 is currently selected for saving the data and displaying it. Before each measurement, another curve must be selected in the **Curve Library** as the data curve, or the previous test will be overwritten.

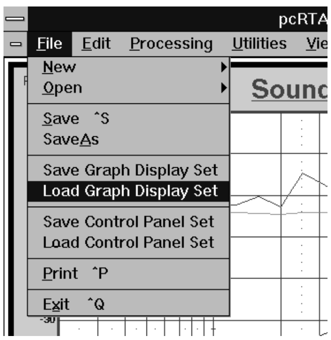


To select another curve for display, click on the oval to the right of the curve number. This will set that curve to save the data from the next test and to display on the graph.

To name a curve, click inside the curve name edit box, and type in the new name.

Click **OK** to close the Curve Library dialog box and save any changes you have made.

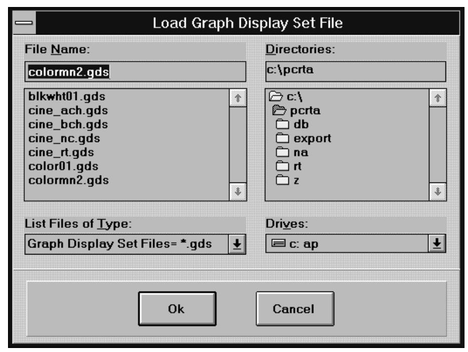
STEP 3 ***Load A-chain Control Panel Settings and Graph Display Settings.***

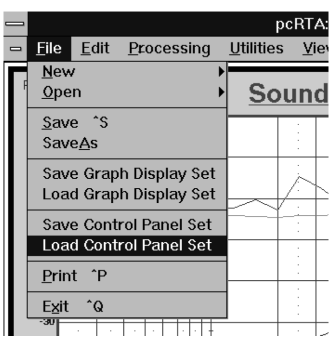


Go to the **File** menu and select **Load Graph Display Set**. A dialog box titled **Load Graph Display Set File** opens.

Load the file **CINE_ACH.GDS**. This file will set all of the characteristics of the display.

Click **OK** to close the dialog box.

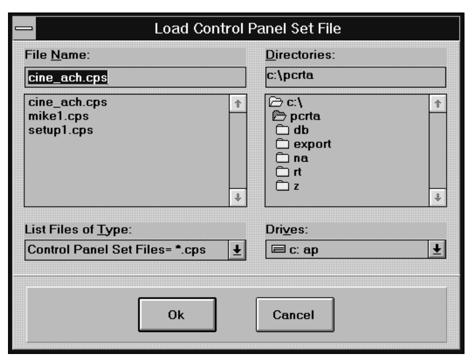




Go to the **File** menu and select **Load Control Panel Set**. A dialog box titled **Load Control Panel Set File** opens.

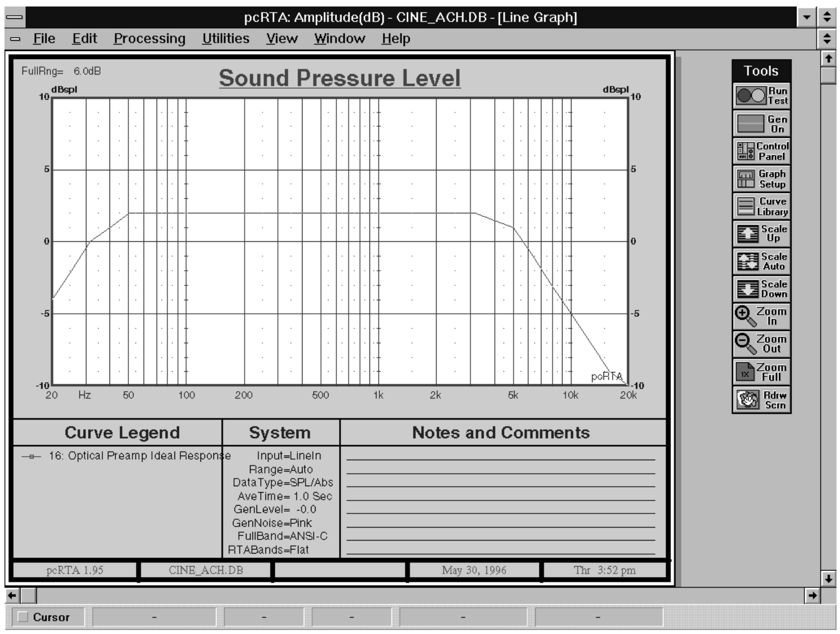
Load the file **CINE_ACH.CPS**. This file will set all of the parameters of the control panel.

Click **OK** to close the dialog box.

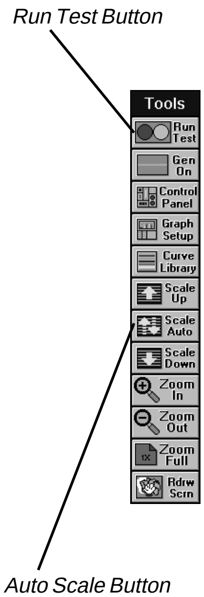


The Line Graph should look like the one shown here.

There is a data curve on this graph showing the ideal response of the optical preamp before adding the slit loss high frequency EQ.



You are now ready to start measuring the frequency response of the optical (and/or magnetic) preamplifier(s).



General procedure for A-chain Alignment
The mechanical and optical checks of the A-chain should be completed before this procedure is started. Consult the manufacturer's documentation.

Load the pink noise film loop. Connect the oscilloscope's X input to the left channel of the cinema processor, and it's Y input to the right channel of the cinema processor. Connect the **Line In** of the pcRTA to the left channel. Press the **Run Test** button on the **Tool Bar** to view the signal on the pcRTA. If you do not see the changing data, you may need to press the **Auto Scale** button on the **Tool Bar**.

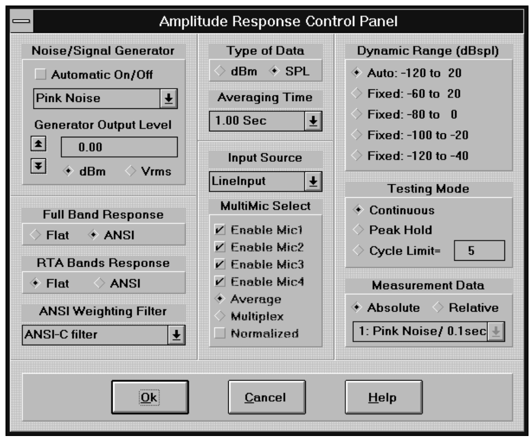
Adjust the azimuth of the projector optics for the narrowest diagonal trace on the oscilloscope. Adjust the focus for the best high frequency response on the pcRTA.

The azimuth and focus adjustments are interdependent and you must alternate between these measurements until the best results are achieved.

When the azimuth and focus adjustments are complete, adjust the high frequency slit loss equalizer for optimal flat response as viewed on the pcRTA.

Connect the pcRTA to the right channel and repeat the adjustments.

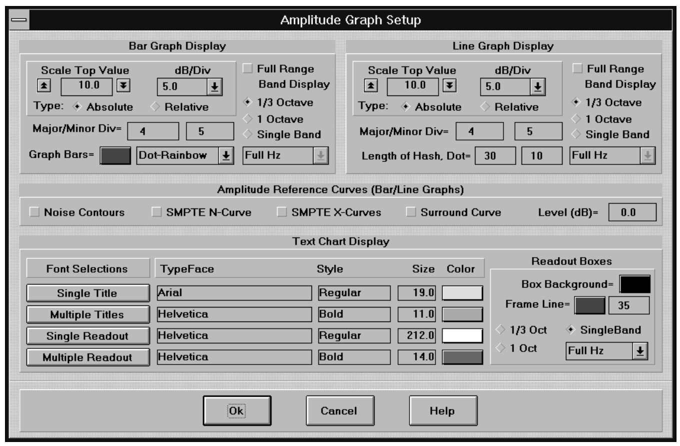
Notes for A-chain Alignment
Here are the settings saved in the Control Panel Set file **CINE_ACH.CPS**:



Control Panel Parameters

Parameter	Value	Parameter	Value
Gen Auto On/Off	Off	Input Source	Line Input
Gen Output Level	N/A	MultiMic Select	N/A
Full Band Response	N/A	Dynamic Range	Auto
RTA Bands Resp.	Flat	Testing Mode	Continuous
Weighting Filter	N/A	Measurement Data	Absolute
Type of Data	SPL		
Averaging Time	1.00 Sec		

Notes for A-chain Alignment (continued)
Here are the settings saved in the Graph Display Set file **CINE_ACH.GDS**:

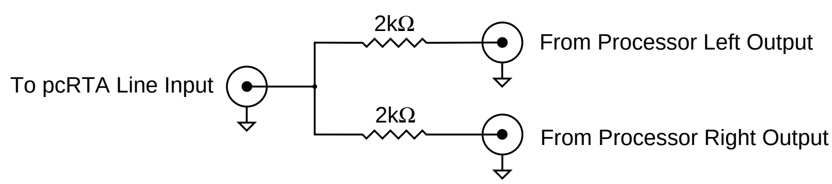


Graph Setup Parameters

Bar Graph Settings		Line Graph Settings	
Parameter	**Value**	**Parameter**	**Value**
Scale Top Value	10	Scale Top Value	10
dB/Div	5	dB/Div	5
Type:	Absolute	Type:	Absolute
Major / Minor Div	4, 5	Major / Minor Div	4, 5
Graph Bars	Dot-Rainbow	Length of Hash, Dot	30, 10
Full Rng Band Display	Off	Full Rng Band Display	Off
1/3 Octave	On	1/3 Octave	On
1 Octave	Off	1 Octave	Off
Single Band	Off	Single Band	Off
Amplitude Reference Curves		**Text Chart Settings**	
Noise Contours	Off	All Parameters	N/A
SMPTE N-Curve	Off		
SMPTE X-Curve	Off		
Surround Curve	Off		

Notes for A-chain Alignment (continued)

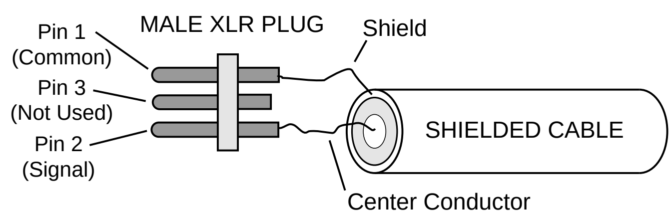
If you do not have an oscilloscope, or want to avoid taking it up to the projection booth, you can set the azimuth by adding the right and left signal electrically and observing the high frequency response. The signals should have a series resistance added to avoid damaging the processor's output circuitry. The diagram below shows the connection method for this technique.



The graph will display a single curve which is a composite of the left and right channels. The azimuth is adjusted for minimum loss in the high frequency region. This setup uses the standard CPS and GDS files used for the A-chain alignment.

Note: *It is important to check that the optical head is perpendicular to the surface of the film after adjustment. It is possible to get a false 'good' reading when the azimuth adjustment is very skewed. When it is near perpendicular, however, there will be only one best response position.*

Notes for A-chain Alignment (continued)
It is possible, using the pcRTA, to view both the left and right channels of the optical preamp simultaneously for easier adjustment of the optics and slit loss eq. The procedure requires the user to build two adaptors to attach the left and right signals to the **Mic-1** and **Mic-2** inputs on the pcRTA. The wiring of the adaptors is shown in the figure below.



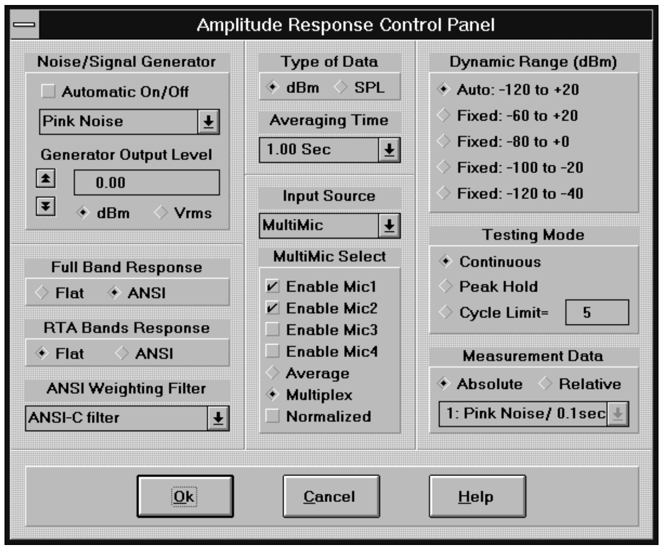
NOTE: *Nothing should be tied to pin 3 of the XLR. Pin 3 carries the 10VDC power supply for the microphones. Connecting this pin to anything other than a LinearX microphone can result in severe damage to the pcRTA.*

The units of measure on the **Control Panel** must be set to dBm, so that the microphone calibration files do not affect the measurements. The **Input Source** must be set to **MultiMic**, with only mics 1 and 2 enabled for measurement. The **Multiplex** button must be pressed instead of the **Average** button, so that pcRTA will display two separate curves rather than one average curve of the two inputs. These control panel settings are contained in the Control Panel Settings file **CINE_AC2.CPS**.

When the MultiMic mode is selected, the data curves will always be in the first four curve entries of the curve library. Data from Mic-1 will be stored in curve 1, Mic-2 in curve 2, and so on. If you have measurement data in the first four curve entries that you want to save, move the data to another curve entry or create a new library.

Press the **Start Test** button on the **Tool Bar**. The **Line Graph** should have two nearly identical lines on it, one for each mic.You can now adjust the optics and slit loss eq's while observing the changes on both channels at the same time. See the next page for the **Control Panel** settings used to make this measurement.

Notes for A-chain Alignment (continued)
Here are the **Control Panel Setup** settings saved in the Control Panel Set file **CINE_AC2.CPS**:



Control Panel Parameters

Parameter	Value	Parameter	Value
Gen Auto On/Off	Off	Enable Mic3	Off
Gen Output Level	N/A	Enable Mic4	Off
Full Band Response	N/A	Average	Off
RTA Bands Resp.	Flat	Multiplex	On
Weighting Filter	N/A	Normalized	Off
Type of Data	dBm	Dynamic Range	Auto
Averaging Time	1.00 Sec	Testing Mode	Continuous
Input Source	MultiMic	Measurement Data	Absolute
Enable Mic1	On		
Enable Mic2	On		

5: B-chain Alignment

Alignment of the B-chain can be done entirely with the pcRTA and your ears. The process involves measuring full band, C-weighted SPL to set the outputs of the individual channels to the same level and then equalizing each channel while viewing the frequency response.

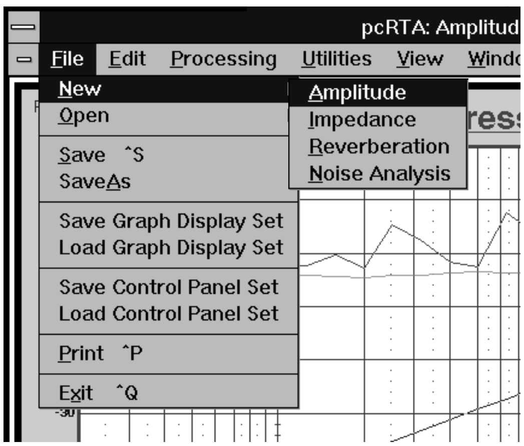
The **Normalized** option will be turned on in the **Control Panel** for these measurements. This feature normalizes the sensitivity of all the mics at 1kHz so that they will each have equal weighting in the 4 mic average. This is essential for proper adjustment of the equalizer.

There are many display options for viewing the full band SPL. You can switch between a text display of the full band SPL and a graph of frequency response using the Window menu. The Bar Graph and Line Graph each have the option of showing the full band SPL as a part of the curve or as a small text display in the upper left corner. Using the multiple windows, you can display the full band SPL with ANSI C weighting while simultaneously displaying the 1/3 octave bands unweighted as bars or a line .

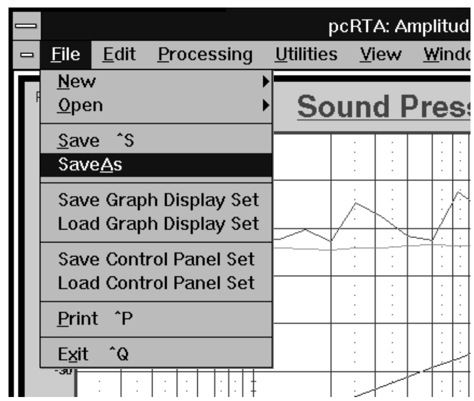
This text will show two specific methods of viewing the full band SPL. Both methods will use the multiple windowing capability. The first involves maximizing the graphs, then switching between a Line Graph and a full band SPL Text Chart. This method is recommended for displays with a resolution of 640x480(VGA) or 800x600(SVGA). The second method, recommended for resolutions of 1024x768 or higher, is to place a small copy of the Text Chart with full band SPL displayed in the corner of the screen, while having a larger Line Graph or Bar Graph covering most of the rest of the screen.

STEP 1 ***Open an new AMPLITUDE MODE curve library.***

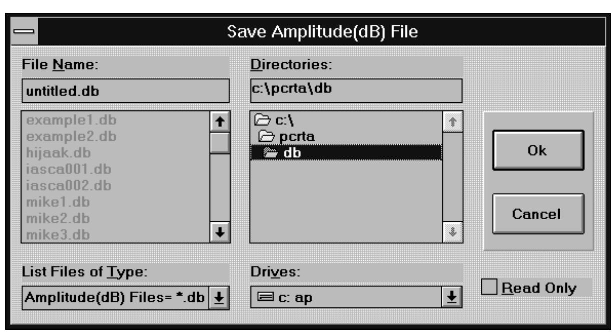
Go to the **File** menu and choose **New**, then choose **Amplitude**. The program creates a new amplitude library with the name: **Untitled.db**.



To give it a different name, go to the **File** menu and choose **SaveAs**.



A dialog box with the title **Save Amplitude(dB) File** opens. Type in the name you want to give the file and click **OK**.

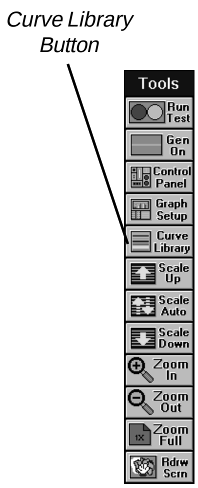


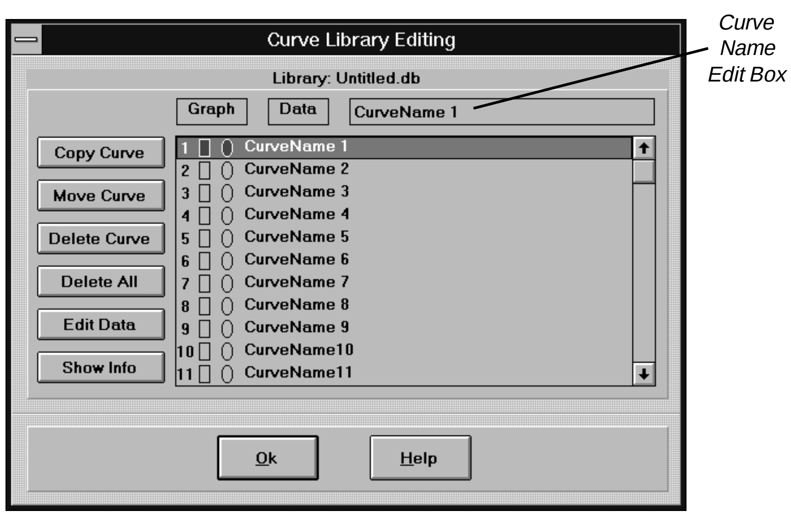
You now have a new amplitude curve library with 20 blank entries ready to receive data.

STEP 2 ***Select and name a curve to receive the measured B-chain data.***

Click on the **Curve Library** button on the **Tool Bar**. The **Curve Library** dialog box opens.

In the figure below, curve 1 is currently selected for saving the data and displaying it. Before each measurement, another curve must be selected in the **Curve Library** as the data curve, or the previous test will be overwritten.



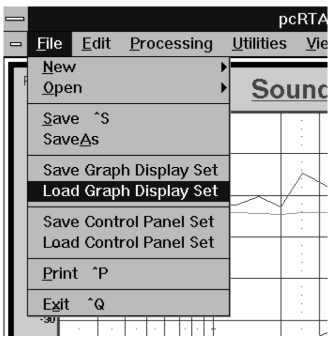


To select another curve for display, click on the oval to the right of the curve number. This will set that curve to save the data from the next test and to display on the graph.

To name a curve, click inside the curve name edit box, and type in the new name.

Click **OK** to close the Curve Library dialog box and save any changes you have made.

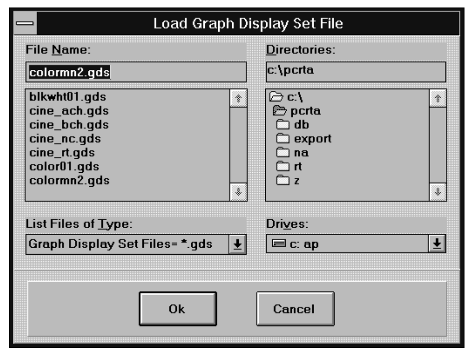
STEP 3 *Load B-chain Control Panel Settings and Graph Display Settings.*

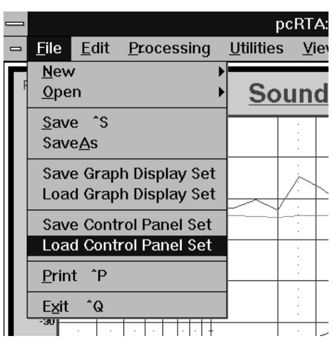


Go to the **File** menu and select **Load Graph Display Set**. A dialog box titled **Load Graph Display Set File** opens.

Load the file **CINE_BCH.GDS**. This file will set all of the characteristics of the display.

Click **OK** to close the dialog box.

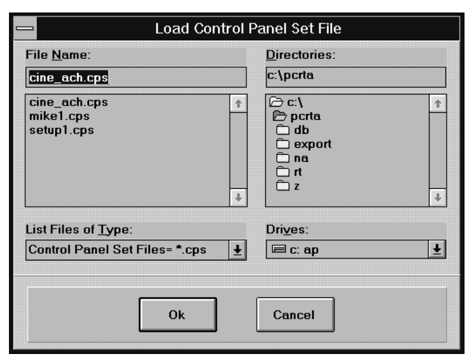




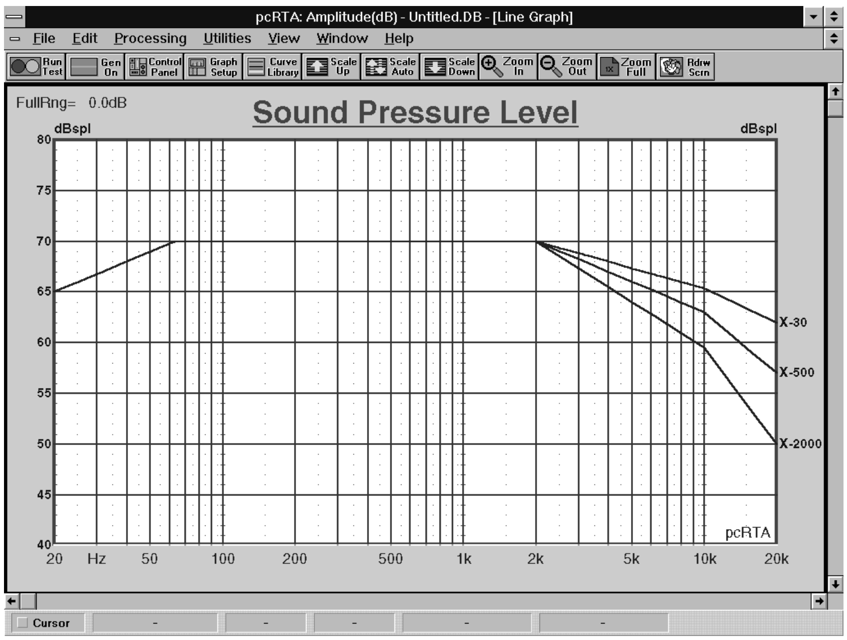
Go to the **File** menu and select **Load Control Panel Set**. A dialog box titled **Load Control Panel Set File** opens.

Load the file **CINE_BCH.CPS**. This file will set all of the parameters of the control panel.

Click **OK** to close the dialog box.

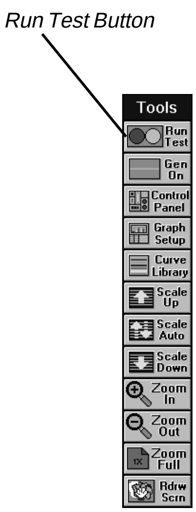


The Line Graph should look like the one shown here.



There are no data curves on this graph, only the grid and the SMPTE-X curves overlay.

You will see three high frequency rolloff curves in the high end of the SMPTE-X reference curve. These curves reflect the fact that the high-frequency roll-off characteristics change for different room sizes. The reference curves correspond to rooms with 30 seats, 500 seats, and 2000 seats.



General procedure for B-chain Alignment

The settings you have loaded include a 10 second averaging time. This means that the pcRTA will collect measurements for 10 seconds and then display the average of all measurements taken during that time. The process then repeats, with all new data. The curve will only change once every 10 seconds.

For coarse adjustments, you could use a faster averaging time. This way, the effects of your adjustments to the system become visible more quickly. At the low frequencies, you will have trouble using faster averaging, so this technique is mainly useful for the mid and high frequencies. The fine adjustments should be done with 10 second averaging or longer for the highest accuracy.

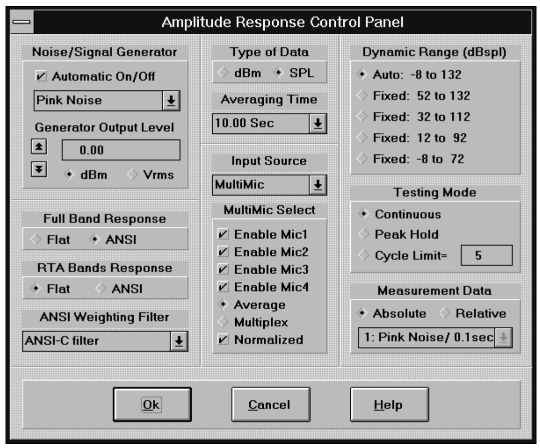
Click the **Run Test** button on the **Tool Bar** to begin. The **Run Test** button changes to the **Stop Test** button while a test is running. You can leave the test running as long as required to set the channel gains and adjust the equalizers.

The typical adjustment process calls for setting the gain of each channel to 85db, C-weighted and then adjusting the eq for a flat response. The software settings that are loaded provide C-weighting on the full band readout and no weighting on the RTA response readout. See the Notes section for information about switching the display between full band SPL text chart display and RTA response line graph or bar graph.

Before adjusting the equalization on each channel, it is a good idea to check for a similar response from each channel and for even coverage throughout the room. If one channel has a drastically different response, it may have a blown driver or crossover problem. Checking the response at each mic individually will indicate any problems with severe standing waves at one mic position. This can cause misrepresentative readings when averaging four mics, and the microphone should be moved.

When you are finished adjusting each channel of the system, you can save the curve for future reference or to provide the customer with hard copy of the final response curves. Simply click the **Stop Test** button when a channel is complete, then go to the **Curve Library** and designate a new entry to receive the data. Save the library when finished and you will have a record on the hard disk of the installation. This information can be very valuable when returning to the theater for realignment of the system.

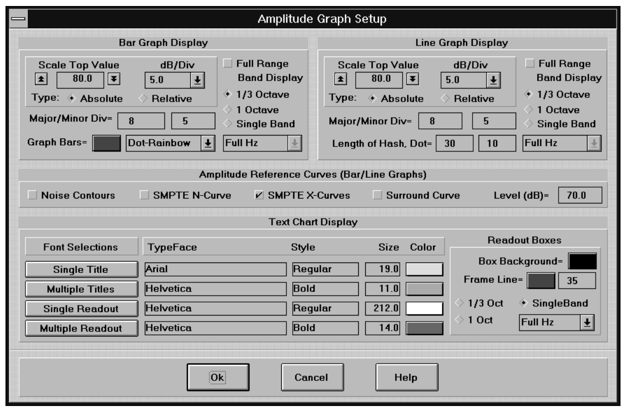
Notes for B-chain Alignment
Here are the settings saved in the Control Panel Set file **CINE_BCH.CPS**:



Control Panel Parameters

Parameter	Value	Parameter	Value
Gen Auto On/Off	On	Input Source	MultiMic
Gen Output Type	Pink Noise	Enable Mic 1-4	On
Gen Ouput Level	0.00 dBm	Average	On
Full Band Response	ANSI	Multiplex	Off
RTA Bands Resp.	Flat	Normalized	On
Weighting Filter	ANSI-C Filter	Dynamic Range	Auto
Type of Data	SPL	Testing Mode	Continuous
Averaging Time	10.00 Sec	Measurement Data	Absolute

Notes for B-chain Alignment (continued)
Here are the settings saved in the Graph Display Set file **CINE_BCH.GDS**:



Graph Setup Parameters

Bar Graph Settings		Line Graph Settings	
Parameter	**Value**	**Parameter**	**Value**
Scale Top Value	80	Scale Top Value	80
dB/Div	5	dB/Div	5
Type:	Absolute	Type:	Absolute
Major / Minor Div	8, 5	Major / Minor Div	8, 5
Graph Bars	Dot-Rainbow	Length of Hash, Dot	30, 10
Full Rng Band Display	Off	Full Rng Band Display	Off
1/3 Octave	On	1/3 Octave	On
1 Octave	Off	1 Octave	Off
Single Band	Off	Single Band	Off

Amplitude Reference Curves

NC	Off	SMPTE N	Off	SMPTE X	On	Surround	Off	Level(dB)	70.0

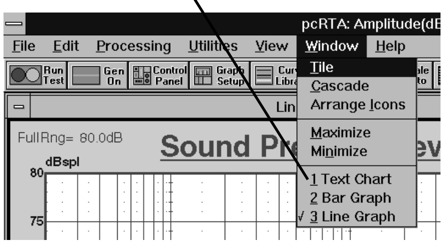
Text Chart Settings

Parameter	Value	Parameter	Value
Single Title Font Size	19.0	1/3 Octave	Off
Single Readout Font Size	212.0	1 Octave	Off
All Other Font Settings	As Desired	Single Band	On
Box Background Color	As Desired	Band to Display	Full Hz

Notes for B-chain Alignment (continued)

With the settings you have loaded, you can switch to a Text Chart view of the full band SPL using the **Window** menu or the **CTRL-TAB** keys. Click **1 Text Chart** on the **Window** menu or press **CTRL-TAB** until the Text Chart appears as the focused window.

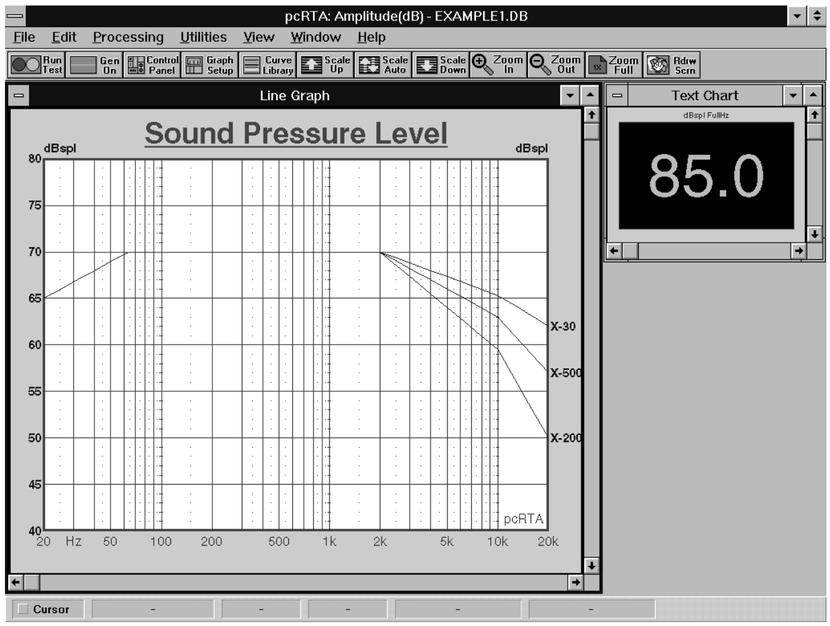
Click here to display Text Chart



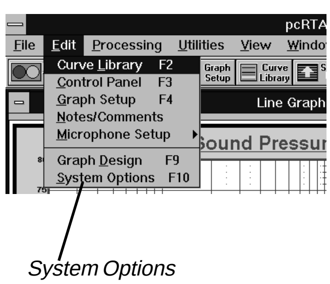
NOTE: *The CTRL-TAB method will only work when the graph window is maximized.*

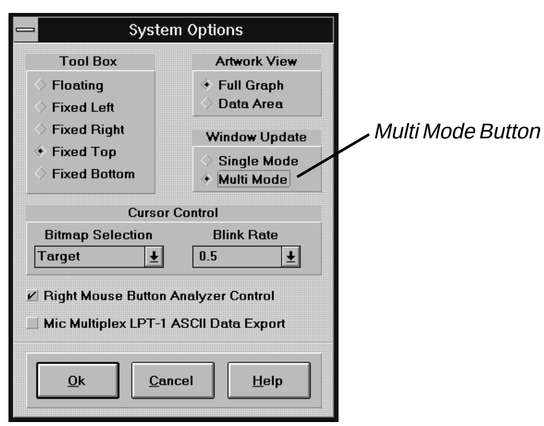
You will now see a full screen Text Chart as shown above. This graph is displaying the C-Weighted full band SPL in large digits.

Now you can resize the Text Chart to a small window in the corner and view the Line Graph as a large window taking up most of the screen. This allows you to see the full band SPL and the real time response curve simultaneously. This mode is recommended for higher video resolutions and large screen monitors. See the figure on the next page.



To use this mode, the software must be set to update both windows at the same time. Go to the Edit menu and click on **System Options** (**F10**). Set the **Window Update** to **Multi Mode**.





6: Noise Criteria (NC) Measurement

Noise floor measurements characterize the steady-state background noise level in an acoustic space. The pcRTA has built-in reference curve overlays for NC responses.

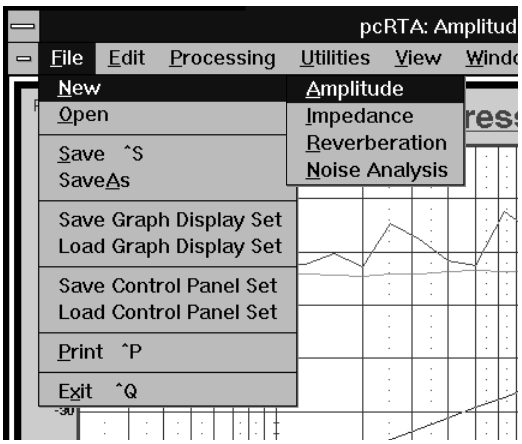
The microphone that you use will affect your ability to measure low-noise environments. For applications in which you only need to verify that the house meets the NC-35 criteria or higher, the M51 mic will suffice. If you need to measure as low as NC-15, you will need the M53 low-noise microphone.

Noise measurements may be taken from one microphone at a time to eliminate the electronic switching noise present in all multiplexed systems. This should only be a concern when using a fast averaging time. When using a longer averaging time (10 seconds or more), you can measure each of the four microphones automatically, and without leaving the measurement position. You can then average the curves from each location to produce a measurement that represents the background noise of the entire room.

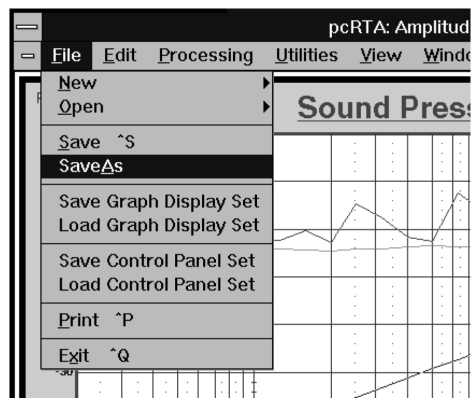
Measuring noise is also an important first step to making Reverb Time measurements. This will be explained in greater detail in the RT section of this chapter.

STEP 1 ***Open an new AMPLITUDE MODE curve library.***

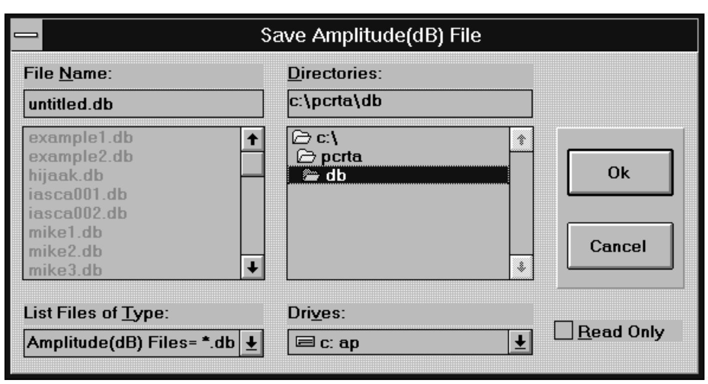
Go to the **File** menu and choose **New**, then choose **Amplitude**. The program creates a new amplitude library with the name: **Untitled.db**.



To give it a different name, go to the **File** menu and choose **SaveAs**.



A dialog box with the title **Save Amplitude(dB) File** opens. Type in the name you want to give the file and click **OK**.

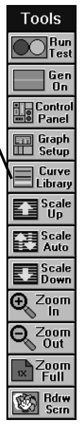


You now have a new amplitude curve library with 20 blank entries ready to receive data.

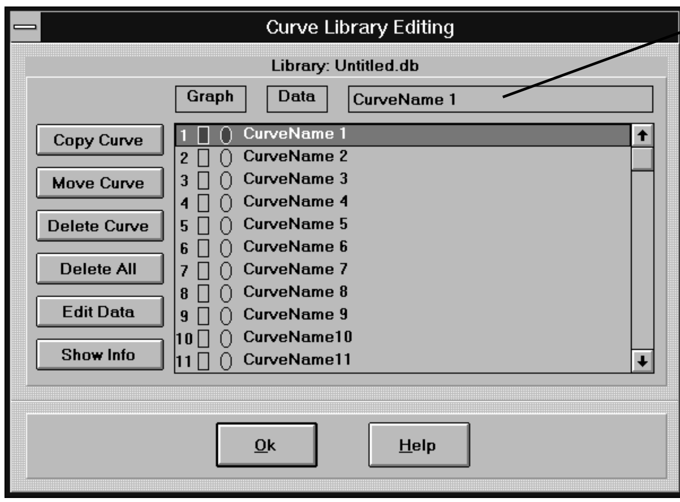
STEP 2 *Select and name a curve to receive the measured data.*

Click on the **Curve Library** button on the **Tool Bar**. The **Curve Library** dialog box opens.

Curve Library Button



In the figure below, curve 1 is currently selected for saving the data and displaying it. Before each measurement, another curve must be selected as the data curve or the previous test will be overwritten.



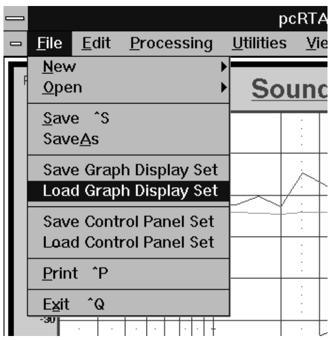
Curve Name Edit Box

To select another curve for display, click on the oval to the right of the curve number. This will set that curve to save the data from the next test and to display on the graph.

To name a curve, click inside the curve name edit box, and type in the new name.

Click **OK** to close the Curve Library dialog box and save any changes you have made.

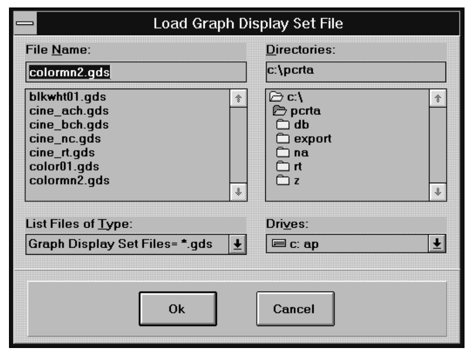
STEP 3 *Load Noise Criteria Control Panel Settings and Graph Display Settings.*

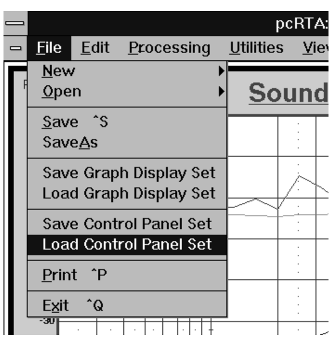


Go to the **File** menu and select **Load Graph Display Set**. A dialog box titled **Load Graph Display Set File** opens.

Load the file **CINE_NC.GDS**. This file will set all of the characteristics of the display.

Click **OK** to close the dialog box.

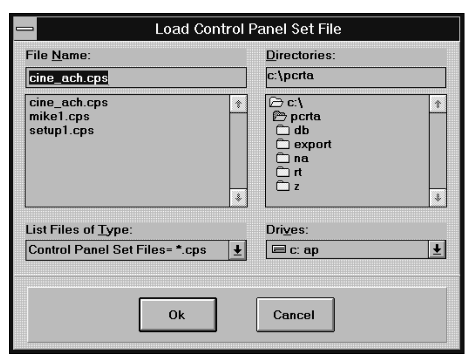




Go to the **File** menu and select **Load Control Panel Set**. A dialog box titled **Load Control Panel Set File** opens.

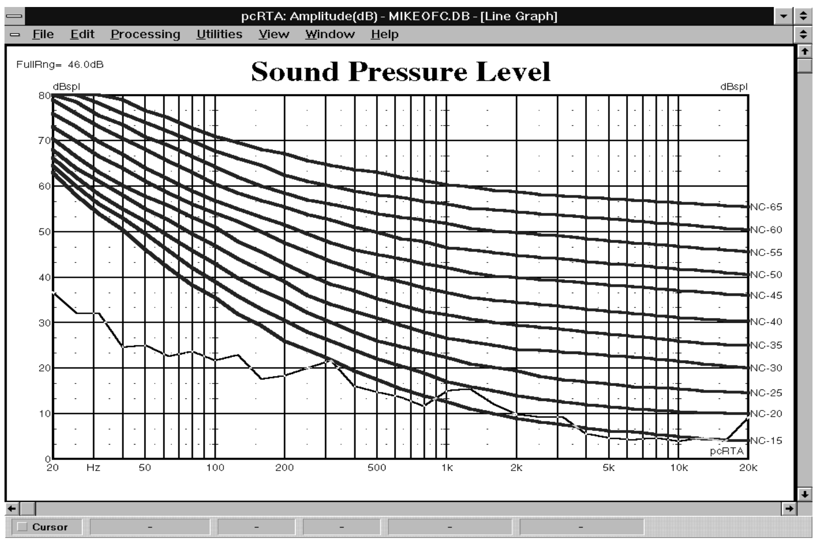
Load the file **CINE_NC.CPS**. This file will set all of the parameters of the control panel.

Click **OK** to close the dialog box.



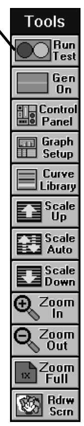
The Line Graph should look like the one shown here.

The data curve on this graph would pass the NC-20 criteria, but would not meet NC-15.



You are now ready to take an NC measurement.

Run Test Button



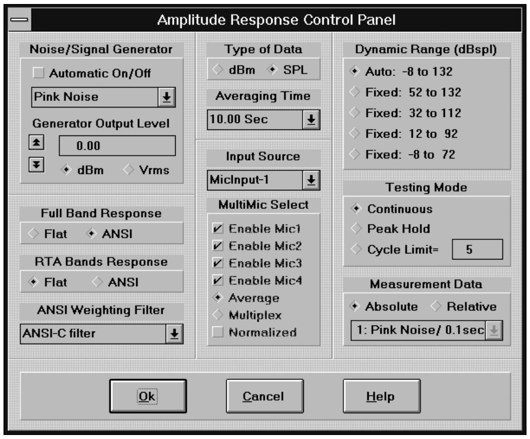
General procedure for Noise Criteria Measurements

The settings you have loaded include a 10 second averaging time and a four mic multiplexing arangement. This means that the pcRTA will collect measurements from **Mic Input 1** for 10 seconds, then display the average of all measurements taken during that time and store that data in curve entry number 1. The process then repeats at **Mic Input 2**, storing the data in curve entry 2. When all four mic inputs have been measured, the test will stop. If you start the test again, the data in curves 1-4 will be overwritten.

Click the **Run Test** button on the **Tool Bar** to begin. Wait for the pcRTA to complete the measurement cycle (total of 40 seconds). The **Run Test** button changes to the **Stop Test** button when a test is running, but the software will not allow you to interrupt the test.

The data from the test is stored in the **Curve Library** in entries 1 through 4, corresponding to mic inputs 1 through 4. If you wish, you can use the **Averaging Process** to produce a single averaged noise curve from the four stored curves.

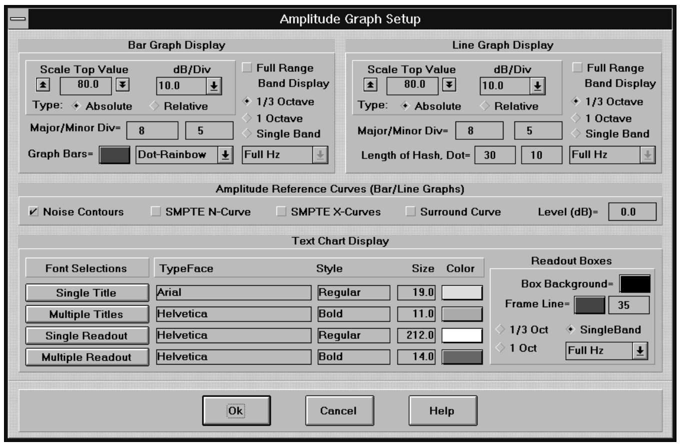
Notes for Noise Criteria Measurements
Here are the settings saved in the Control Panel Set file **CINE_NC.CPS**:



Control Panel Parameters

Parameter	Value	Parameter	Value
Gen Auto On/Off	Off	Input Source	MultiMic
Gen Output Level	N/A	MultiMic Select	Enable 1-4
Full Band Response	ANSI	MultiMic Mode	Multiplex
RTA Bands Resp.	Flat	Normalized	Off
Weighting Filter	ANSI-C	Dynamic Range	Auto
Type of Data	SPL	Testing Mode	Cycle Limit (2)
Averaging Time	10.0 Sec	Measurement Data	Absolute

Notes for Noise Criteria Measurements (continued)
Here are the settings saved in the Graph Display Set file **CINE_NC.GDS**:



Graph Setup Parameters

Bar Graph Settings		**Line Graph Settings**	
Parameter	**Value**	**Parameter**	**Value**
Scale Top Value	80	Scale Top Value	80
dB/Div	10	dB/Div	10
Type:	Absolute	Type:	Absolute
Major / Minor Div	8, 5	Major / Minor Div	8, 5
Graph Bars	Dot-Rainbow	Length of Hash, Dot	30, 10
Full Rng Band Display	Off	Full Rng Band Display	Off
1/3 Octave	On	1/3 Octave	On
1 Octave	Off	1 Octave	Off
Single Band	Off	Single Band	Off

Amplitude Reference Curves		**Text Chart Settings**	
Noise Contours	On	All Parameters	N/A
SMPTE N-Curve	Off		
SMPTE X-Curve	Off		
Surround Curve	Off		
Level (dB)	N/A		

7: Reverb Time (RT60) Measurement

Reverb Time (RT) measurements characterize the reverberant properties of an acoustic space. The graphs of RT display the amount of time it takes for acoustic energy to decay by a preset amount in dB at each frequency.

The process of measuring reverberation consists of generating a stimulus noise for a length of time sufficient to excite any reverberant modes in the space. The stimulus is then cut off, and the analyzer detects when the noise has decayed by a finite amount, such as 60dB (RT60). The pcRTA has built-in reference curves for measuring RT.

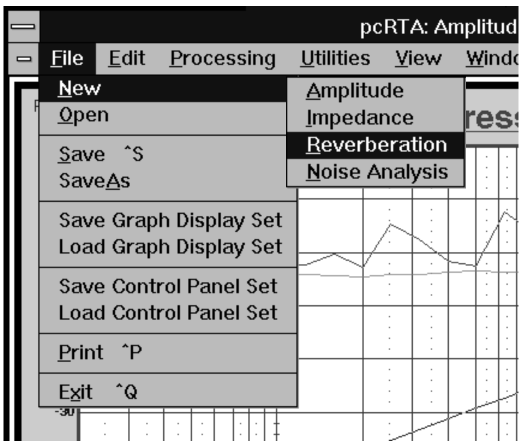
Measuring RT60 can be somewhat problematic, because it requires that the sound system be capable of producing a signal that is at least 60dB higher than the noise floor. For this reason, the pcRTA includes the ability to measure to the less demanding limits of RT40 and RT20. Once the measurement is made using RT40 or RT20, you can extrapolate the data to represent RT60 by scaling the curves. If the noise floor is only a problem at low frequencies, you can take an RT60 measurement and allow the analyzer to time out at the low frequencies where the data is not needed for verification of the cinema. This is explained in greater detail in the notes section.

RT measurements are taken from one microphone at a time. The mics cannot be multiplexed in the RT measurement mode.

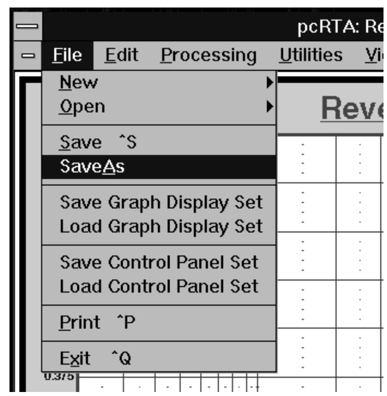
To get an accurate RT60 curve for a room, it is necessary to take at least two measurements from each microphone and then average all of the curves.

STEP 1 ***Open an new Reverberation Mode curve library.***

Go to the **File** menu and choose **New**, then choose **Reverberation**. The program creates a new reverb time library with the name: **Untitled.db**.



To give it a different name, go to the **File** menu and choose **SaveAs**.



A dialog box opens with the title **Save ReverbTime(RT) File**. Type in the name you want for the file and click **OK**.

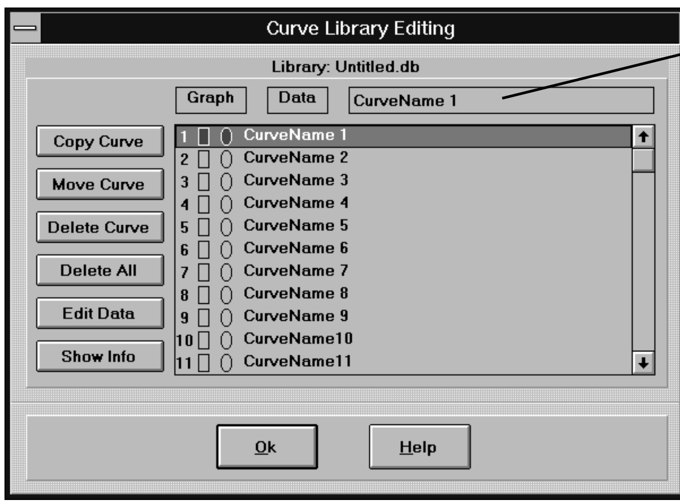
You now have a new Reverb Time curve library with 20 blank entries ready to receive data.

STEP 2 ***Select and name a curve to receive the measured RT data.***

Click on the **Curve Library** button on the **Tool Bar**. The **Curve Library** dialog box opens.

Curve Library Button

In the figure below, curve 1 is currently selected for saving the data and displaying it. Before each measurement, another curve must be selected in the **Curve Library** as the data curve or the previous test will be overwritten.



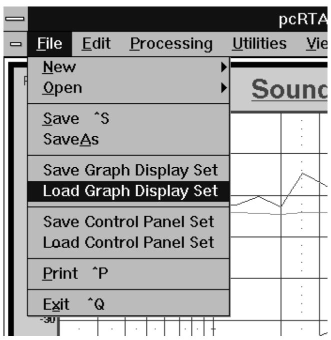
Curve Name Edit Box

To select another curve for display, click on the oval to the right of the curve number. This will set that curve to save the data from the next test and to display on the graph.

To name a curve, click inside the curve name edit box, and type in the new name.

Click **OK** to close the Curve Library dialog box and save any changes you have made.

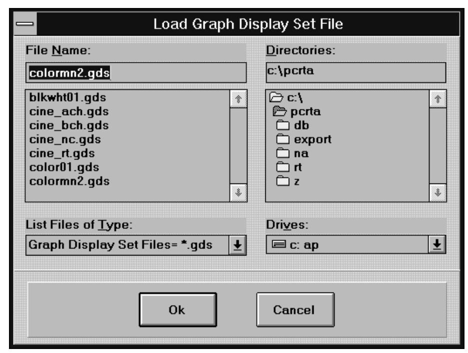
STEP 3 ***Load Reverb Time Control Panel Settings and Graph Display Settings.***

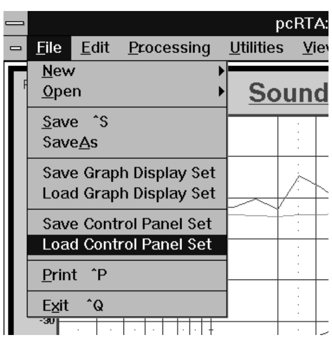


Go to the **File** menu and select **Load Graph Display Set**. A dialog box titled **Load Graph Display Set File** opens.

Load the file **CINE_RT.GDS**. This file will set all of the characteristics of the display.

Click **OK** to close the dialog box.

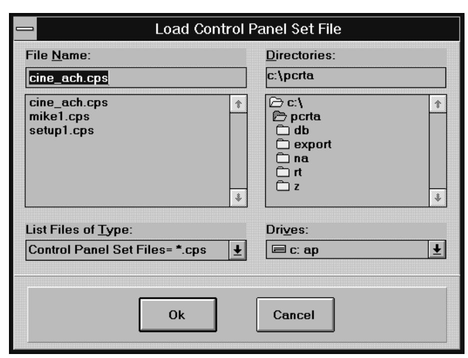




Go to the **File** menu and select **Load Control Panel Set**. A dialog box titled **Load Control Panel Set File** opens.

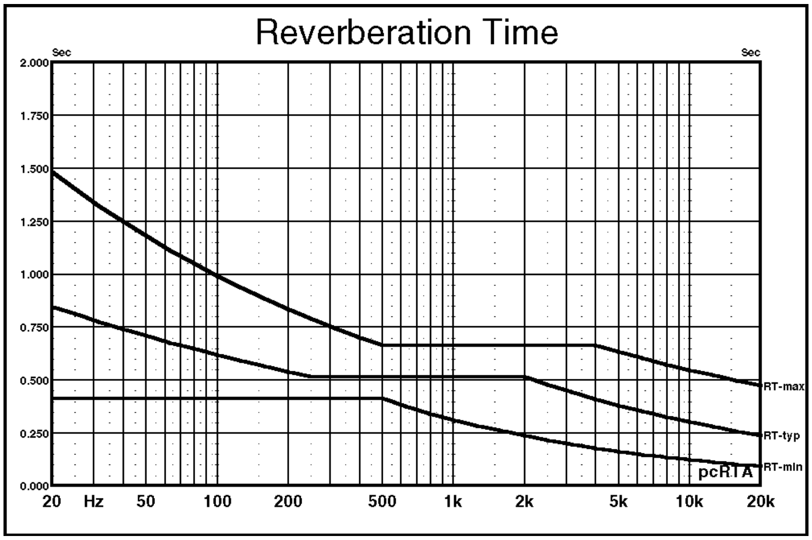
Load the file **CINE_RT.CPS**. This file will set all of the parameters of the control panel.

Click **OK** to close the dialog box.



The Line Graph should look like the one shown here.

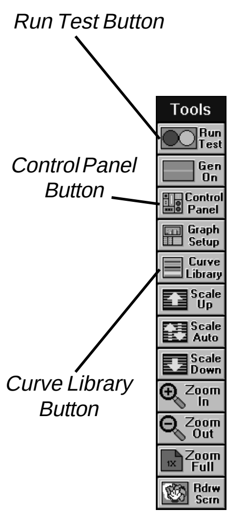
There are no data curves on this graph, only the grid and the RT curves overlay.



You are now ready to start measuring Reverb Time.

General procedure for Reverb Time Measurements

The settings you have loaded include a 5 second stimulus time and a 5 second time out. This means that the pcRTA will generate pink noise for 5 seconds and then collect measurements for 5 seconds. It will then display a graph of time vs frequency and a graph of decay rate (amplitude vs time). This will only happen once unless you hit **Run Test** again.



Click the **Run Test** button on the **Tool Bar** to begin. Wait for the pcRTA to complete it's measurement cycle (10 seconds). The **Run Test** button changes to the **Stop Test** button while the test is running, but the pcRTA will not allow you to interrupt this type of test.

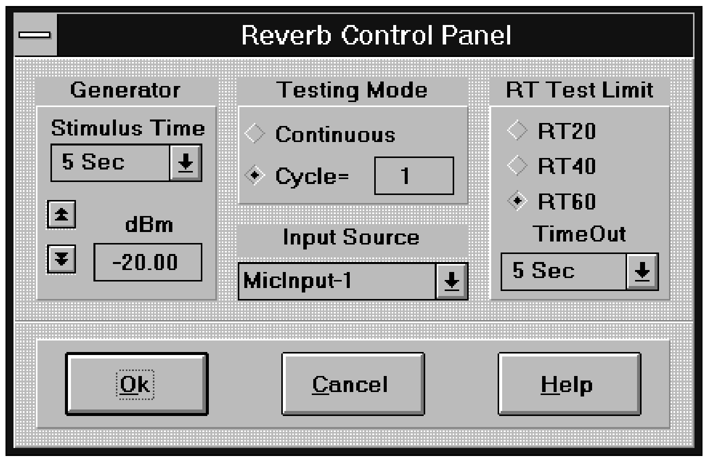
Go to the **Curve Library** and select the next curve in the list to receive data. Run the test again with the **Mic-1 Input** selected.

Go to the **Curve Library** and select the next curve in the list to receive data. Go to the **Control Panel** and change the **Input Source** to **Mic-2 Input**. Repeat the test twice for mic 2.

Continue through all four microphones and save the data from each mic to a different curve entry. When you are finished, use the **Averaging** process to produce a single averaged RT curve from the two sets of curves taken at four different positions.

You may wish to use the **Scale** process to change an RT40 or RT20 curve to represent an RT60 indication. Use a linear ratio of 1.5 to convert RT40 to RT60 and a linear ratio of 3.0 to convert RT20 to RT60.

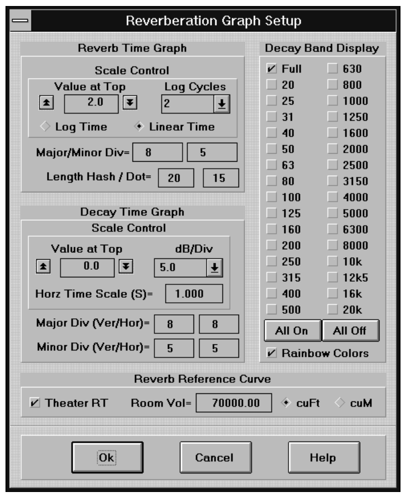
Notes for Reverb Time Measurement
Here are the settings saved in the Control Panel Set file **CINE_RT.CPS**:



Control Panel Parameters

Parameter	Value
Gen Stimulus Time	5 Sec
Gen Output Level	-20.00 dBm
Testing Mode	Cycle= 1
Input Source	MicInput-1
RT Test Limit	RT60
TimeOut	5 Sec

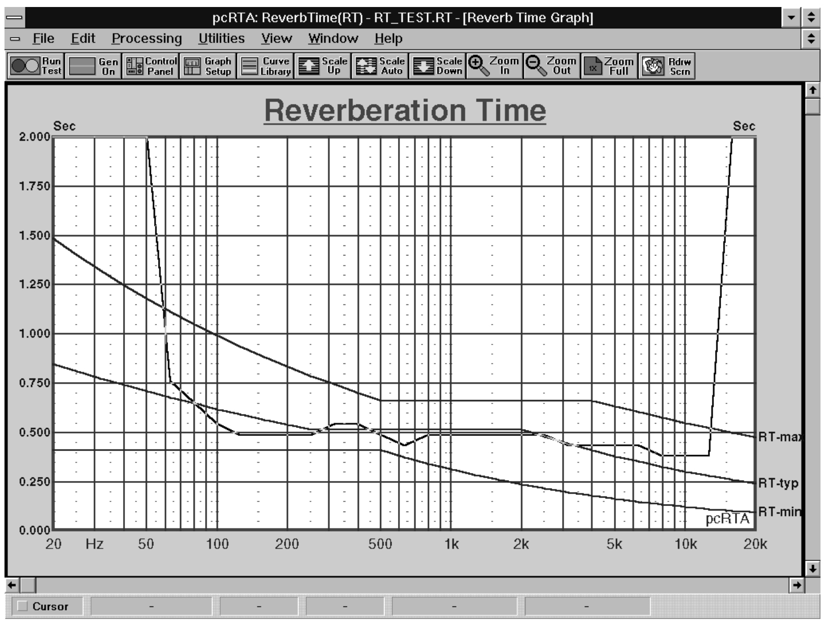
Notes for Reverb Time Measurement (continued)
Here are the settings saved in the Graph Display Set file **CINE_RT.GDS**:



Graph Setup Parameters

Parameter	Value
RT Value at Top	2.0
RT Log Cycles	2
RT Major/Minor Div.	8, 5
RT Length Hash/Dot	25, 15
Decay Time Graph	N/A
Decay Band Display	N/A

Notes for Reverb Time Measurement (continued)
In some rooms it may not be possible to achieve the low noise floor necessary to take true RT60 measurements down to the 20Hz band and up to the 20kHz band. Since most RT60 specifications are listed only from 125Hz to 8kHz, you can measure in the RT60 mode and ignore timeouts in the low and high frequencies (below 125Hz and above 8kHz).



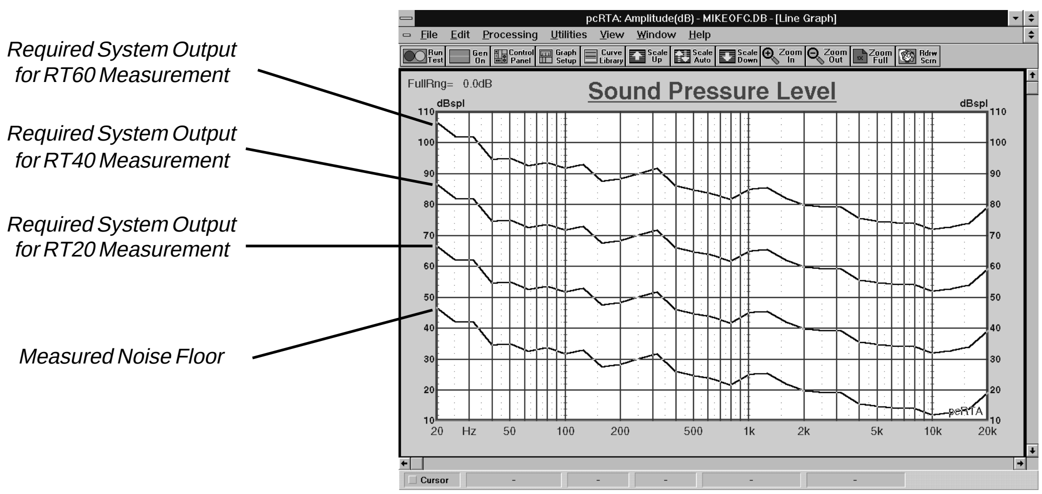
The curve shown here has good RT60 data within the 125Hz - 8kHz region, while the very low and very high frequencies timed out during the measurement. It is common to see a higher noise floor in the low frequency region, which caused this result in the measurement.

Notes for Reverb Time Measurement (continued)

If you want to measure Reverb Time at all frequencies without timeouts, you need to consider the size of the room, the background noise level, and the output capability of the sound system. In the control panel, you can choose a stimulus time, an RT test limit, and a time out (measurement cutoff time).

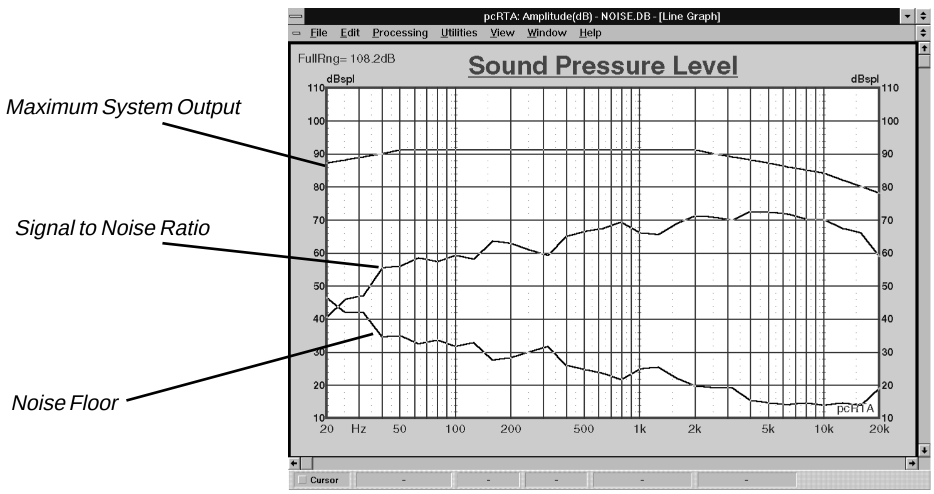
The stimulus time should be long enough to fully excite the reverberant modes of the room. 5 seconds is a good starting point for this parameter.

The RT test limit should be set according to the dynamic range available. This can be thought of as the signal to noise ratio of the room. The maximum output of the system divided by the noise floor will give the maximum RT limit that can be measured.



The graph above shows a noise floor curve that was scaled up by 20dB, 40dB, and 60dB. This gives a graphic indication of the required output level from the system to perform RT testing to each of the limits (RT60, RT40, RT20).

Notes for Reverb Time Measurement (continued)
The next graph shows a system's maximum output, the noise floor, and the ratio of the two. From this, you can directly read the maxmium RT limit as being RT40, since the signal to noise curve is above 40dB at all frequencies.



The time out determines how long the pcRTA will continue before it cuts off the measurement. In the RT60 mode, for example, when the stimulus signal stops, the pcRTA measures the decaying signal at each frequency until it drops by 60dB. When the time out is reached, the measurement stops. Any bands which did not drop by 60dB will display the time out value on the RT graph. If the stimulus signal was not 60dB above the noise floor at any given band, that band will never fall below the RT limit, and it will time out. If you observe bands timing out even though the dynamic range is sufficient, increase the time out value.