

## INTRODUCTION

The Cal/Config software application for mARK2™ enables the calibration and configuration of Gennum Digital hearing instruments.

The software uses a set of software building blocks called The Manufacturers' Application Resource Kit™ or mARK2™. These building blocks work "behind the scenes" to perform device calibration at final test using standard test equipment.

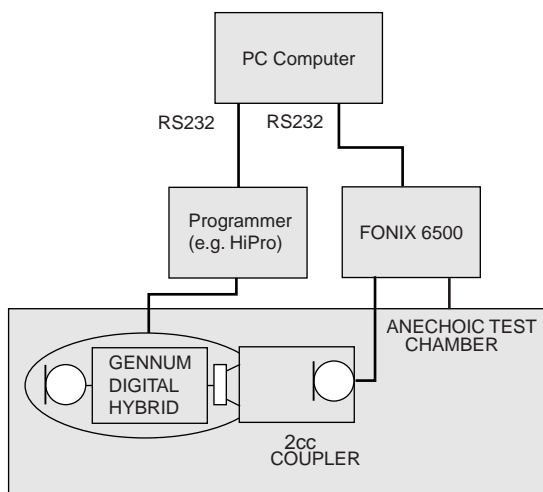


Fig. 1 Typical Test Equipment Configuration

Figure 1 shows a typical connection of the test equipment at final test. The fully completed shell of the hearing instrument is coupled to the Frye measurement microphone in the usual manner with a 2cc coupler and connected to the programmer with an appropriate programming cable. Although this procedure can be adapted to work with any test equipment, it has been developed to work primarily with the following standard equipment:

- Frye FONIX 6500 Hearing Instrument Test System equipped with the RS232 interface (earliest tested release of Frye firmware is ver. 4.21E)
- Interacoustics TBS25 (or similar B&K model) anechoic test chamber
- Programming box (eg. HiPro, Microcard, Gennum DSP programmer)
- PC running Windows 95/98/2000/NT/XP

The Interacoustics chamber is recommended over the Frye chamber as it provides better acoustic isolation. However, as long as an adequate signal-to-noise ratio is obtained, any test box will suffice. A minimum of 40dB SNR is required to obtain a 0.1dB accuracy.

## SOFTWARE INSTALLATION

Upon installing ARKbase™, a shortcut to Cal/Config2 is created under the Manufacturing Tools folder (all folders discussed here are sub folders of the Gennum folder under the Start Menu). The Frye FONIX 6500 Configuration Tool, Workstation Manager, and mARK Conversion Tool are under the Configuration Tools folder.

## FRYE FONIX 6500 CONFIGURATION TOOL

Before performing calibration and configuration of Gennum digital hybrids, it is necessary to run the FONIX 6500 Configuration Tool so that the Cal/Config software application will know which COM port to use for communication with the FONIX 6500 and what timeout value to use when communication occurs; otherwise, a communication failure will occur. The default value for the timeout is one second and it is recommended that this value be used unless communication errors occur.

The COM port can be found by clicking the Start Menu, Settings, and Control Panel. Choose the System icon and change to the Device Manager tab. Here, under Ports (COM & LPT) the available COM ports can be checked. The COM port can be an integer value from 1 to 15 and the timeout must be a positive value in milliseconds.

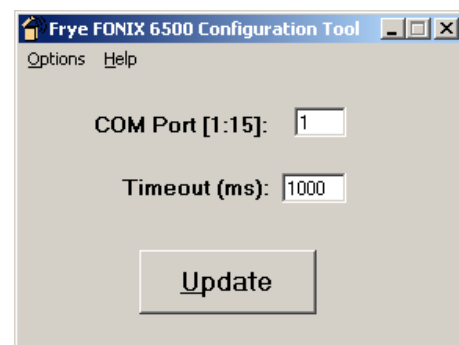


Fig. 2 Frye FONIX 6500 Configuration Tool

## WORKSTATION MANAGER

The Workstation Manager is a software application that sets any workstation specific options. It is designed to replace the Options form in previous versions of Cal/Config.

To set up the default settings for a workstation:

1. Open the Workstation Manager.
2. Fill in the settings for the various workstation related options or click "Open File" to open and edit an existing .wrk file.
3. Click "Save Settings" to save all settings to a .wrk file.
4. Click "Exit" to close the program.

The options available in the Workstation Manager are:

- Stimulus and Measurement device
- Programmer
- The default ear to communicate through
- Verify if burn operations were successful
- Display calibration results to the operator in the instructions window of Cal/Config
- The configuration directory where Cal/Config will search for .ids files
- Show background which displays the splash background
- A log file, which must be specified with a path, to store the calibration results
- Report Errors to Operator. This can only be disabled if logging to file is chosen.
- Max Noise Level which is the maximum noise measure allowed before each calibration step takes place
- The stimulus level. This is a composite signal which is applied by the stimulus device after calibration

The .wrk created in the Workstation Manager is then referenced in Cal/Config using the /WorkFile command line parameter (see the Cal/Config Command Line Parameters section for further details). To avoid using a command line parameter to access the .wrk file, save the file in the same directory as CalConfig2.exe as "worksetup.wrk".

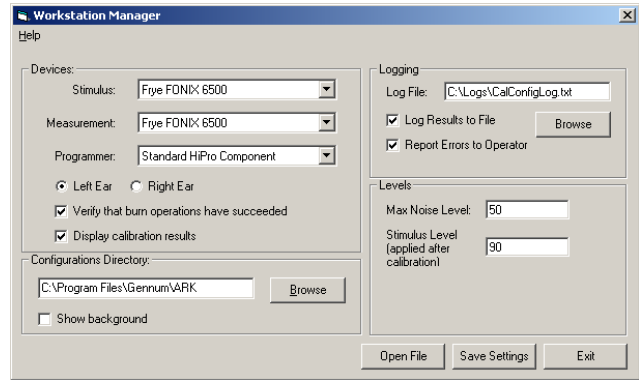


Fig. 3 Workstation Manager

## CAL/CONFIG AND IDS

Setting up the calibration parameters was done in the Engineering Mode in previous versions of Cal/Config. To increase the simplicity of the Cal/Config software application, setting up calibration parameters has been relocated to IDS. Only the .ids file needs to be created to perform calibration and configuration on Gennum digital hybrids. The IDS also contains a scratch editor so that the scratch data can be edited and saved to the configuration file.

### CALIBRATION SETUP IN IDS

The calibration setup section can be opened from Cal/Config -> Setup... on the menu. Selecting this menu item will open a new form with a series of tabs corresponding to the calibration options available for the selected product. For instance, a PARAGON product will have directional calibration options available while a FOUNDATION product will have trimmer calibration options available. Once all of the options are selected in the calibration setup, press OK and save the .ids file. The calibration setup options will be included in the saved .ids file.

### General

All products will have a general calibration tab. This tab allows for the set up of general options for a product configuration.

The general options will include:

- Configure scratch area (See the Scratch Editor section)
- Use serial number as the first four bytes of the scratch area. This is entered in the serial number box in Cal/Config and will overwrite the first four bytes stored in the scratch editor.

- Use control parameter values from Memory Configuration which brings in the control data from the .ids file, if it exists, and burns it into the hearing instrument during the configuration process of Cal/Config.

- Set the active memory after the calibration process
- The configuration type. The value entered should correspond to a value in the "Select Calibration Type" combo box in Cal/Config so this file will appear in the "Select Configuration" combo box when that option is selected in the "Select Calibration Type".

NOTE: Calibration types can be defined in the ConfigFile.txt file located in the root directory where ARK was installed. The default configuration types are BTE, ITE, ITC, CIC.

- Static or momentary memory select

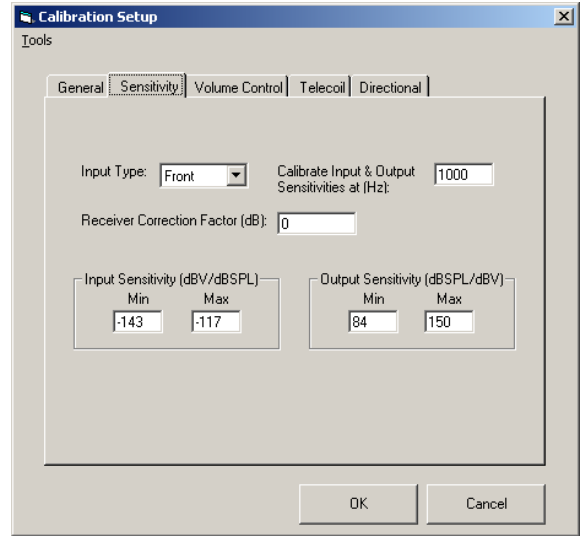


Fig. 5 Sensitivity Calibration Setup

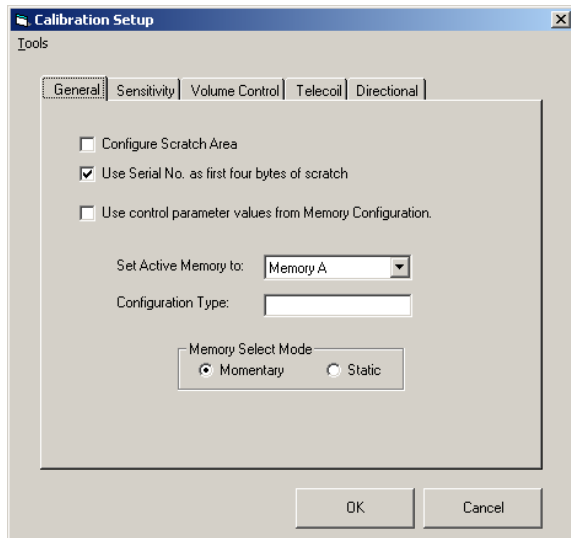


Fig. 4 General Calibration Setup

**Sensitivity**

The sensitivity calibration setup options determine how to perform calibration of the input and output transducers. The sensitivity options include:

- Input type which selects the input transducer to be used for the sensitivity calibration.
- The source frequency to use when calibrating the transducers (specified in Hz)
- The receiver correction factor. This is specified in dB and will be subtracted from the receiver sensitivity when calibration is performed.
- The input and output sensitivity ranges. If the sensitivity measured falls outside of the respective transducer range, an error will be reported and the calibration process will stop.

**Volume Control**

The volume control calibration setup determines whether or not to calibrate the external volume control. Selecting the calibrate volume control check box will calibrate the volume control. For FOUNDATION products, the choice can be made to use two terminal or three terminal volume controls. For PARAGON products, this option is not available.

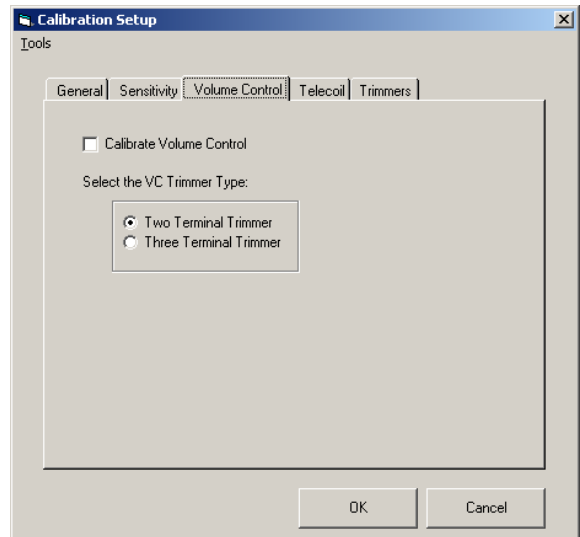


Fig. 6 Volume Control Calibration Setup

**Telecoil**

The telecoil calibration setup determines how to perform calibration of the telecoil.

The telecoil options include:

- Calibration of the telecoil. All other options on this tab become enabled once this is checked.
- Prompt for repositioning of the telecoil during calibration. This is because some anechoic test boxes, such as the interacoustics box, have their magnetic coil located along the side of the box rather than in the centre where the hearing instrument is initially positioned for maximum acoustic pickup.
- The telecoil sensitivity range. If the sensitivity measured falls outside of the specified range, an error will be reported and the calibration process will stop.
- Telecoil gain adjustment. This is specified in dB and will be subtracted from the telecoil sensitivity when calibration is performed.

NOTE: Calibration of the telecoil can be avoided altogether by specifying a certain amount of gain to be applied in the telecoil path. This can be set up through ARKonline™ as a constant or it can be a slider where the gain can be set using an application such as the IDS. The gain can be set anywhere from -10 to 23dB.

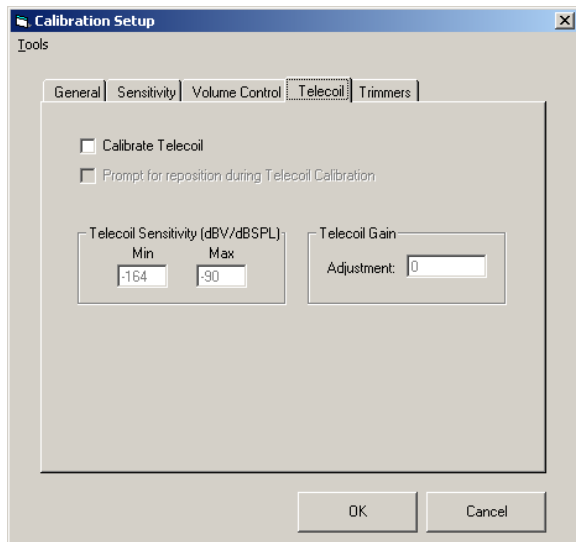


Fig. 7 Telecoil Calibration Setup

**Directional**

The directional calibration setup determines how to perform FRONTWAVE™ calibration.

NOTE: This tab is available for PARAGON products and is removed for FOUNDATION products.

The directional options include:

- Enabling the calibration of FRONTWAVE™. All other options on this tab become enabled once this is checked.
- Specifying the microphone spacing. This is entered in mm.
- The expected null depth. Enter into this grid the frequency and reduction pairs. After FRONTWAVE™ calibration takes place, the hearing instrument is configured into bi-directional mode and the null depth is measured at the frequencies specified. This value is compared against the reduction value in the grid for the corresponding frequency. If the null depth is less than specified, an error will be reported.

NOTE: Once a frequency and reduction pair are entered into the grid, a new row will appear allowing for more data to be entered.

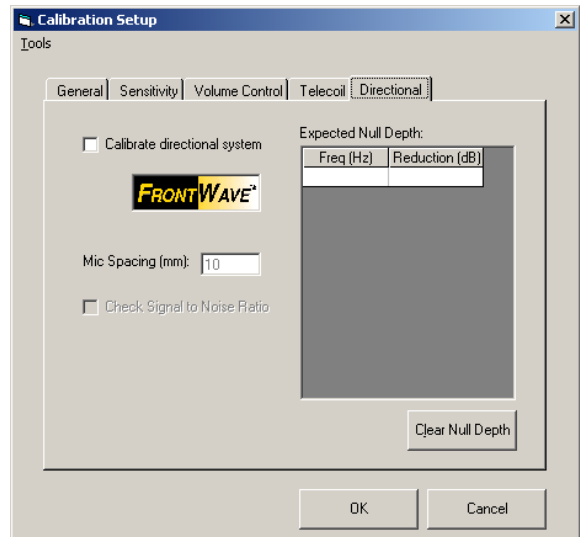


Fig. 8 Directional Calibration Setup

### Trimmer

The trimmer mode calibration setup determines how to configure trimmers.

NOTE: This tab is available for FOUNDATION products and is removed for PARAGON products.

The directional options include:

- Enable the calibration of trimmers
- Calibrate trimmers as two terminal or three terminal
- Check trimmer connections after configuration. This is a check to ensure that the connected trimmers are functioning properly. The trimmers can be checked at  $V_{REG}$  or GND. Depending on the selection, position the wiper of the trimmer to the respective position before calibration and configuration. If the trimmer is not connected properly or the wiper is not positioned properly, an error message will be displayed.
- Secondary verification of trimmers. This option checks that multiple queries of the trimmer setting return consistent results. If the trimmer is not consistent, an error message will be displayed.

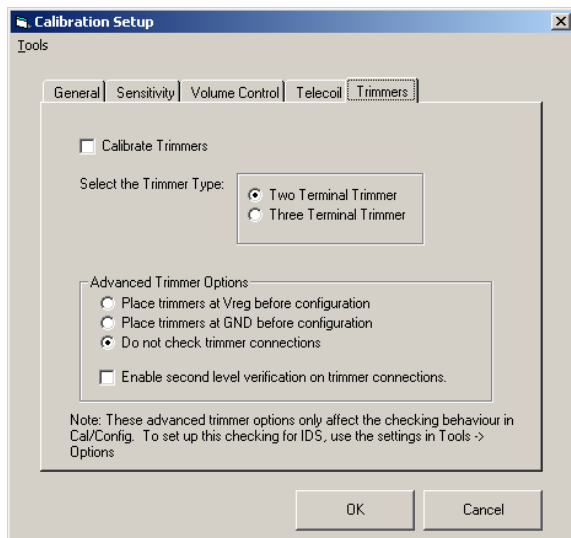


Fig. 9 Trimmer Calibration Setup

### Acoustic Calibration Bypass

All calibration routines are set by default to be performed acoustically. This option can be changed in the acoustic calibration bypass section. It is available from the Tools->Acoustic Cal Bypass... menu item on the Calibration Setup form.

The options available are:

- Skip acoustic calibration.
  - NOTE: The acoustic calibration and bypass mode are mutually exclusive. That is, only one can be chosen for a configuration.
- The microphone sensitivity (in dBV/dBSPL). This value will be assigned to the part in place of the sensitivity that would be determined in the acoustic calibration.
- Assume the device's microphone matches the microphone model. Checking this check box will set the microphone sensitivity to 0 and this assumes that the microphone matches the model.
- The receiver sensitivity (in dB SPL/dBV). This value is similar to that of the microphone.
- Assume the device's receiver matches the receiver model. This is similar to that of the microphone.
- The telecoil sensitivity (in dBV/dBSPL). This value is similar to that of the microphone.
- Assume the device's telecoil matches the telecoil model. Checking this check box will set the telecoil sensitivity box to 0. The value burned into the part will be assigned to 20dB less than the sensitivity of the microphone.

NOTE: For telecoil calibration, the calibrate telecoil check box on the telecoil tab must still be checked for telecoil calibration to take place.

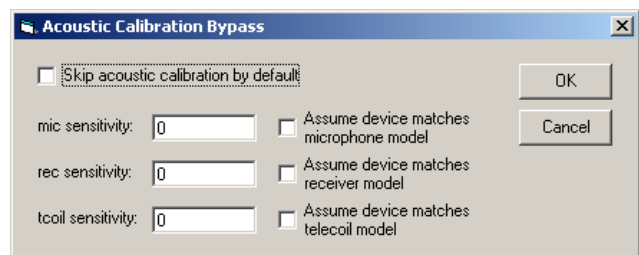


Fig. 10 Acoustic Calibration Bypass

## SCRATCH EDITOR

The scratch editor can be opened in the IDS from Cal/Config -> Scratch Editor... on the menu. The scratch editor will display 128 bytes per page and will show as many pages as necessary to expose the number of bytes of scratch information that the chosen product can have. The information can be entered into the scratch editor in binary, decimal, hexadecimal, and ASCII.

Scratch files created for older versions of Cal/Config can be opened in the editor using the Import .txt Data button.

If a connected device has been initialized in the IDS, the read and write buttons in the editor will be enabled and the device's scratch contents can be read into the editor or burned from the editor by pressing the read and write buttons respectively. When a connected device's scratch memory is burned and the "Use Serial No. as first four bytes of scratch" is selected in the Cal/Config Setup section, the Serial No. text area will be burned to the part.

NOTE: The value entered for the Serial No. is only intended to be used when burning to an attached device. This value will not be saved to the .ids file.

Once the data has been set in the scratch editor, pressing OK and saving the IDS configuration to a .ids file will include the scratch data. Alternately, opening up a .ids file will fill the scratch editor with the contents of the file.

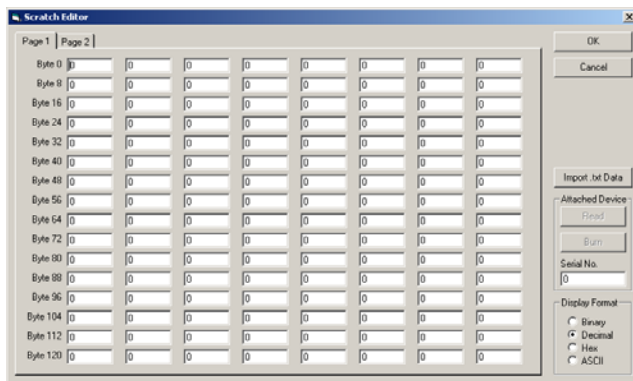


Fig. 11 Scratch Editor

## CAL/CONFIG

Cal/Config has been simplified to contain only what was referred to as the Production Mode in previous versions of Cal/Config.

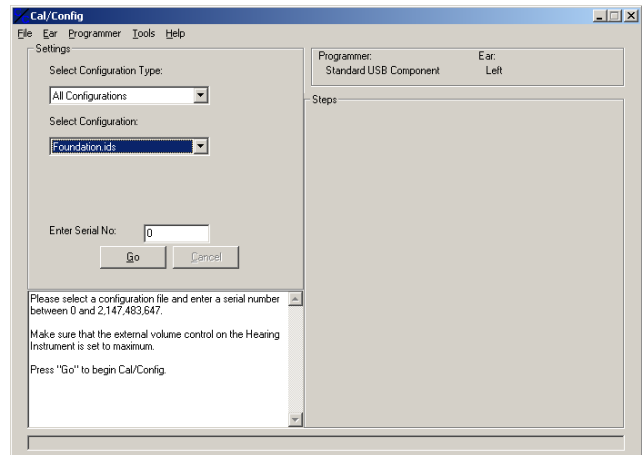


Fig. 12 Initial View of Cal/Config

## MENU ITEMS

The File menu item contains two sub-menu items. Refresh Files and Exit. The Refresh Files option refreshes the Select Configuration combo box with the contents of the configuration directory. This is because files created and saved in the IDS after Cal/Config is opened will not be visible until Refresh Files is pressed.

The Ear and Programmer menu items select the ear and programmer. The ear and programmer are initially set to their respective values from the selected .wrk file (see Cal/Config Command Line Parameters). The currently selected programmer is also displayed in the upper right hand corner of the Cal/Config form.

The Tools menu item has four sub-menu items: Force Single Acoustic Cal, Check Calibration, Manual Calibration..., Reset Factory Defaults. All of these items become available once a configuration is selected in the Select Configuration box.

Pressing Force Single Acoustic Cal will force acoustic calibration to take place on the next hearing instrument which is calibrated. This option is reset after the next calibration process. This has been implemented so that an .ids file can be set to perform bypass acoustic calibrations but the operator can still execute an acoustic calibration with the same file.

Check Calibration contains sub-items which are relevant to the device contained within the configuration file in the Select Configuration box. Pressing one of the check calibration options will check if the selected option is calibrated in the connected device. The results will be returned in a message box.

Pressing Manual Calibration... opens a form which performs manual calibration. In the Manual Calibrate form, select a calibration element and a series of input parameters will be displayed for that element. For example, pressing Input Sensitivity displays Raw Sensitivity in the Input Parameters box. Enter appropriate values for the input parameters and press Set after entering each parameter. Once all the parameters are assigned, press GO. The calibration element selected will be programmed into the device.

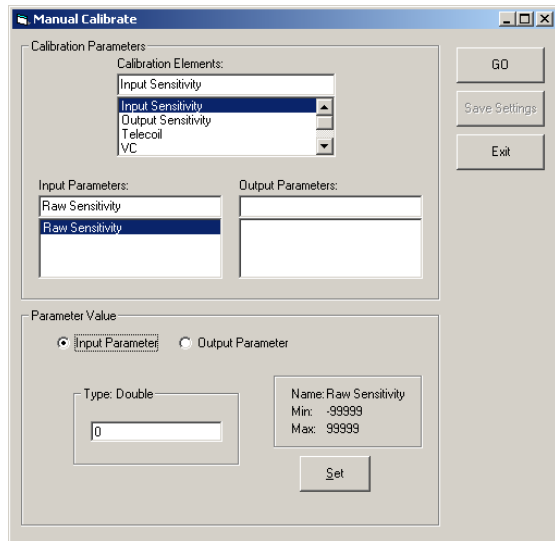


Fig. 13 Manual Calibrate

Reset factory defaults will reset all calibration parameters in the connected hearing instrument. This is useful when evaluating the benefits of calibration.

**PERFORMING CALIBRATION AND CONFIGURATION**

Calibration and configuration can be performed with the following steps:

1. In the Select Configuration Type box, select the configuration types to be displayed in the Select Configuration box. Those files which were saved with their Configuration Type (on the General tab of Cal/Config in the IDS) matching this selection will be displayed in the Select Configuration box. The default is All Configurations.
2. In the Select Configuration box, select the configuration file to use.
3. Enter a serial number if Use serial no. as first four bytes of scratch was selected in the configuration file. The serial number can range from 0 to 2,147,483,647.

4. Press Go (it will become enabled at this point)
5. If applicable, make sure that the telecoil is pointed perpendicular to the magnetic field in the anechoic test box before beginning or when prompted to do so.
6. Pressing cancel at any time during the calibration and configuration process will cancel the process. Please be patient with the response of the program returning control since the system cannot interrupt a single step mid way through. The system will cancel once the step is completed.

NOTE: If /TrimDisplay (see the Cal/Config Command Line Parameters section) is used and a FOUNDATION product is selected in the Select Configuration box, a series of trimmer combo boxes will be displayed at the bottom of the form. These combo boxes will initially be set to the trimmer assignments defined in the .ids file. The trimmers can be reassigned by changing the combo box settings before pressing Go.

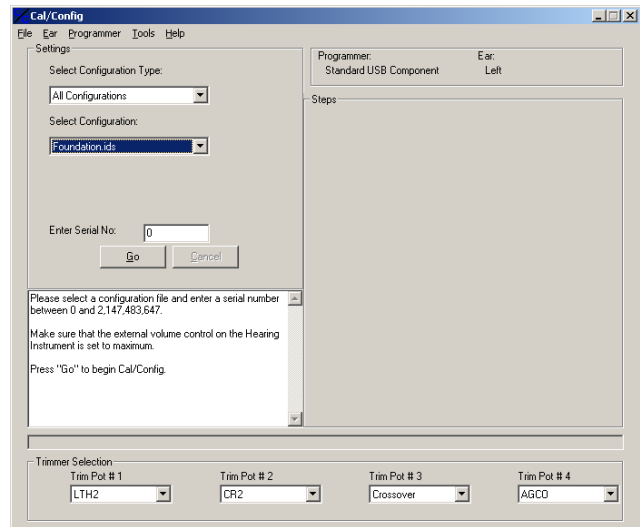


Fig. 14 Cal/Config with /TrimDisplay

After each step is completed, a green check mark will indicate that the step completed successfully. If a step does not complete successfully, a red X will appear. If the user has not deselected "Report errors to operator" in the Workstation Manager, then Cal/Config will stop and display an error message. Otherwise, it will display the red X but will continue the calibration and configuration process. Upon completion, the form will indicate that the process was successful and the user can begin the process for another hearing instrument.

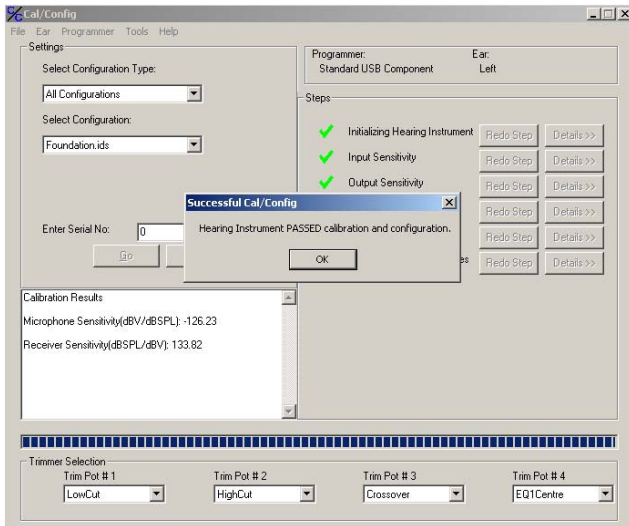


Fig. 15 Successful FOUNDATION Calibration and Configuration

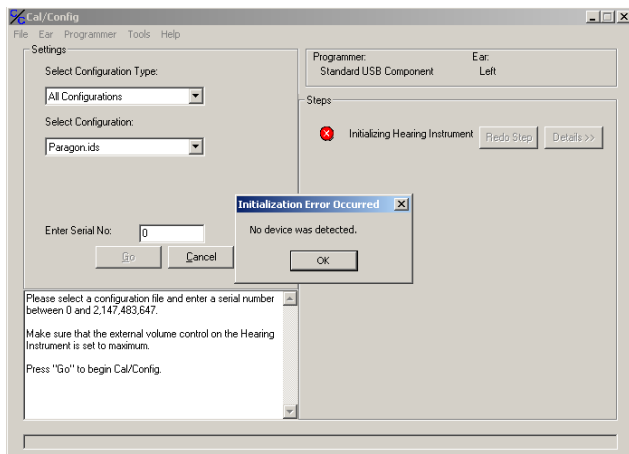


Fig. 16 Unsuccessful PARAGON Calibration and Configuration

## CAL/CONFIG COMMAND LINE PARAMETERS

Cal/Config can be run with several command line parameters to enhance the capabilities of the application. To use the command line parameters, create a shortcut to Cal/Config2 on the desktop. Right click on the shortcut and select properties. Modify the target to add the desired command line parameter(s). For example, to use the /TreeStruct command line parameter, set the target to:

```
"C:\Program Files\Gennum\ARK\CalConfig2.exe" /TreeStruct.
```

NOTE: The command line parameters are not case sensitive.

The command line parameters available for Cal/Config are:

- /NoLogo — This option removes the Gennum logo from being displayed on startup.
  - /TreeStruct — Enables the tree structure selection setup for Cal/Config (see the Tree Structure section)
  - /SkipMemX — Skips burning memory X where X = B, C, D. For example, to skip burning memory D use /SkipMemD.
  - /ShowMems — This displays a menu item which allows an operator to select which Paragon or Duet memories to skip without having to restart the application to specify a different set of /SkipMemX arguments. If the user runs the program with /SkipMemX arguments, those settings are the defaults that appear in the menu list. If no /SkipMemX arguments are included, then no memories will be skipped as default.
  - /WorkFile — Causes a dialog box to appear on Cal/Config startup. Select a .wrk file created in the Workstation Manager.
- NOTE: This option only needs to be run once since the application will remember the most recent .wrk file selected.
- /ForceAcoustic — This forces all calibration routines to be done acoustically. That is, all acoustic bypass settings will be ignored and the calibration routine will instead be done acoustically.
  - /TrimDisplay — This option displays the trimmers for trimmer based FOUNDATION products.
  - /QuickConfigureChars=X — The maximum number of characters to allow in the quick configure box in tree struct mode. X is the maximum number of characters that can be entered. For example, to allow a maximum of five characters to be entered, use QuickConfigureChars=5.

## TREE STRUCTURE

Cal/Config can be run in default mode or in tree structure mode. Tree structure mode allows operators to select configuration files based on defined criteria rather than selecting the files from a list. The selections chosen will point to a configuration file.

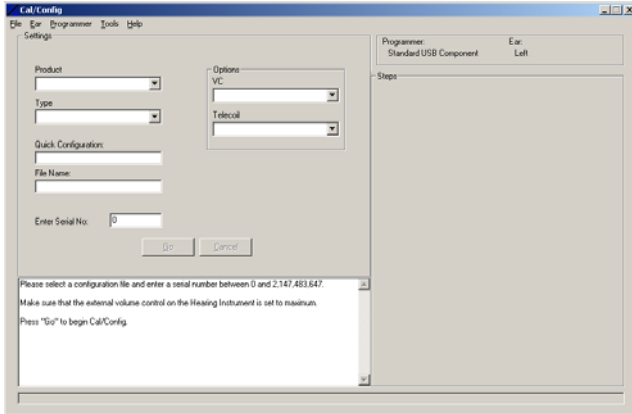


Fig. 17 Default Tree Structure

The default tree structure has two selections, Product and Type, and two options, VC and Telecoil. An operator would select a product and then, based on the selected product, a set of types would be displayed in the type box. The options can be selected as yes or no but depending on the selections in the Product and Type boxes, these options may not be applicable and will be disabled. For example, selecting PARAGON as the product and CIC as the type, VC and telecoil are disabled.

Once the selections are chosen, a file will appear in the File Name box and Go will become enabled. Calibration and configuration can proceed by pressing Go and the hearing instrument will be calibrated and configured with the file in the File Name box. If a configuration is not defined for the selected setting, a message box will indicate that the selection is invalid.

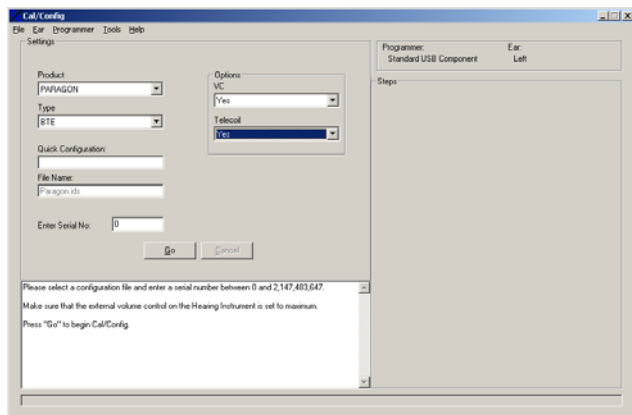


Fig. 18 Configuration selected from the tree structure

Tree structure settings can also be chosen with the Quick Configuration box. Enter text into the Quick Configuration box and press Enter. If the configuration is recognized, then the tree structure will be automatically assigned with associated values defined for the quick configuration. The default quick configuration definitions are located in the TreeFileMap.txt file in the root directory where ARK was installed. Please see the Customizing the Tree Structure section for more information.

### Customizing the Tree Structure

The tree structure layout can be customized to display different selection options. Customizing the layout is done by modifying the TreeSelectors.txt file located in the root directory where ARK was installed.

There are three characters which, when they appear as the first character on a line, are interpreted as special characters. These characters are %, #, and \*. The % indicates that the line is a comment and should be ignored.

The # character defines a combo box in the tree structure which appears on the left side of the settings area. These combo boxes cannot be disabled and when selected, but will fill the following combo box with certain values when a selection is made. The value beside the # character indicates the name which will appear above the combo box. The following lines will define the values and behaviour of the combo box until another special character line is reached. For each of these lines, the first item on the line defines the value to add to the combo box. The following tab delimited items on the line define what values in the following combo box will appear when that item is selected in the combo box.

Consider the default example:

```
#Product
PARAGON      BTE  ITE  ITC  CIC
FOUNDATION   BTE  ITE  ITC  CIC
#Type
BTE
ITE
ITC
CIC
```

In this example, there are two combo boxes that are defined, Product and Type. Product has two items: PARAGON and FOUNDATION. Type has four items: BTE, ITE, ITC, and CIC. When Cal/Config is run, only the Product combo box will have values in it and the Type combo box will be empty until a Product is selected. If PARAGON is selected, the Type combo box will be filled with BTE, ITE, ITC, and CIC.

The \* character defines a combo box in the tree structure which appears on the right side of the settings area. These combo boxes always have values appear in them but can be disabled by the combo boxes on the left.

NOTE: The \* combo boxes can only be defined in the file after all # combo boxes are defined. The value beside the \* character indicates the name which will appear above the combo box. The following tab delimited items on the line define what combinations of the # combo boxes will make that combo box disabled. The combinations must appear as "," delimited values. There will be as many values as there are # combo boxes. If all selections of a # combo box make the \* combo box disabled, the "\*" wildcard character can be used. The following lines will define the values of the combo box until another special character line is reached.

Consider the default example:

```
*VC          *,CIC
Yes
No
*Telecoil    *,CIC
Yes
No
```

In this example, there are two combo boxes defined, VC and Telecoil. Both of these combo boxes are made disabled when any Product is selected and the Type is set to CIC. If this were only true when PARAGON was selected, the definition would be "PARAGON,CIC".

NOTE: More than one definition to disable the combo box can be applied but further definitions must be tab delimited on the same line. Both of these combo boxes have two values, Yes and No.

#### Tree Selection and File Association

Once the tree structure is customized, the selections must be assigned to associated .ids files. This is done in the TreeFileMap.txt file located in the root directory where ARK was installed.

There is one special character which, when it appears as the first character on a line, is interpreted as a special character. This character is the % and indicates that the line is a comment and should be ignored. All other lines define file associations from selections. The association is defined by specifying the combo box selections, in the order that they are defined in the TreeSelectors.txt file and tab delimited. This is followed by the .ids file to associate and then the quick configure text. These values are also tab delimited.

Consider an excerpt from the default example:

```
PARAGON      ITC  No   No   Paragon.ids  PAR_ITC
PARAGON      CIC  -    -    Paragon.ids  PAR_CIC
FOUNDATION   BTE  Yes  Yes  Foundation.ids
FOUN_BTE_V_T
```

In this example, there are three file associations. If Product is PARAGON, the type is ITC, the VC is No, and the Telecoil is No, then Paragon.ids is the file which will be used to configure the hearing instrument. Entering PAR\_ITC into the Quick Configure box in Cal/Config and pressing enter bring up the defined configuration file.

In the second definition, the VC and Telecoil are assigned to "-". This is because these options are disabled in that configuration.

NOTE: If a configuration is selected and no file association is found, a warning message will be displayed indicating that a file was not found for the given association.

In order to ease in the construction of these files, it is recommended that a spreadsheet be used to create these files using different cells for tab delimited values. Then, save the file as a tab delimited ASCII text file in the names and locations provided.

#### mARK CONVERSION TOOL

Since there may be a need to use calibration definitions from old versions of Cal/Config, the mARK Conversion Tool will take an old calibration file (.clc), memory configuration file (.ids) and scratch file (.txt) and convert them into a new .ids file.

There are parameters which are now stored in the .ids file which were previously not saved in the .clc file. These parameters can be appended into the new .ids file by selecting them in the Extra Options form. This form is available from the Tools -> Extra Options... item on the menu. If these parameters are not changed, the default values shown will be saved to file. These options must be selected before converting the .clc file(s).

To convert a single file:

1. Press the convert button in the Single File section.
2. Select a .clc file in the dialog box that appears.
3. Input the new .ids filename to be saved.

To convert a directory of .clc files:

1. Press the Convert All button in the Directory section.
2. Select a directory where the old .clc files are located.
3. Select a directory where the new .ids files should be created. The new .ids files will have the same names as the corresponding .clc files, except that they will have "\_new" added to the end of the name. i.e. example.clc will become example\_new.ids.
4. A prompt will appear if the new file name already exists in the storage directory. Select yes to replace the existing file.

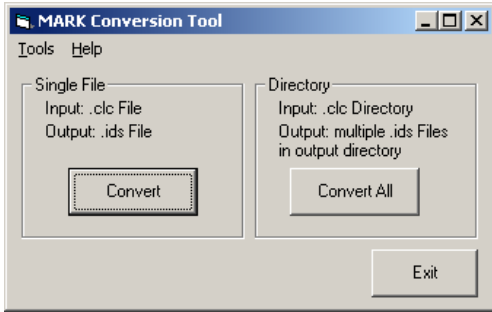


Fig. 19 mARK Conversion Tool

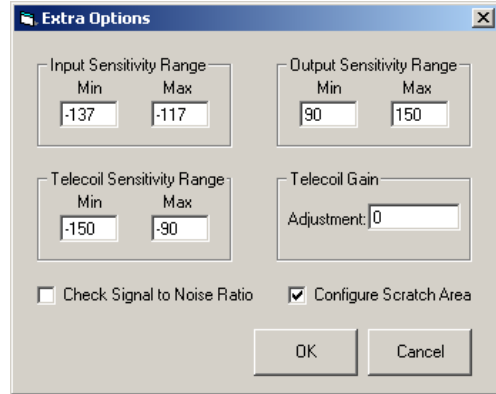


Fig. 20 mARK Configuration Tool — Extra Options

**DOCUMENT IDENTIFICATION**

**APPLICATION NOTE**

The product is in a development phase and specifications are subject to change without notice. Gennum reserves the right to remove the product at any time. Listing the product does not constitute an offer for sale.

**REVISION NOTES:**

Added command line argument /ShowMems.

**GENNUM CORPORATION**

MAILING ADDRESS:  
P.O. Box 489, Stn A, Burlington Ontario, Canada L7R 3Y3  
Tel. +1 (905) 632-2996 fax: +1 (905) 632-2814

SHIPPING ADDRESS:  
970 Fraser Drive, Burlington, Ontario, Canada L7L 5P5

**GENNUM JAPAN CORPORATION**

Shinjuku Green Tower Building 27F, 6-14-1, Nishi Shinjuku,  
Shinjuku-ku, Tokyo, 160-0023 Japan  
Tel. +81 (03) 3349-5501, Fax. +81 (03) 3349-5505

Gennum Corporation assumes no responsibility for the use of any circuits described herein and makes no representations that they are free from patent infringement.

© Copyright May 2003 Gennum Corporation. All rights reserved. Printed in Canada.