# 11 SINUSOIDAL MENU

## 11.1 INTRODUCTION

All sinusoidal measurements that CLIO is capable of are described in this chapter. The options under the Sinusoidal menu command are the following: Frequency Response, Impedance, Parameters, Distortion, Polar and Calibration. These will now be described.

## 11.2 FREQUENCY RESPONSE

This option is used to measure sinusoidal steady-state frequency responses. Fig. 11.1 shows the frequency response control panel.

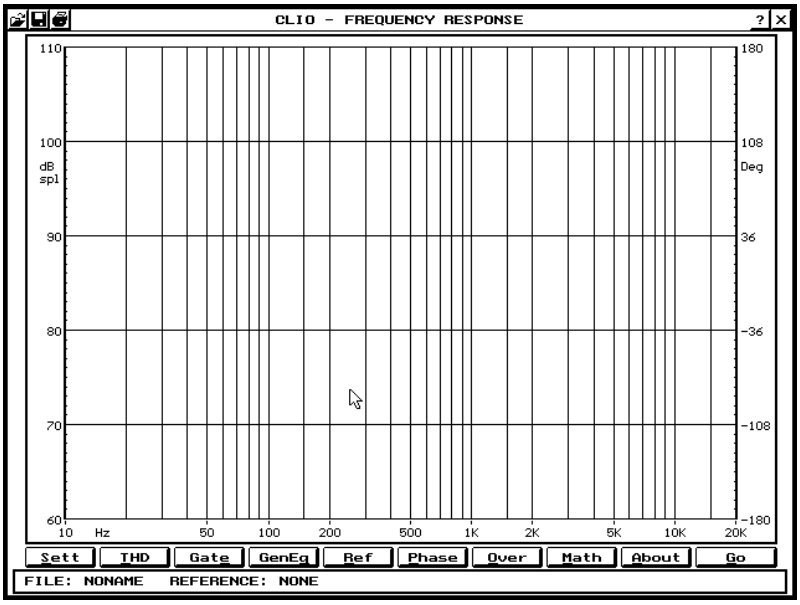



*FIGURE 11.1 – The Frequency Response control panel*

### 11.2.1 MEASUREMENT SETTINGS

Pressing the **S**ett button from the Frequency Response control panel you reach the Setting dialog box shown in Fig. 11.2.

Here you can define several parameters that has effect either on the display or on the measure. In the Amplitude Scale radio button group you define the dB/Div of the Y axis. The same result can be obtained directly from the Frequency Response control panel with PgUp/PgDn keys. In the Frequency Scale radio button group the graph frequency limits can be selected. In the THD group two check boxes enables display of 2nd and 3rd harmonics (if the THD button is on, in the Frequency Response control panel); from the input field Rise you can define how much the harmonics graphs are risen. As with Amplitude Scale and Frequency Scale this choices affects only on the display and take effect on the measure currently in memory. In the Resolution group the frequency resolution of the measure can be defined; this acts on the number of measuring points. From the Limits and Speed group the measure frequency limits can be typed in; the minimum frequency limit is 10 Hz, and the maximum is 20 kHz. Clearly, the minimum frequency may not be greater than the maximum frequency. The speed radio buttons, if not in gated mode, define how long the signal is hold before Clio measure it.

(!) Burst response of D.U.T. has to be taken into account in selecting measurement speed; if in doubt, use the “Slow” one.

In the Gate group the parameters for gating measurements can be defined. The most frequent application of this technique is quasi-anechoic frequency response of Loudspeakers. Basically you define an acquisition delay that takes account of the time of fly of the sound and a “meter on” time that should be short enough to exclude reflections. Against this requirement to evaluate amplitude of a sinusoid at least one full cycle has to be monitored; hence the shortest the “meter on” time is, the highest is the start frequency of the sweep. This frequency is located form Clio as result of the “meter on” time defined. All what has been pointed out regarding low frequency limits and other precautions in the MLS chapter, holds here. Furthermore when you have setup the measure we strongly suggest to perform an MLS measure and have a look at the impulse response. Any important parameters as propagation time and first reflection arrive can be easily deduced from this. The input field **Delay** tells Clio to start evaluating the input signal after the time input; the maximum allowable delay is 1250 ms. The **On** field defines for how much time to integrate the input signal; the generated burst length will be adjusted accordingly the maximum allowable read time is 200 ms. The **Freq** input field is used by Auto Delay and Auto Phase as we will describe. If the **Auto Delay** check box is active, Clio, before starting the measure will calculate the delay time automatically using the frequency typed in the Freq input field. After the measure, opening Settings again the calculated delay value in ms will be displayed. The default value for test frequency is 10kHz. In practical application this means that Clio calculates the delay from the distance between the high Frequency devices (tweeter) and the microphone. This distance can be obviously quite different for the other speakers. **Auto Phase**, when enabled, acts a time shift on the acquired data directed to minimize the derivative of Phase response around the Frequency typed in Freq field. When you first run the program the Settings control panel starts with the default settings; these settings, changed from user or not, will be saved on disk along with the measurement and, because they will be reloaded as such from the disk, always check that the settings of the measurement you are undertaking are correct.

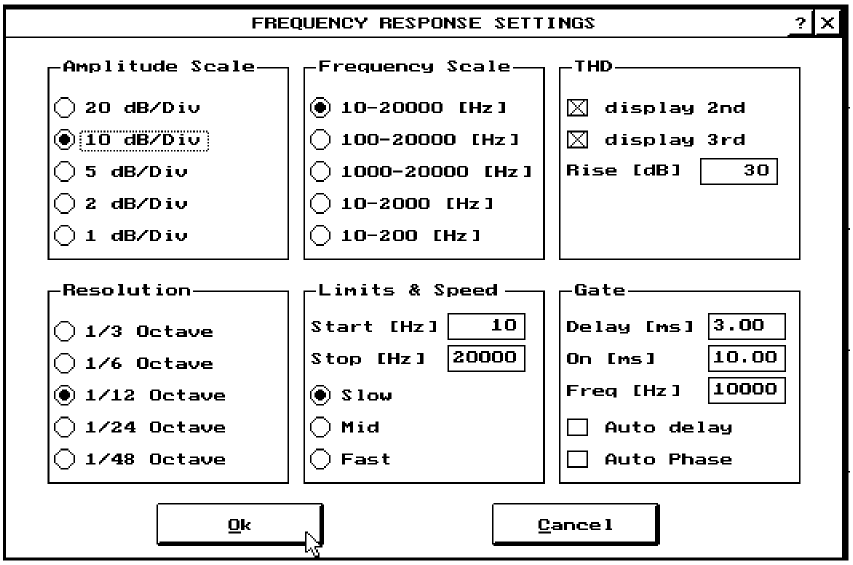



*FIGURE 11.2 – The Settings dialog box*

The number of points in the export file is also affected by these settings. It is also possible to display overlaid plots of the results of measurements taken with different settings for the frequency range of each measurement. When you exit from CLIO, these settings will not be saved in the CLIO.STP file. Therefore, when the program is reloaded, the default settings will be used.

### 11.2.2 SWEPT THD RESPONSE

Activating the THD check box, CLIO will perform a second and third harmonic analysis; the distortion curves will be displayed together with the fundamental. Refer to the Settings paragraph regarding display parameters. The export ASCII file will contain distortion data instead of phase.

NOTE: due to the overall bandwidth of the analyzer the second harmonic is limited to 12 kHz while the third harmonic is limited to 8 kHz.

NOTE: the GenEq, Ref, Phase and Over function buttons are disabled when THD is active.

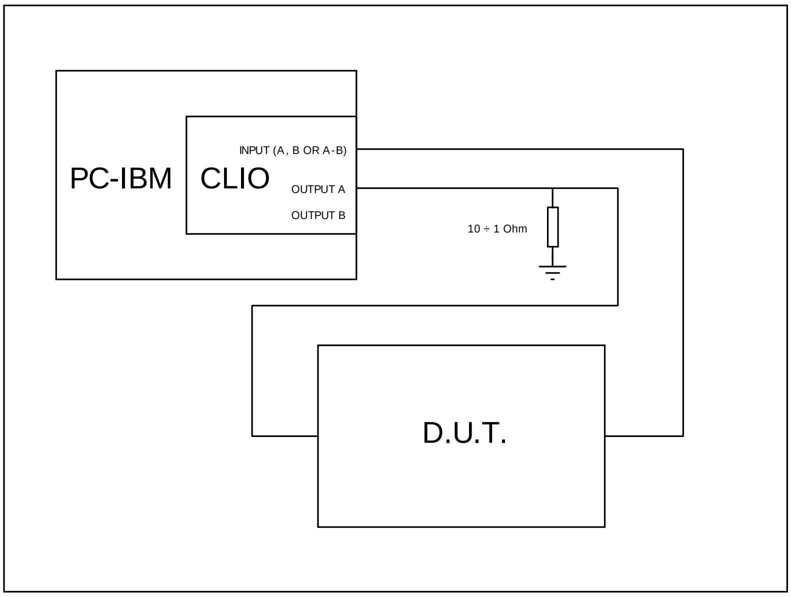
NOTE: THD and Gate can be activated at the same time. However it should be pointed out that for meaningful distortion data the gate parameters are very critical. As a starting point the delay time should be increased slightly to prevent settling time of the speaker to affect distortion. The distance between different speakers and the microphone should be as constant as possible. Even very little reflections should be excluded from the response. A very absorbing room environment is of great help.

### 11.2.3 SINUSOIDAL MEASUREMENTS WITH GATING

Activating the Gate button, CLIO will perform sinusoidal gated measurements. You will be able to control the delay of the acquisition (in ms) and the read time (in ms) of the analyzer as well as other parameter as described in the Measurements Settings paragraph.

### 11.2.4 OTHER FUNCTION BUTTONS

GenE**q** When activated an open file dialog box appears. From here a .txt file can be loaded. This text files has the same structure as an export file of Clio (Refer to the dedicated chapter for more information). With the above file you can define each measuring point of the sweep in terms of frequency and output level. A typical application is RIAA preamplifier de-emphasis test (a file riaa.txt is present in the Job1 directory as an example). Regarding output levels value from +12dBu to -63dBu are accepted. It is anyway suggested, to enhance S/N ratio for Clio's output levels below -20dBu, to use an external passive attenuator and increase levels accordingly.




**R**ef This activates the reference option, and opens a window containing a list of files with the ".FRS" extension. By loading one of these files, the current measurement, and those executed afterwards, will be displayed as dB-difference (complex ratio) with respect to the reference file. The dB scale of the graph will change, having at its center the 0 dB level.

NOTE: When you activate this option, the Over option will be deactivated and all overlaid curves will be lost. It will be subsequently possible to recall the Over function to overlay more than one curve in the Ref mode. The same thing will happen when, by pressing the Ref button again, one returns to the normal mode. In order to display frequency response curves as dB-difference with others, it is necessary that the settings, frequency resolution and amplitude range, be the same for all measurements, otherwise the program will give an error message and return to the standard mode.

**P**hase The phase curve will be activated and it will be plotted on the display. The "Over" button can be useful when you want to simultaneously display both the modulus and the phase curves. In order to do so, activate the overlap option, otherwise the display will only show the phase curve, and by pressing the button again, the modulus curve.

**O**ver Activates the overlay mode for plots. The curves are stored in a 10-curve FIFO buffer. Once the number of curves has reached 10, and the buffer is full, the oldest curve (in chronological order) will be replaced with the last executed or loaded measurement. By pressing the button another time, this option will be deactivated and the last executed or loaded measurement will remain on screen. It is possible to display the previously overlaid curves by reactivating this option, but if another measurement has been executed the curves will be lost.

**M**ath Used for post-processing the actual frequency response measurement. In order to use this function a measurement must previously have been loaded or executed. By pressing this button the Mathematical Tools dialog box shown in Fig. 11.4 will appear on your screen.

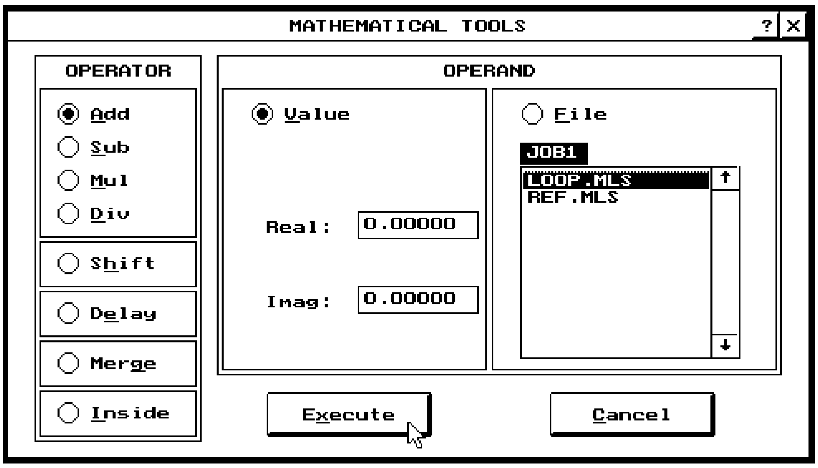



*FIGURE 11.4 – The Mathematical Tools dialog box*

Four fundamental mathematical operations are present: Add (addition), Sub (subtraction), Mul (multiplication), Div (division). Several extra options are also present: Shift, Delay, Merge and Inside. An exclusive switch permits one to choose operations between the actual measurement and either a complex value (the Value radio button) or a file (the File radio button); only one of these radio buttons can be selected at any time. When performing operations using a supplied value, the desired value (real part and imaginary part for math operations, time for delay operations, Frequency for Merge function, dB for Shift function) must be typed into the appropriate fields. By pressing Execute the program will execute the selected operation for every frequency value using the defined complex value and will display the graph of the result.

If the “Inside” operation has been selected, the program will process a measurement that has been executed with the microphone placed inside the box so as to make it equal to one that has been executed in the open air. Please note that the level that is presented is rather arbitrary, and its interpretation is determined by experience of use. Being a complex and rather limited measurement, please refer to the publications listed in the bibliography references for further information related to the application of this technique.

If the “Delay” operation has been selected, a positive or negative time shift is applied to the measurement. This is extremely useful in correcting any large group delay that might arise, such as from acoustical measurements.

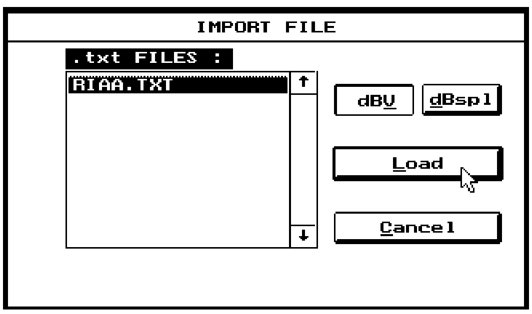
If the “Merge” operation has been selected, two response, the one in memory and the one in the selected file, will be merged. The merge happens at the Frequency specified in the Freq input filed. The data in memory will be considered from Clio as the reference regarding level and phase and will be used as the highest part in frequency (above Freq value). The response in the file will be level and time shifted to merge the one in memory and will be used as the lowest part in frequency.

When performing operations with files, one must choose the file, from the proposed list, with which to execute the desired operation (Inside and Delay cannot be used with files). If the selected file is compatible with the one in memory (with regard to frequency limits and resolution), once the Execute button is pressed the program will proceed with the desired operation (at each frequency), and will display the graph of the result.

Always remember that in both cases the results of the post-processing operation will replace the saved measurement. It is also possible to save the results to disk as a sinusoidal measurement file. It is recommended that you post-process only those measurements saved on disk.

**A**bout Used to add, display, and modify the text of a comment used to describe the measurement. The comment will be saved along with the measurement, and the print routine will print it along with the measurement.

**G**o Used to execute the measurement (with the frequency range that was defined with the “Settings” option). You can stop the measurement procedure at any moment by pressing the Esc key, at which point that part of the measurement that has been completed will appear on screen.




*The Import File dialog box*

As an unique feature of this menu pressing Ctrl+F3 it is possible to import measurements saved as ASCII text files from the current directory, which will enable them to be plotted as graphs. The dialog box associated with this command is shown left. Aside from the measurements exported from the MLS menu, it is also possible to import files generated by other software packages or which have been manually created using any ASCII text editor (for example EDIT.EXE that is supplied many versions of MS-DOS). For further information on the format of these files, please refer the chapter dedicated to this subject.

## 11.3 IMPEDANCE

This option serves to obtain impedance measurements taken under sinusoidal steady-state conditions. The modulus range in which the system furnishes reliable results in Internal Mode (see below) goes from 1 to 400 ohms. Once this option is chosen the Impedance Analysis control panel screen shown in Fig. 11.5 will be displayed.

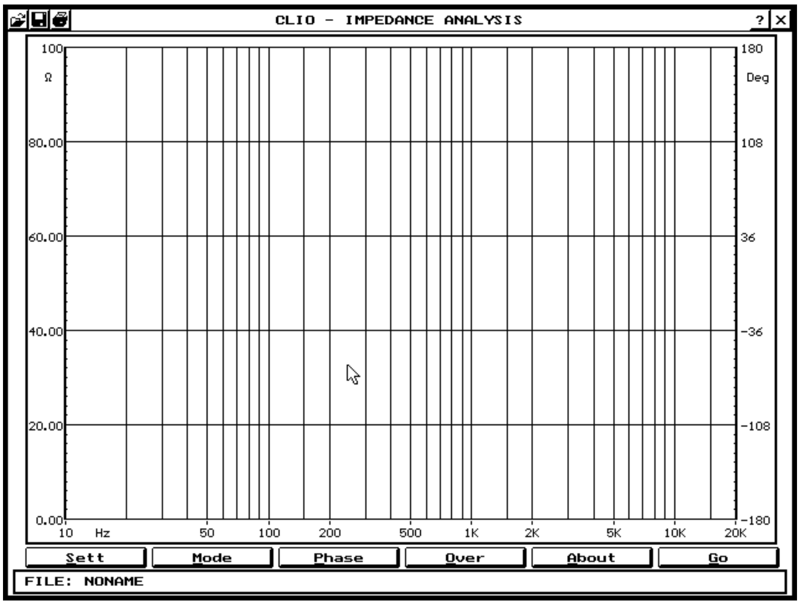
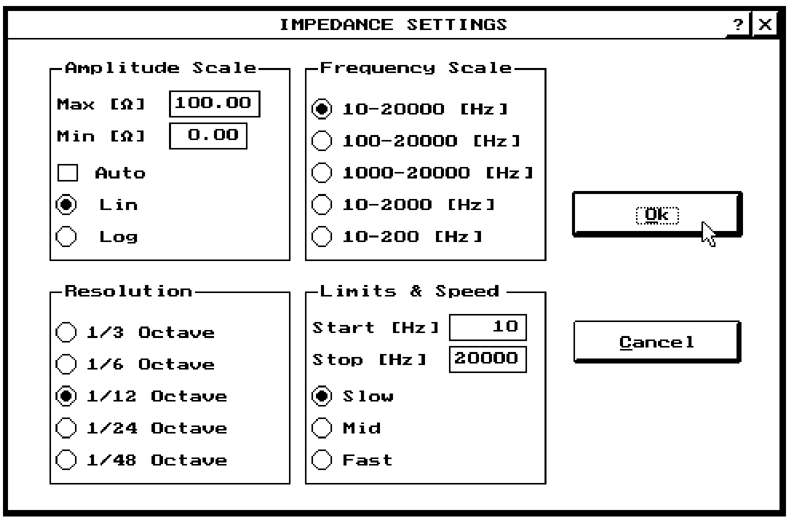



*FIGURE 11.5 – The Impedance Analysis control panel*

### 11.3.1 FUNCTION BUTTONS

**Sett** Pressing the Sett button from the Impedance Analysis control panel you reach the Setting dialog box shown below. Four group of radio buttons and input fields are present. Frequency Scale, Resolution, Limits and Speed are an exact replica of the Frequency Response Settings and were described above. Amplitude Scale allows to define, typing the desired values, the minimum and maximum ohm value of the Y axis. Linear or logarithmic display can be selected with the appropriate radio button; the Auto check box, if enabled allows Clio to automatically select the scale upon the measure maximum and minimum values. If logarithmic display is selected 0 will not be accepted as minimum value and 0.01 will be taken instead.



**M**ode Allows to define four possible ways of measuring impedance. These are Internal, Constant I, Constant V and I Sense. The last one is feasible only if you are using a CLIOQC Model 2 or Model 3 amplifier (see later). Refer to figure 11.6 (a, b, c) for the right connections which are different in each case.

**Internal Mode**, which does not require external amplifier, allows to measure impedance relaying on CLIO's output impedance which is 100 ohm. CLIO's output level is set during the measure to 0dB. As already said values of impedance from 1 to 400 ohms can be accurately measured this way. For lower or higher value one of the other modes should be used.

With **Constant I and Constant V Modes** an external power amplifier is required as well as a sensing resistor. Both input channels of CLIO are used. Strictly speaking how "Constant" either current or voltage are depends on the resistor value chosen. For real constant operation this value should be either much greater or much smaller then the impedance to be measured. When the Constant I mode is selected the software proposes a value of 1000 Ohm while if you select Constant V a value of 0.1 Ohm is proposed; these are only indicative values. The electrical level of the measurement signal is left as an user

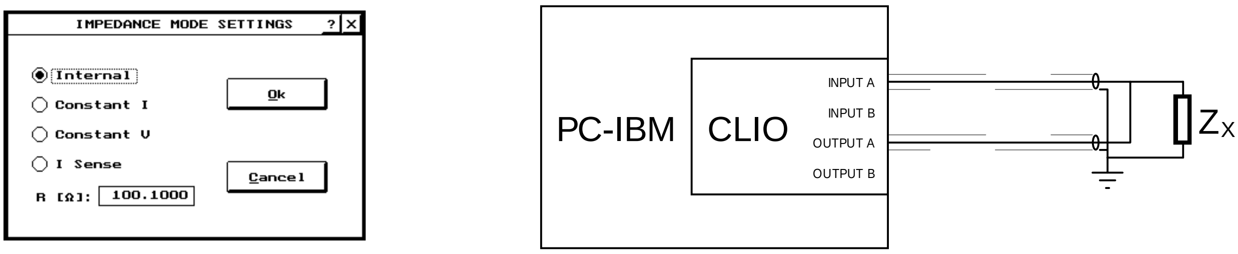



*FIGURE 11.6a – Impedance measurements in "Internal Mode"*

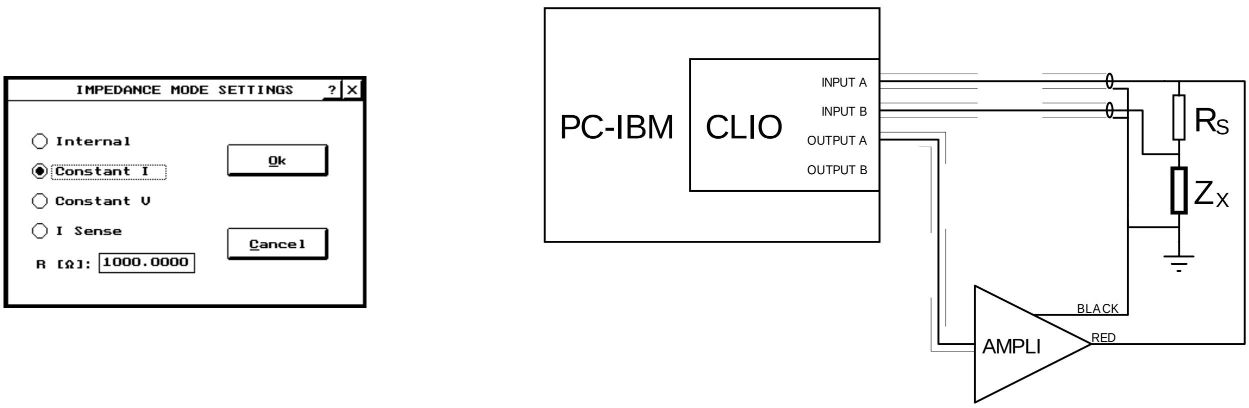



*FIGURE 11.6b – Impedance measurements with an external sensing resistor Rs in "Constant Current Mode"*

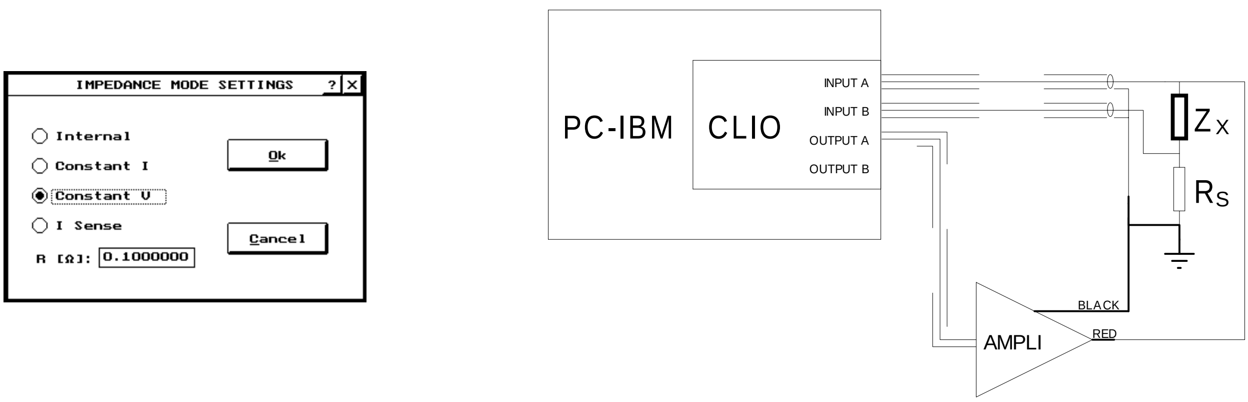



*FIGURE 11.6c – Impedance measurements with an external sensing resistor Rs in "Constant Voltage Mode"*

choice. It should be pointed out here that CLIO measures levels in both sensing points as complex values, that is real and imaginary part; therefore accuracy in case of linear devices is not affected by the ratio of sensing resistor to measured impedance as it would be with an RMS voltmeter.

## MEASURING IMPEDANCE WITH THE CLIOQC AMPLIFIER&SWITCHBOX

If you use this unit the Impedance Mode setting interact both with the unit's own custom control panel (see also 7.4.4) and the relative connections with CLIO. You can measure impedance in **Internal Mode** referring to Fig. 11.6d for connections and relative settings.
Should you use the **I Sense Mode** (available only for Model 2 and Model 3) please refer to Fig. 11.6e. The I Sense feature has general utility aside impedance measurements i.e. current distortion measurements driving loudspeakers; in case of impedance measurements theoretically doesn't differ from the Constant Voltage Mode measurement. However the known voltage gain and sensing resistor allow CLIO to perform the measurement with a very simple setup; the measuring level is left to the user; the CLIO input channel B has to be connected to the I Sense output of the amplifier.

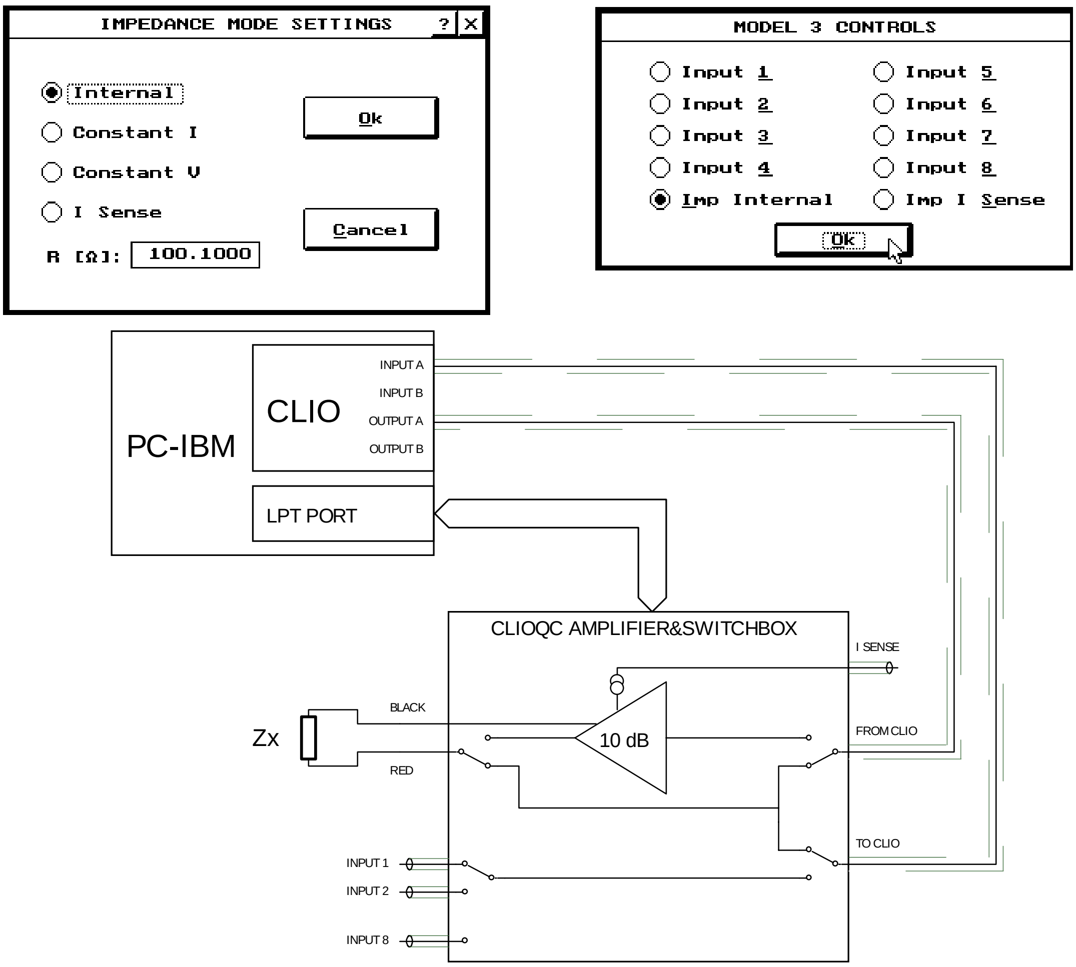



*FIGURE 11.6d – Impedance measurements with the CLIOQC amplifier in "Internal Mode"*

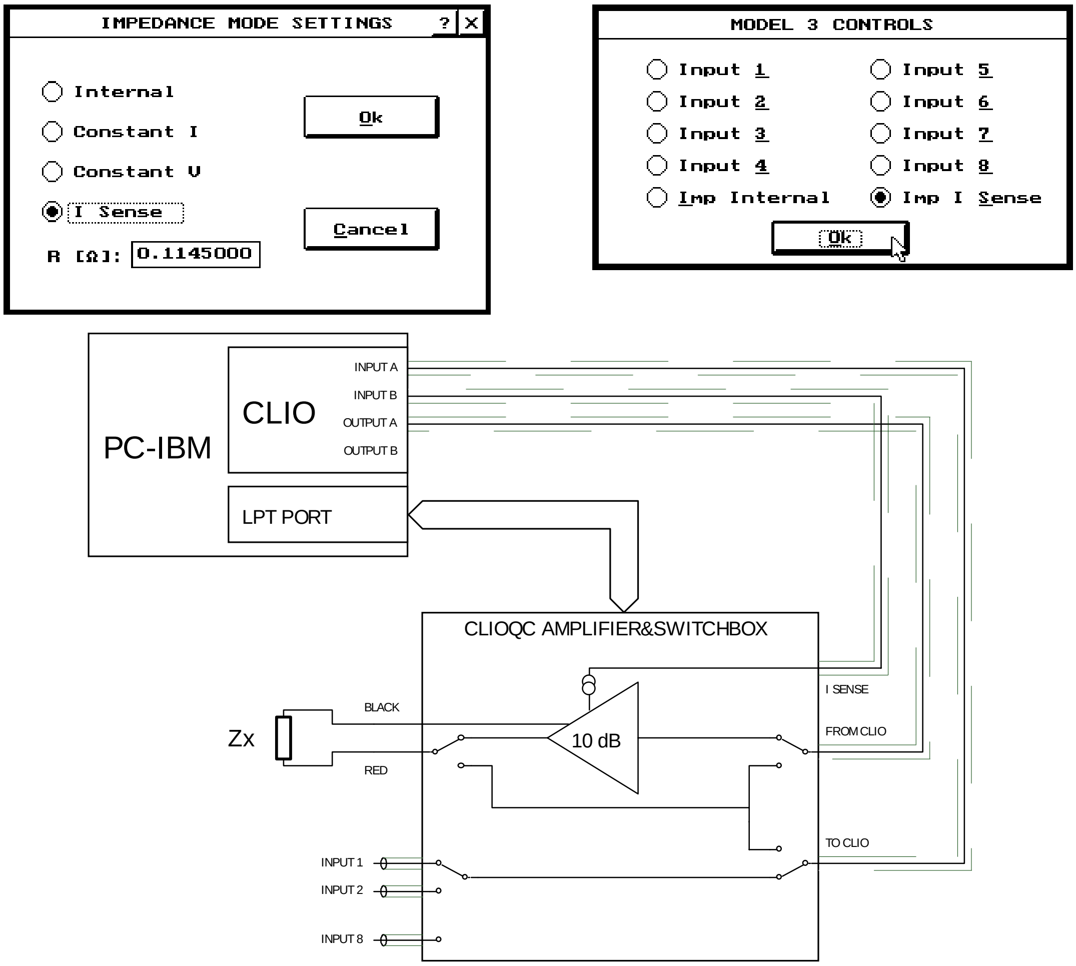



*FIGURE 11.6e – Impedance measurements with the CLIOQC amplifier in "I Sense Mode"*

**P**hase The phase curve will be activated and it will be plotted on the display. The "Over" button can be useful when you want to simultaneously display both the modulus and the phase curves. In order to do so, activate the overlap option, otherwise the display will only show the phase curve, and by pressing the button again, the modulus curve.

**O**ver Activates the overlay mode for plots. The curves are stored in a 10-curve FIFO buffer. Once the number of curves has reached 10, and the buffer is full, the oldest curve (in chronological order) will be replaced with the last executed or loaded measurement. By pressing the button another time, this option will be deactivated and the last executed or loaded measurement will remain on screen. It is possible to display the previously overlaid curves by reactivating this option, but if another measurement has been executed the curves will be lost.

**A**bout Used to add, display, and modify the text of a comment used to describe the measurement. The comment will be saved along with the measurement, and the print routine will print it along with the measurement.

**G**o Used to execute a measurement with the frequency range and resolution defined with "Settings". The measurement may be stopped at any moment by pressing the Esc key.

## 11.4 SPEAKER PARAMETERS

This option is used to obtain the mechanical and electrical parameters of the loudspeaker. Having chosen this option, the control panel screen shown in Fig. 11.7 will be displayed. Before moving on to the description of each option, we would like to offer a few words of advice. The automatic determination of loudspeaker parameters may induce the user to believe that he may ignore the many considerations that lie behind this type of measurement. This type of approach is highly inadvisable. Although loudspeaker parameter measurement achieved with CLIO is extremely accurate, no automatic procedure may completely substitute for the good sense and experience of an operator. At the end of this section we will quickly point out some hints that have originated from experienced CLIO users who worked with earlier releases of the software.

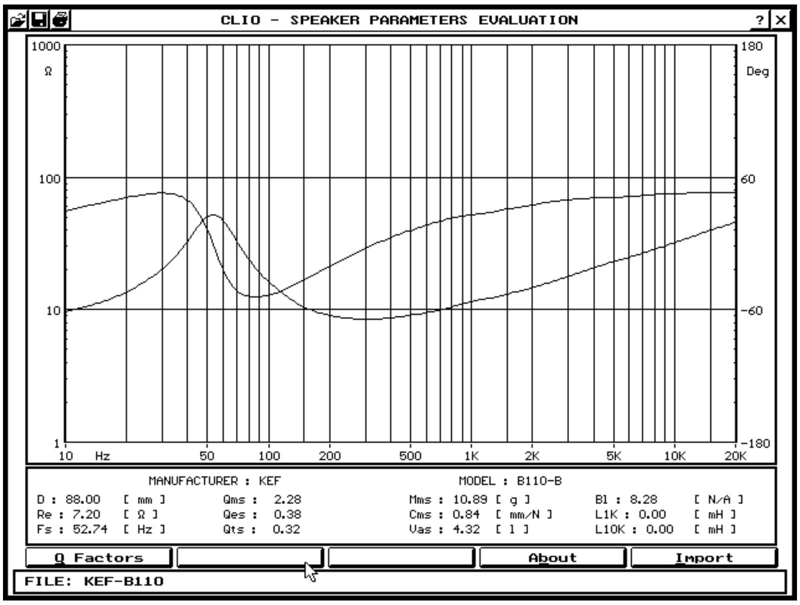



*FIGURE 11.7 – The Speaker Parameters control panel*

It has to be recognized that the parameters of a loudspeaker are deduced from an electrical measurement of its impedance. In all those cases in which a manual measurement based upon the same methods fails, for any given reason that cannot be further described, CLIO's automatic routines will also fail. Furthermore, the program asks for, and accepts without question, the weight of the added mass, the diameter of the speaker, or the volume of the test box. All of these parameters have to be chosen by the user after due consideration, as they must be related to the characteristics of the speaker. From this menu, as will be clear below, it is possible to evaluate speakers parameters importing data from the Impedance Analysis menu. However here only the Internal mode is supported.

### 11.4.1 FUNCTION BUTTONS

**Q** factors — Used to acquire the Qes, Qms, and Qts parameters of the loudspeaker measured in free air or in a closed box, and it is also a prerequisite for measuring the remaining speaker parameters. After the button has been pressed the program will request the manufacturer, model number, and Re (DC resistance of the loudspeaker). After this data has been supplied the program, if not in Import mode, will proceed to measure the impedance curve of the loudspeaker from 10 Hz to 20 kHz. This measurement is completely independent from the one that may be obtained through the Impedance menu command, and it will be saved along with the loudspeaker's parameters.

At the end of this process a plot of the impedance curve will be shown, and a Minimum Square Error routine the will determine Fs and the various Q factors. Once this has been completed the display will update to show the measured parameters. Should there be any anomalies present on either the impedance curve or the estimated parameters, it would be imprudent to accept the values and to proceed any further with the estimation process.

The following error-message may appear during the parameter estimation process: “Resonance Frequency not found”. This means that the program was unable to find the resonance frequency of the loudspeaker from the impedance curve that was measured. This may happen when, for example, the speaker for one reason or another does not present an impedance which is considered to be sufficiently reliable for use in the parameter estimation process. Another remote possibility is that the resonance frequency falls outside of the system’s range (12 Hz to 10 kHz).

**A**dded mass This button is not active, at first, because in order to proceed with this function (parameter estimation using the added mass technique) an impedance curve and its Q factors must have already been measured. After the button has been pressed the program will request the weight of the added mass and the diameter (in millimeters) of the loudspeaker (accepted ranges are 0.1–1000 grams for the mass and 15–1000 mm for the diameter). Once this data has been inserted the program will, if not in Import mode, begin to re-measure the loudspeaker’s impedance with the added mass and evaluate in the same way as before the new resonance frequency value, which has to be less than the original one, and all the other parameters are shown.

During this procedure the following error-message may appear: “Resonance with Added Mass not found”. This might happen if the loudspeaker’s Fs value with the added mass in place falls outside the available measurement range, or because the added-mass Fs value is too close to the loudspeaker’s natural resonance frequency. There are two reasons why this might occur: the size of the added mass is too small or the speaker suspension is too compliant. In the last case, although the parameters obtained are not complete, this is can be relatively important because the added air load mass contributed by the enclosure will serve to modify the loudspeaker’s parameters from their free air values. This will of course have an effect on the low frequency alignment of the system enclosure that is used.

**K**nown Box This button is not active at first, just like the Added Mass button. Once this button is pressed the program will request the volume of the box (in litters) and the diameter (in millimeters) of the loudspeaker. The acceptable range of values for the box volume is 0.1–1000 litres, while for the speaker diameter it is 15–1000 mm. Once this data has been supplied the program will, if not in Import mode, begin to measure the new impedance of the system comprised of the loudspeaker plus box and find a new resonance frequency. The error messages that may be displayed and their possible causes are, in principle, the same as those discussed in the Added Mass section.

**A**bout Used to add, display, and modify a text comment relevant to the measurement. This comment will be saved along with the measurement and the print routine will print them out together.

**I**mport When active redirects parameter evaluation towards files measured with the Impedance Analysis menu. By pressing Q factor an open file dialog box appears. Selecting the desired file speakers Parameters are evaluated using the same MSE routine described. The same happens pressing either Added Mass or Known Volume. Obviously in that case the file to select must have been done with one of the two methods.

### 11.4.2 ADVICE AND CAUTIONARY NOTES

As was stated before, a loudspeaker's parameters are deduced from an electrical measurement of impedance. Aside from the electrical parameters Re and Qes, there are acoustical and mechanical elements that act on the electrical part with greater or lesser contributions. Therefore, when performing loudspeaker parameter measurements a number of practical problems may arise, and we will now discuss these and offer some suggestions as to how they might be avoided.

When performing a loudspeaker parameter measurement you must always first verify that the impedance curve looks correct. Apart from the curve of the modulus of the impedance, take care that phase curve does not have any peaks or sharp variations with the exception of those that occur at the resonance frequency. Such anomalies may be introduced into the measured impedance by incorrectly supporting the loudspeaker. During a measurement, the base of speaker magnet structure should be placed on a stand that leaves a space of 30–40 cm from any boundary. Great care must be exercised to ensure that the first structural resonance frequency of the support base is much higher than that of the loudspeaker driver under test. This may be verified by inspecting the impedance modulus curve to see that it does not have spurious peaks.

If the peak in the impedance modulus at the resonance frequency is too smooth or does not exist, then CLIO will fail to determine both Fs and the loudspeaker's Q factors. Although this is most likely to happen with ferrofluid damped tweeters, it can also occur when measuring some midranges or woofers, but this is much less common. If such an error does in fact occur with a loudspeaker driver that you are trying to measure, then do not proceed any further with the measurement. In such a case the parameters of the loudspeaker may simply not be able to be electrically measured.

There are two possible methods used to measure the additional parameters other than the "Q" factors: adding a mass of known size and loading the speaker with a known air volume. We will proceed to describe some of the advantages and drawbacks inherent in the use of either of these two methods.

Irrespective of whether the added mass or known volume method is used, CLIO requires that the loudspeaker diameter be supplied as an input, and the accuracy of this value is quite critical because it is raised to the fourth power during the calculations. Nevertheless, the tolerance in this measurement acts directly on the Vas value when the added mass method is used, and directly on the Mms value when the known volume method is used.

The added mass must have the widest possible support-base and must not be magnetic. A good choice is the use of a roll of tape that may be unrolled to form masses of different weight. Regarding the weight of this mass we suggest that you choose a value similar to the Mms value of the speaker. However, you should check that the displacement of the cone after the application of the added mass is less than 1/10 of the Xmax value of the driver (maximum linear cone excursion capability). If not, then reduce the size of the mass.

The advantage of a mass greater than the driver's Mms is that, usually, it is not necessary to glue the mass to the cone. You may verify that the mass is correctly applied by taking an impedance measurement from the Impedance Analysis control panel without losing the data that has been acquired up to this point. It is also suggested that you save the measurement executed up to now.

Because the known box method directly determines the Vas value, and that is one of the main parameters that is directly used along with the Q factors, it might seem to be the preferred method. Nevertheless, there are a number of possible drawbacks that can arise from the use of this method. They include the following: box losses due to air leaks; internal standing waves developed within the enclosure; structural resonance of the enclosure panels; the amount of air that moves together with the cone depends, among other things, on the shape of the box. All of these factors can work to reduce the accuracy of the parameter estimates unless care is taken when selecting a suitable enclosure. Also, if loudspeaker drivers with a wide range of Vas values are being measured, then a number of different enclosure volumes may be necessary to obtain the best possible results; in general, drivers with a large Vas value will need to be measured in a box that also has a relatively large volume.

Should also be evident that a loudspeaker is a transducer. Any source of noise will be converted in electrical signal and will affect the measure. This is worst with single tone noise. As already pointed out Clio analyze the signal with a very sharp digital band-pass filter tuned on the generated frequency and has therefore a very high immunity to this problem. A quite environment is anyway suggested. Also, using Internal mode User has not control over measure level. The level chosen further reduced from the ratio between the 100 ohm output impedance guaranteed the measure is within the linear behave of the device. In Import mode importing measure executed either in Constant I or in Constant V mode the measure level is completely user defined. Make your own experience but parameter may change a lot towards level. Furthermore in real application a loudspeaker is connected to an amplifier which usually is a constant voltage source. In Constant I mode voltage at the speakers terminals changes with frequency in a not predictable way. In Constant V mode once the level is defined this will be nearly the same at all frequency greatly simplifying the definition of a standard level.

### 11.4.3 SPEAKER PARAMETER SYMBOLS

Bl product between magnetic flux density and length of voice coil conductor

D effective diameter of driver diaphragm

Fs resonance frequency of driver

L1K inductance of voice coil at 1 kHz

L10K inductance of voice coil at 10 kHz

Mms total moving mass

Qes Q of driver at Fs considering electrical resistance Re only

Qms Q of driver at Fs considering non electrical resistances only

Qts total Q of driver at Fs considering all system resistances

Re dc resistance of voice coil

## 11.5 DISTORTION

**NOT available in Lite version!**

From within this menu it is possible to measure distortion Vs level or Power (Fig.11.8). Four Standards are available, THD, SMPTE, DIN and CCIF.

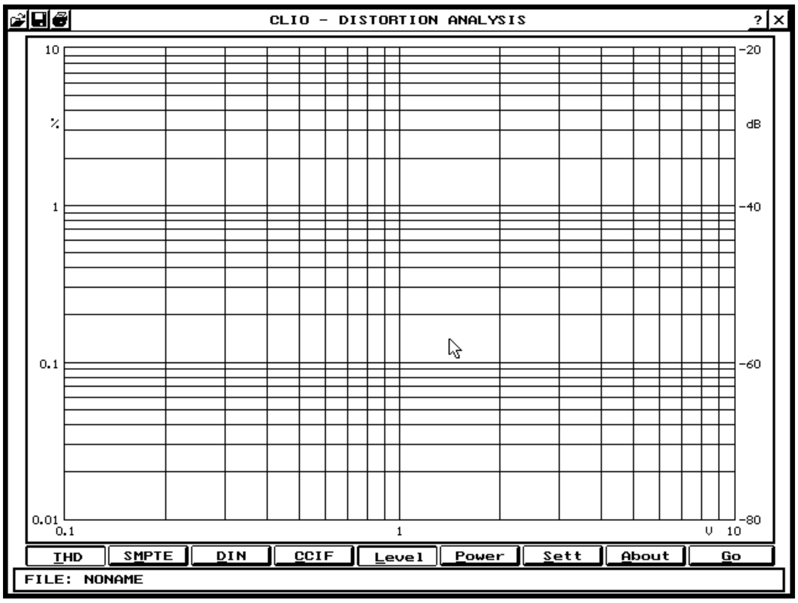



*FIGURE 11.8 – The Distortion control panel*

### 11.5.1 FUNCTION BUTTONS

**T**HD — Standard THD, Total Harmonic Distortion is Selected. Test Frequency is selected from within the Distortion Settings control panel as described below. THD is analyzed via spectrum analysis and the result value should be lower than in the THD+NOISE analyzer working with fundamental rejection concept.

**S**MPTE — Activates the SMPTE standard intemodulation distortion test. Two tone are generated, at 75Hz and 7kHz with an amplitude ratio of 4:1. Intermodulation is analyzed with spectrum analysis.

**D**IN — Activates the DIN standard intemodulation distortion test. Two tone are generated, at 250Hz and 8kHz with an amplitude ratio of 4:1. Intermodulation is analyzed with spectrum analysis.

**C**CIF — Activates the CCIF difference frequency distortion test. Test signal are two tones, 1kHz apart.

**L**evel — Activates plot of distortion Vs. level in Vrms.

**P**ower — Activates plot of distortion Vs. power in Watt.

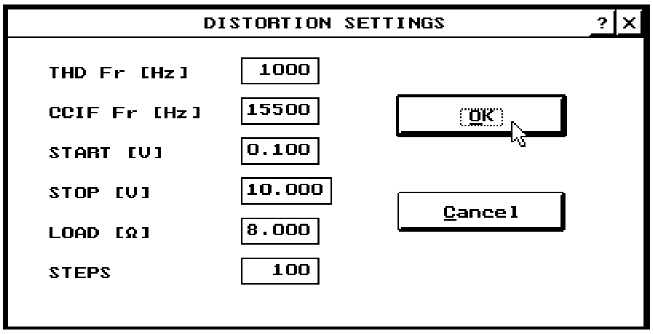
**S**ett — It opens the Distortion Settings control panel.

**A**bout — Used to add, display, and modify the text of a comment used to describe the measurement. The comment will be saved along with the measurement, and the print routine will print it along with the measurement.

**G**o — Used to execute a measurement with the frequency range and resolution defined with “Settings”. The measurement may be stopped at any moment by pressing the Esc key.

### 11.5.2 DISTORTION SETTINGS

Several numeric input field define the needed parameters.




THD Fr — is for the frequency of THD measurements; it may range from 10Hz to 5kHz.

CCIF Fr — is for the frequency of CCIF measurements; the CCIF frequency typed in is in the center of the two. As an example typing a frequency of 15500Hz Clio will generate two tones at 15kHz and 16kHz. Admitted values are from 7kHz to 20kHz.

START and STOP — are for levels, in Volts or Watts, at which the measure should start and stop. Measurements stops anyway if distortion exceed 10%. Should be noted that the maximum output of Clio is 3.1 Volts RMS with sinusoidal signal. When the measure starts Clio checks for the D.U.T. gain at the lowest level. The maximum Stop level can never exceed, in Volts, 3.1*Gain.

LOAD — used only if Power is selected, define the value in ohm of the load connected to the D.U.T.. This value is used to calculate the output power and should never be 0.

STEPS — define the number of steps between START and STOP; it has therefore effect on measure speed.

### 11.5.3 WARNINGS

Performing distortion test, especially with power devices, requires caution. Heavy overload of the D.U.T. should always be avoided and START and STOP limits must be chosen with care. Understanding for any test the kind of signal Clio will generate is a must. These signals are either a single tone for THD, or a two tone for SMPTE, DIN and CCIF. From the Generator and Level Meter control panel any of this signal can be generated and the D.U.T gain easily measured. FFT analysis should be used for evaluating overload level and general performance. Finally some care should be used in interpreting level and power with different test signal. Distortion, any of the four available, is plotted again level (X axis of the graph). Level is intended in Volt RMS; power is intended as squared level divided for the load. If distortion is caused by D.U.T. saturation, this is usually related more to the peak value of the signal than to its RMS value. The two extreme cases are THD and CCIF; in THD cases the Peak/RMS ratio of the signal is 1.41, in CCIF case is 1.98 that is 3dB higher. As a consequence saturation occurs for lower RMS level with CCIF.

## 11.6 POLAR

**NOT available in Lite version!**

This option is used to measure sound level at different angles from a sound source at a given frequency. Fig.11.9 shows the Polar control panel. Both manual and automatic rotation device are handled from Clio. As automatic rotation device the Outline model ET1 - ST1 automatic electronic turntable is controlled via LPT port. The measurements is performed with sinusoidal stimuli at any frequency from 10 to 20kHz and an automatic gated acquisition; it therefore allows to perform anechoic polar plot in normal rooms with the same low frequency limitation already described for MLS and gated sinusoidal Frequency Response.

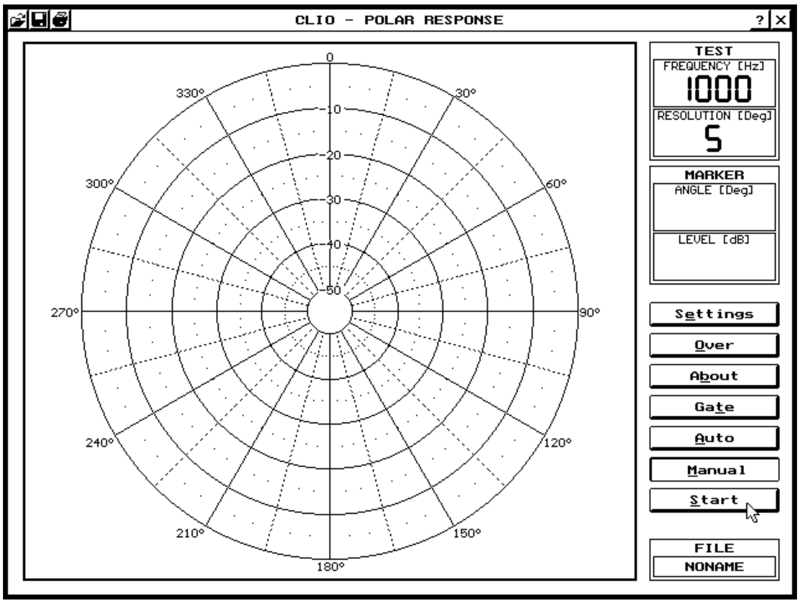
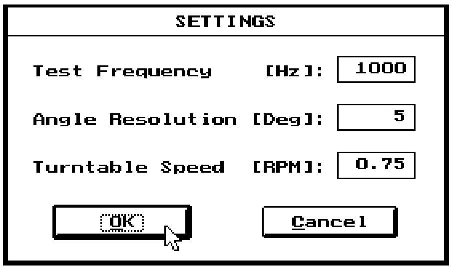



*FIGURE 11.9 – The Polar control panel*

### 11.6.1 POLAR SETTINGS

Pressing the S**e**ttings button from the Polar control panel the dialog box shown with the following input fields appears.




Test Frequency

Defines the frequency for the polar plot. The range is from 10Hz to 20kHz. The default value is 1kHz.

Angle Resolution

Defines in how many steps the 360 degrees rotation is divided. The default value is 5 degrees. This means that the measurement is performed in 360/5=72 steps. The admitted range goes from 1 to 360 degrees. Obviously measurement speed is hardly related with the resolution.

Turntable speed

Defines the time Clio should wait between steps. This time allows the turntable to reach the new position. The default value is 0.75 RPM (round per minute). This field is ignored in manual mode.

### 11.6.2 OTHER FUNCTION BUTTONS

**O**ver — Activates the overlay mode for plots. Two curves can be displayed, that is the one in memory and the previous one that appears with dashed line in a different colour.

A**b**out — Used to add, display, and modify the text of a comment used to describe the measurement. The comment will be saved along with the measurement, and the print routine will print it along with the measurement.

**A**uto/**M**anual — This two buttons works in or mode and are used to tell Clio if an automatic turntable is present or not. In manual mode Clio prompts the user at any angle step. In Automatic mode Clio at every step sends the control signal to the turntable via the LPT port and waits for the time defined in the Turntable speed input field.

Ga**t**e — Allows gated measurements (see 11.2.1). The acquisition delay is always automatically calculated.

**S**tart — Start the measurements. Always check the output level from the Generator and Level meter control panel at the selected frequency.

### 11.6.3 MEASUREMENT INFORMATION

Once a measurement has been executed it is possible to inspect it with the aid of a circular marker.

Also displayed are several information that characterize the measurement:

0 dB — Maximum acquired value to which reference the 50 dB amplitude scale.

-6dB angle — Coverage angle.

Q — Directivity factor.

DI — Directivity index.