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ARKfit Programmers Guide



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APPLICATION NOTE

Introduction

This document describes how to use the ARKfit component and example application. It is intended as a reference for those who already have an understanding of programming with ARK. If you require an introduction to ARK, please see the ARK tutorial.

Running FitEx

The first screen that appears when FitEx starts is the audiogram input screen. You can enter an audiogram by either clicking on the audiogram area, or by clicking on one of the buttons in the “Sample Audiograms” area. To continue with the fitting process, click on the “Fitting” tab.

On the fitting screen, the targets generated by the fig6 algorithm appear in the frequency response graph as a series of three thin lines, corresponding to 40 dB SPL, 60 dB SPL, and 80 dB SPL inputs. The heavier lines show the predicted performance of a hearing instrument configured with the default parameter selections. To change the product that will be fit, select a library and product in the drop-down list boxes in the upper right-hand corner of the window.

To adjust the hearing instrument's parameters to match the targets, click the “AutoFit” button. The fit can then be further fine-tuned by adjusting the thresholds, crossovers, and gains. To transfer the parameter settings to the Interactive Data Sheet (IDS) application to allow for the full setting of parameters to be adjusted, click “Run IDS”, then “Update Params”. The IDS can also be used to program the parameters into a hearing instrument.

Restrictions

There are some restrictions on the parameter maps that are compatible with ARKfit:

- Compression ratio must be the calculated parameter
- The low level gain parameters must have the parameter names LLGAIN1, LLGAIN2, etc.
- The high level gain parameters must have the parameter names HLGAIN1, HLGAIN2, etc.
- The lower threshold parameters must have the parameter names LTH1, LTH2, etc.
- The upper threshold parameters must have the parameter names UTH1, UTH2, etc.
- The wideband gain parameter must have the name WidebandGain
- For the best results, the default ranges and resolutions should be selected for each parameter

Developing Applications with ARKfit

In FitEx, the ARKfit component is accessed using the m_Fit reference. In Form_Load, m_Fit is initialized with the line:

```
Set m_Fit = New ARKfit.AutoFit
```

The set of frequencies at which the targets are specified are then passed to ARKfit as follows:

```
m_Fit.SetFrequenciesSafe MF
```

MF is an array of doubles containing frequencies in half octave steps. Other frequency points may also be used.

In the cmbProducts_Click event, which is called when a product is chosen, a reference to the product component is passed to the ARKfit component via the Product property assignment:

```
m_Fit.Product = m_Prod
```

In the cmdAutoFit_Click event, targets passed from the previous call are first cleared by executing:

```
m_Fit.ClearTargets
```

The new targets are then added via the AddTargetSafe method as shown below:

```
m_Fit.AddTargetSafe 40, lowtargets_adj  
m_Fit.AddTargetSafe 60, midtargets_adj  
m_Fit.AddTargetSafe 80, hightargets_adj
```

The first argument to AddTargetSafe is the input level for the target in dB SPL. The second argument is an array of doubles containing the target gains in dB, one for each frequency point specified in the call to SetFrequenciesSafe.

Finally, the autofit routine is executed using the call:

```
m_Fit.AutoFit
```

Autofit Sequence

The autofit routine adjusts the parameters in the product specified using the Product property so that the product performance matches the targets as closely as possible.

The autofit routine performs the following series of steps:

1. The wideband gain is adjusted so that the highest input level target curve is matched as close as possible at 2 kHz.
2. The crossovers (for 2 and 4 channel products) are adjusted so that they coincide with the steepest sloping regions in the lowest input level target curve.

3. At the frequency in the centre of each channel, as determined by the crossovers, a best fit straight line is plotted between the input/gain points specified by the targets. It is assumed that all of the input levels specified in the targets are in the compression region, that is, between the lower and upper threshold.
4. For each channel, the best fit input/gain curve is extrapolated to the lower threshold to determine the low level gain. Similarly, the best fit curve is extrapolated to the upper threshold to determine the high level gain.

NOTE: The lower threshold and upper threshold are not adjusted by the autofit routine. It is expected that the fitting application will adjust these values to the desired input range before autofitting is performed.

As with other ARK components, the ARKfit component returns exceptions using the standard COM exception handling routines, which are transparently handled by Visual Basic as VB exceptions.

For more information on ARK, please visit the ARK web site ark.onsemi.com

ARKfit Interface API Definition

```
interface IAutoFit : IDispatch
{
    HRESULT SetFrequencies([in] long n, [in, size_is(n)] double* freqs);
    HRESULT SetFrequenciesSafe([in] SAFEARRAY(double)* freqs, [in, defaultvalue(-1)] long n);
    HRESULT ClearTargets();
    HRESULT AddTarget([in] double inputlevel, [in] long n, [in, size_is(n)] double* points);
    HRESULT AddTargetSafe([in] double inputlevel, [in] SAFEARRAY(double)* points, [in, defaultvalue(-1)] long n);
    [propget]
    HRESULT Product([in] IProduct2* product);
    [propget]
    HRESULT Product([out, retval] IProduct2** rval);
    HRESULT AutoFit();
    [propget]
    HRESULT Version([out, retval] BSTR* rval);
};

HRESULT SetFrequencies([in] long n, [in, size_is(n)] double* freqs);
Specifies the list of frequencies that the targets use.

HRESULT SetFrequenciesSafe([in] SAFEARRAY(double)* freqs, [in, defaultvalue(-1)] long n);
Specifies the list of frequencies that the targets use (VB-compatible).

HRESULT ClearTargets();
Clears the list of targets.

HRESULT AddTarget([in] double inputlevel, [in] long n, [in, size_is(n)] double* points);
Adds a target frequency response. Each point corresponds to a frequency specified using SetFrequencies.

HRESULT AddTargetSafe([in] double inputlevel, [in] SAFEARRAY(double)* points, [in, defaultvalue(-1)] long n);
Adds a target frequency response (VB-compatible). Each point corresponds to a frequency specified using SetFrequenciesSafe.

[propget]
HRESULT Product([in] IProduct2* product);

[propget]
HRESULT Product([out, retval] IProduct2** rval);
The product to be fitted.

HRESULT AutoFit();
Executes the autofit algorithm.

HRESULT Version([out, retval] BSTR* rval);
The version number of the component.
```

ARKfit Exceptions

Below is a description of the restrictions placed on each method in ARKfit. The exception that will be returned to the user in all cases is E_ARK_PARAMETER(value 800405E8 hex). This exception indicates that invalid parameter settings have been chosen.


AddTarget Restrictions

1. If the set of frequencies have not been specified this will cause an error. The frequencies should be specified using SetFrequencies or SetFrequenciesSafe if using Visual Basic.
2. The number of target points that are specified must match the number of frequencies that have been specified.

AutoFit Restrictions

1. If a required parameter is not in the parameter map an exception is returned. The required parameters are the crossovers, low and high level gains, upper and lower thresholds, and wideband gain.
2. More than three targets must be specified in order to do the crossover fit with AutoFit. To add more targets call AddTarget or AddTargetSafe for VB.

3. Three channel instruments are not currently supported in ARKfit. If you are attempting to fit a product with only 3 channels an exception will be returned to the user.
4. If the AutoFit algorithm was unable to fit the crossover frequencies an exception will occur. In order to fix this problem more frequency resolution should be provided in the product component.
5. An exception will occur when no targets have been specified. The function AddTarget of AddTargetSafe must be called before running Autofit.
6. If no product has been selected an exception will be returned. A product must be specified first.
7. When doing the gain adjustments within AutoFit an exception will occur if the required values are not in the lists of the following parameters: wideband gain, low and high level gains, and lower and upper thresholds. For best results, the default ranges and resolutions should be selected for each parameter in ARKOnline.

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