

AUDIO MANAGEMENT CONTROLLER (AMC) MANUAL



Description

The Blue Sky Audio Management Controller (AMC) is an 8-channel audio DSP platform with both 24-bit digital and analog I/O.

Each channel of the AMC has a sample rate converter (by stereo pair), a 31 band 1/3 octave equalizer, eight parametric / free assignable filters, individual channel delays, and lip-sync delay.

An 8x8 cross-point mixer allows any input to be mixed to any output.

The flexible bass management system can be customized on a channel-by-channel basis, or turned-off completely.

The AMC has 6 presets, each of which stores complete setup information, including filter setting, I/O configuration, delays, etc.

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AMC I/O connections

The AMC I/O connections use Tascam DB25 connectors for both analog and digital. **These DB25 cables are not supplied.**



Channel assignments

The channel assignments are SMPTE standard

- 1) Left
- 2) Right
- 3) Center
- 4) LFE
- 5) Left Surround
- 6) Right Surround
- 7) Left Rear
- 8) Right Rear

The channel assignments match the labels on the remote.

However, these channels labels are for reference only. Any channel can be used for any purpose desired. The only exception is the LFE channel which includes the bass management filters. Since these filters can be disabled (using the AMC Control Software), the LFE channel can be reconfigured as a standard channel like the others.

Analog I/0

The analog inputs and outputs are balanced with a switchable maximum level of +12/+24 dBu. Both analog and digital outputs are active irrespective of whether the inputs are digital or analog.

Digital I/0

The digital inputs and outputs are AES/ EBU 110 ohm and transformer isolated. When using the digital inputs the master digital clock is derived from the Left/ Right input or the system clock using a sample rate converter. Currently the master clock is limited to a native sample rate of 48 kHz.

A future firmware upgrade will allow either 48 kHz or 96 kHz to be selected.

If you want to use the AMC with a digital input of 44.1 kHz, 88.2 kHz or 96 kHz you must use the built-in sample rate converter. 192 kHz is not supported.

Sample Rate Converters

Each stereo input pair (Left/Right) has an independent Cirrus Logic sample rate converter that can be activated through the AMC Control Software.

If you want to utilize any sample rate other than 48 kHz or digital inputs that are not synchronized to the LEFT/ RIGHT input, you must activate the sample rate converter for that channel.

For example, you are running a 48 kHz 5.1 mix with digital inputs driving the AMC, but you want to connect an additional stereo signal to left and right rear channels from another digital audio source. This source also outputs 48 kHz but it is not using the same digital audio master clock as the 5.1 mix. In this case, you would activate the sample rate converter for that stereo input.

Remote cable

The cable between the remote and the rack unit is a standard Ethernet Cat-5 cable with RJ–45 connectors.

However the signal protocol between the remote and rack is RS-232 not Ethernet. The remote cable has been tested to 50 ft.

Warning: Do not plug the remote or rack unit into an Ethernet port. It was not designed for this, and doing so may damage the port or unit.

Quick setup and use

The AMC comes with six presets: 3 analog and 3 digital.

The standard set up is 5.1 with 80 Hz bass management. Channels 7 & 8 are routed to channels 1 & 2 and the LFE.

There are also presets for 5.1 mix-down to stereo and to mono.

The display has a short description of the presets. These presets can be modified on a limited basis using the menu on the remote or completely reconfigured using the AMC Control Software.

The AMC Remote



The AMC Remote / Operation

MUTE - mutes all channels, both digital and analog

REF – sets the system gain to a user defined reference level. The default setting is -20 dB. The default setting can be changed utilizing the remote menu or the AMC Control Software.

DIM/CANCEL – sets the system gain to a user defined level. The default setting is -30 dB. The default setting can be changed utilizing the menu or the AMC Control Software. The DIM/CANCEL switch is also used to exit the menu mode

MUTE MODE – mutes the selected channels when pressed.

SOLO MODE – solos the selected channels when pressed.

SOLO/MUTE BUTTON – solo's or mutes that channel

PRESETS – loads the preset.

MENU – allows a limited number of parameters to be changed within a preset. When exiting the menu mode, the changed parameters are automatically stored in flash memory.

GAIN – uses a rotary incremental encoder that changes the system gain in 0.5 dB increments. Also used to scroll through the menu and change the selected parameter.

The MENU

Menu Switch – enters the menu mode and switches between scroll and parameter modes.

In the Scroll mode, the gain control "scrolls" through the menu items.

In the Parameter mode, the gain control changes the selected parameter. To switch between modes, tap the menu key. The current mode is displayed at the bottom of the display.

Dim/Cancel switch - exits the menu mode and stores the changed values in the current selected preset.

An example of using the **MENU** to change the left calibration to +3 dB.

- 1) Tap the menu switch.
- 2) Rotate the gain control to cycle through the menu items to left calibration.
- 3) Tap the menu switch to enter parameter mode.

- 4) Rotate the gain control CW or CCW until the display reads +3.0 dB.
- 5) Tap the menu key to go back to scroll mode.
- 6) Tap the dim/cancel switch to exit the menu and store the preset.
- 7) To change multiple items, follow 1-5 on each parameter and then hit the dim / cancel key when you have completed all your changes.

Menu Items

- Channel Calibration sets the output level for the selected channel. Used to balance channel levels.
- 2) Channel Delay sets the time delay for the selected channel. Channel delay is used to time align each speaker to compensate for the unequal distances between the listener and the speaker. For example, a subwoofer is usually farther away from the listener than the front speakers, so the sound from the subwoofer arrives later than the sound from the front speakers. In this case you would add additional time delay to each of the front speakers to time align with the subwoofer. The time delays of each speaker can be measured using the AMC Control software and the optional recommended measurement microphone and USB audio interface. (See the section on additional equipment you will need, below.)
- 3) Lip Sync delay Many video displays have video processing delays which can cause the audio to be out of sync with the picture. To compensate for video delay, an overall audio time delay can be added to re-synchronize the audio with the picture.
- 4) +12/+24 analog max output level switch Some studio monitors are high gain devices that have a nominal input level of around -10 dBu, and not +4 dBu. This switches gain structure to +12 dB to optimize the signal to noise ratio. Only affects the analog inputs and outputs.
- 5) 10mv sine wave output Puts a 10mv 1 kHz sine wave on all output channels that can be use to trace down wiring issues or to verify the AMC is outputting a signal.
- 6) Restore factory default clears all entered preset data and restores the factory presets. Follow the prompts on the screen.

Firmware Updates

The firmware in both the remote and rack can be updated through the USB ports and the using the Blue Sky Firmware Tool. There are separate updates for the Remote and Rack.

Currently the firmware update tool only works under Windows 7 or an Apple computer running Windows 7 using Bootcamp or a virtual machine using Parallels or VM Ware. It will work on both 32 bit and 64 bit operating systems.

A native OSX version will be released in the future.

Upgrading the firmware in the AMC

Before using the AMC Control program, the firmware in the AMC and Remote may require updating. The AMC control program is tied to a specific version of firmware. For example, AMC Control Software version 4.02 will only work with firmware 4.02 etc.

The firmware version installed in the Rack and Remote is displayed on the remote screen during power. If the firmware requires upgrading to match a new version of the AMC Control program, follow the following steps.

- Download and install both firmware update tools from the Blue Sky website. The installation tool will create a new directory in the Program Files (0x86) sub-directory. The firmware update tool uses the Microsoft Net Framework runtime library which is normally already installed with Windows.
- 2) If it won't run go to http://www.microsoft.com/enus/download/details.aspx?id=3387 and download and install the Microsoft Visual C++2005 Redistributable Package (x86).
- 3) If you get a message that the program requires Elevation and will not run, right click on the installer and click Run As Administrator.
- 4) **Power down the AMC**, and plug-in the USB cable into the front of the rack. If this is the first time you've connected your AMC to your computer you may get a message that the computer is installing drivers for the USB interface. Wait until that completes and tells you it's been successful.
- 5) Start the program. The 2nd line from the bottom indicates the currently installed firmware
- 6) Click Open Hex File and select the file new firmware for the AMC Rack.
- 7) Click Program/Verify.
- 8) Click Read Device.

- 9) The second line from the bottom is the software version installed.
- 10) Click the X in the upper right-hand corner to close the program. The firmware installation process is complete.
- 11) Repeat the process for the remote, using the remote firmware update tool and the USB connector on the rear of the remote.
- 12) Once you are done, disconnect the USB cables, power up the AMC, and verify that the firmware versions of the remote and rack match.

The AMC Control Software

The AMC Control Software is a 32 bit Windows 7 program and is intended for use only with the Blue Sky AMC. The program will not start unless the AMC is connected to the computer by USB.

The program will work with 64 bit Windows 7. It has not been certified for other versions of Windows. In addition, the program has been used successfully on Intel based Apple OSX computers running Windows 7 via Bootcamp or in a virtual machine using VMware or Parallels.

A copy of the AMC Control software is available for download. Contact Blue Sky for a download link.

Installing the AMC Control software

Download the setup program and save it to your computer at a location where you can find it.

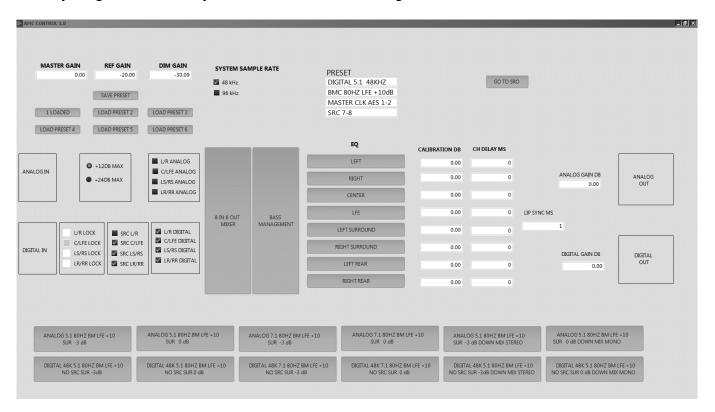
Double-click of the setup program to install it. The installer will create a folder under the program files (0x86) called Blue Sky and install the program there.

Running the Program

Turn on the AMC and wait unit the red LED on the front of the AMC is flashing approximately once every two seconds.

Plug the USB cable into the front of the AMC. If this is the first time you have connected the AMC to your computer you may see a message that says USB detected, installing software. Wait until the computer is done and the LED on the front of the AMC goes back to flashing.

If everything is connected you should see the following screen:



This is the main setup screen for the AMC control program. It shows which preset is loaded in the AMC, and the current configuration of that preset.

The AMC control program reads the master gain setting from the remote and will update that setting in real time.

Since the master gain setting is affected by the mute, reference, and dim switches, the AMC control display will reflect the system gain if you activate those switches.

It will *not* recognize presets changes made on the remote, or parameter changes using the menu of the remote. To manipulate those values use the AMC control software and save those values using the blue buttons in the AMC control program. The same holds true for loading and saving presets.

Navigating around the interface

Loading a preset – Click on the blue buttons in the upper left hand corner of the screen. Whenever you load a preset, the current preset will automatically be saved to flash memory in the AMC rack.

The blue boxes represent items that are activated when clicked with your mouse. In some cases clicking a blue box will initiate an action. In other cases the box will open up another screen.

The black boxes with white text represent parameters that can be entered directly using the delete key, the backspace key, numerical keypad and the enter key.

The check boxes represent an either/or setting. For example, if you click the left/right digital check box it will automatically turn off the left right analog check box.

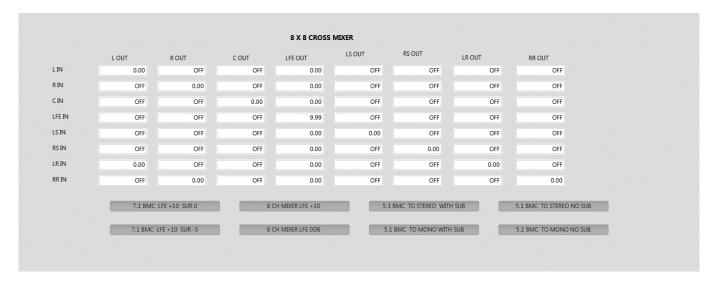
Digital in lock status box – shows whether a digital input has a valid digital signal attached.

Sample rate converter status box – selects whether the digital input has its sample rate converter activated. Since for the digital input the master clock is the left/right input clock if the sample rate converter is activated for the left/right input, the software automatically activates the sample rate converter on all inputs.

Preset display – these 4 lines of text is what will appear on the remote when a preset is loaded. Each line of text can be changed directly using the keyboard and delete and backspace key.

Channel Calibration – sets the relative balance between the channels. These values can be entered directly in the boxes or entered automatically using the SRO procedure. See the Speaker Room Optimization (SRO) section below for more information.

Cross Mixer Screen – when you click on the cross mixer box on the main screen it will open up a new screen as follows.



The cross mixer screen shows how each of the selected inputs (analog or digital) are routed to each individual channel output.

The value is in decibels. For example a setting of 0 dB equals a gain of 1.

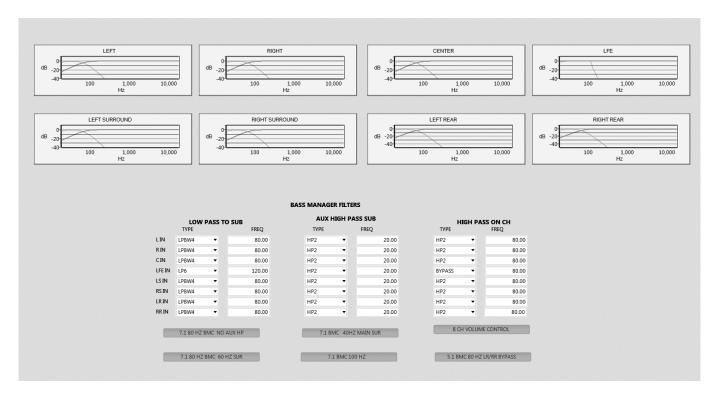
To turn off the routing of an input you can either type in the text "off", or "OFF".

The blue buttons along the bottom configure the mixer to common settings when engaged.

Note: In some cases, as in theatrical movie releases, the surrounds are 3 db down from the main speakers. If that is the case, you also want to drop the surround feeds to the subwoofer. For example, you would set LS IN to LS OUT at -3 dB, and then also set LS IN to LFE out at -3 dB.

To go back to the main AMC control screen click the X in the upper right-hand corner of the screen

Bass management screen – the blue bass management button will bring up the following screen.



The bass management screen shows the bass management settings for each individual channel and the graphs show the resulting frequency response.

Note: These graphs however do not show the EQ control settings on these channels.

For each channel the type of filter employed and the cutoff frequency of that filter can be selected.

The filter labels have the following meanings:

Bypass	No filter in circuit
LP2	2 nd order 12 dB/oct low pass filter with a Q of .707
LPBW4	Two LP2 filters in series resulting in a 24 dB/oct low pass
LP6	6th order Chebyshev 36 dB/oct filter (typical LFE Filter)
HP2	2 nd order 12 dB/oct high pass filter with a Q of .707
HPBW4	Two HP2 filters in series resulting in a 24 dB/oct high pass

For the feeds to the subwoofer, you have a choice of Bypass, LP2, LPBW4 and LP6 filters.

In addition to the low pass filters for the subwoofer there are auxiliary high pass filters that can be used on each channel feed to the subwoofer. The choices for the high pass filter are Bypass, HP2 and HPBW4.

Normally these filters are used with bass management where you don't want the signal sent to the subwoofer to go down to 20 Hz.

For example, if you're doing editorial work on a soundtrack that is being mixed for a theatrical release, a bass managed system mix can result in too little bass when played back on the theatrical system. This is because front speakers in a theatrical system typically only go down to 40 Hz.

So to get better translation, you could employ a 40 Hz HP2 or HPBW4 high pass filter on the left, center, and right channels.

The same holds true for surround speakers. In a typical theater setup the surrounds typically do not go down below 60 Hz. Again to get better translatability you may employ a 60 Hz high pass filter on the surround channels.

The AMC system also includes a high pass filter for the each channel.

These filters are not in the subwoofer feeds but on the individual channels. The choices are Bypass, HP2 or HPBW4.

The bypass setting is used when you're not using bass management.

HP2 or HPBW4 are used depending on the actual speaker attached to the channel. If the speaker is made for bass management, (i.e., Blue Sky SAT6D) then you use a HP2 set to 80 Hz. If however, if the attached speaker is a full range monitor that may go down to 50 or 40 Hz, you'd use a HPBW4 to get a better blend with the subwoofer.

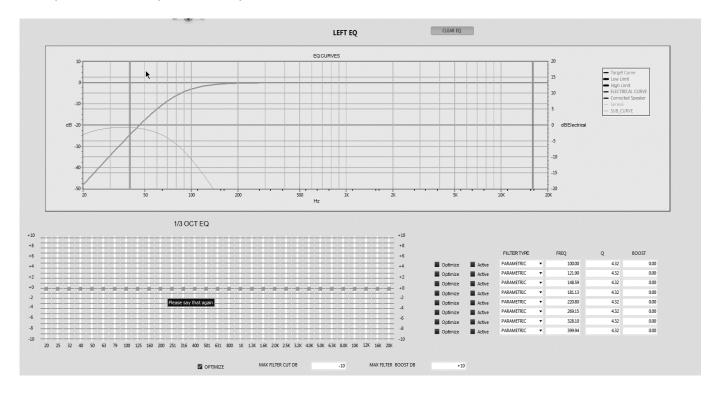
EQ screens - clicking on one of the blue EQ boxes will open up an EQ screen for that channel. For example clicking the left box will open up the following screen.

Each channel of the AMC has a 31 band 1/3 octave graphic equalizer and 8 uncommitted filters.

There are several choices for filters including low pass shelf, high pass shelf, parametric, low pass high pass etc.

The optimize check box determines whether the graphic EQ or any of the individual filters will be used in the speaker room optimization process. The active check box determines whether the filter is used or bypassed.

The maximum filter cut and boost settings set the maximum range of correction of the filters during the speaker room optimization process.



Speaker Room Optimization (SRO)

Overview

SRO is a system for measuring the acoustic response of a speaker system and correcting the speaker system to a target frequency response.

The measurement portion of SRO uses a special noise signal called a maximum length sequence (MLS). Unlike white or pink noise, MLS signals have unique properties that allow them to be used to calculate the impulse response of a speaker, which contains the complete frequency, phase, and time response of the speaker.

Once you have obtained the impulse response, with the use of a fast Fourier transform (FFT), it is easy to calculate the frequency response of the speaker. Once the frequency response is obtained, the next phase is optimizing.

During the optimization process, the uncorrected frequency response of the speaker is compared against a desired frequency response called the target curve.

The target curve can be an "X" curve, a flat frequency response curve or an arbitrary curve that the user created.

The software then compares the speaker response against the target and generates an error value. The error value is a quantitative measure of how well they match. The larger the error the worse the match.

The software uses filters (like a 1/3 octave equalizer) to correct the frequency response of the speaker to lower the overall error (i.e. a better match).

It does this using a genetic mutation algorithm called BOO.

BOO mathematically generates thousands of different EQ settings and determines which one gives the best match to the target curve.

Once BOO picks the best match, the user has the option of accepting it or tweaking manually form there.

One last point. The SRO program will correct many frequency response problems but it does have limitations. It will not give repeated reliable results if the room is too noisy. It will not make a poorly designed room with poor acoustic treatment sound like a well designed room.

Additional equipment you will need

The Blue Sky SRO program uses an inexpensive USB audio interface and measurement microphone to generate test tones and measure the frequency response of the speakers attached to the AMC.

You will need the following:

- 1) Measurement microphone the recommended choices are the Dayton Audio EMM-6 or Behringer ECM8000. However, it is possible to use other high quality other measurement microphones, but the above are known to work fine, and are relatively inexpensive.
- 2) USB Interface the ART USB Dual PRE is the recommended USB audio interface used for measurement. It is an inexpensive system with dual microphone preamps, dual audio outputs, operates at 48 kHz and has a phantom power supply for the measurement microphones. It uses the built-in driver for windows.
- 3) Microphone stand.
- 4) 2 1/4" TRS- to XLR male microphone cables. One can be short (1.5 ft) for the loop back connection and one should be long enough to connect to the speaker.
- 5) XLR microphone cable for the measurement microphone

Setting up the ART USB Dual Pre to use with Blue Sky SRO Software.

- 1) Connect the short TRS to XLR male cable from the Dual Pre right output to the Dual Pre right microphone input.
- 2) Set the mix fader to computer (Max CW).
- 3) Set the output level straight up (12 O'clock).
- 4) Press the phantom power switch to on.
- 5) Press the power to on.
- 6) Connect the measurement microphone into the Dual Pre left microphone input.
- 7) Set the gain control on the left input to 18.
- 8) Set the gain control on the right input to 3.
- 9) Connect the USB cable from the computer into the ART USB interface on the back. If it's the 1st time the device is connected to the USB port you'll get a driver installation message.

- 10)Setup the ART as the default playback device and set its Playback properties. Windows Control Panel-> Sound-> Playback ->USB Audio CODEC -> Set Default Properties- >Advanced-> 16 bit, 48000Hz (DVD Quantity) -> OK.
- 11) Setup the ART Dual Pre as default recording device and set its recording properties.

Windows Control Panel-> Sound->Recording->Microphone USB Audio CODEC ->Set Default

Properties-> Listen-> Uncheck ->Listen to device

Properties-> Levels-> 100.

Properties-> Advanced-> 2 channel 16bit, 48000 Hz -> OK.

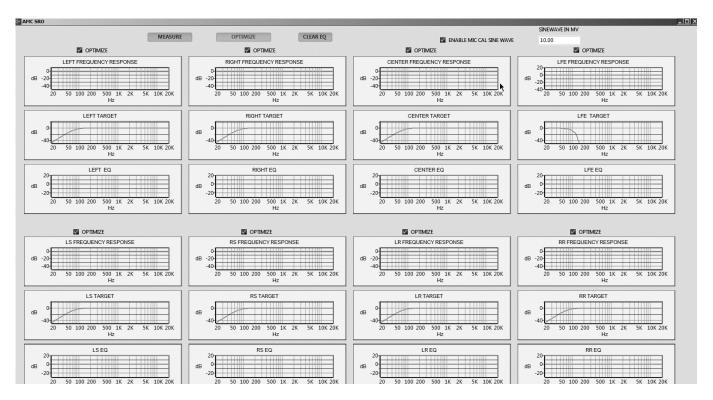
Note: If you disconnect the ART Dual Pre from your computer, you may have to go through this process again.

After you have set up the ART USB Dual Pro to work with the Blue Sky SRO program, follow these additional steps to connect the ART USB Dual Pre to the Blue Sky AMC.

- 1) Using a microphone stand set the measurement microphone at your listening position and at ear height.
- 2) As previously stated, connect the measurement microphone into the Dual Pre left microphone input.
- 3) Connect the output of the Dual Pre Left channel to Right Rear analog input on the AMC.

Starting the SRO program.

Once the AMC Control program is running, click the SRO button in the right hand corner of the main screen. The following screen will pop up.

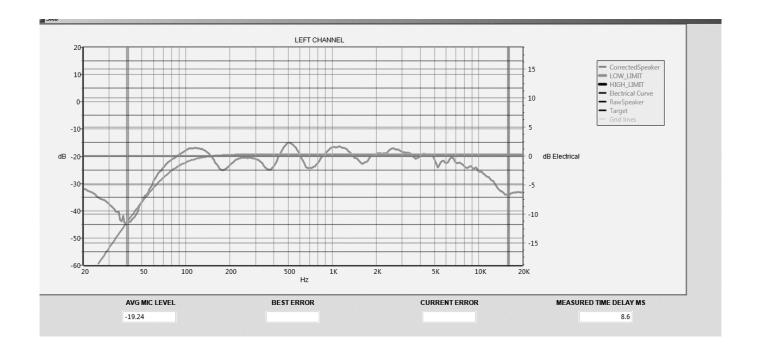


This screen shows the current state of the EQ, target filters, measured frequency response and corrected frequency response of all the channels. Clicking on the small graphs will open up a larger graph.

The optimize button above each channel determine if the channel is measured and/or optimized. For example: If you want to measure only the left channel click on the optimize button for the left channel and hit the **Measure** button.

NOTE: You can't optimize a channel until you measure the channel.

Making a Measurement



The GREEN curve is the measured frequency response.

The RED curve is the target response.

The BLUE curve is the electrical response of the EQ installed in the speaker.

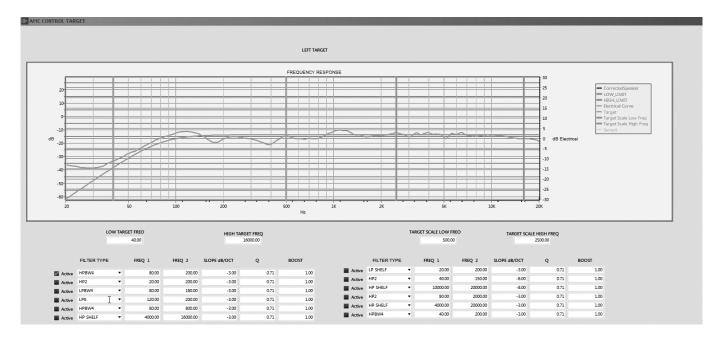
The optimum average microphone level is somewhere is between -20 to 0 dB.

If the level is low, increase the gain on the remote control. If the measured response is too low, the noise floor of the room and or the microphone may prevent an accurate measurement.

Normally when optimizing a Blue Sky SAT6D, the remote gain control is set for 0dB.

Checking or Adjusting the Target Curve

To review or adjust the Target curve for any speaker, click on the target curve, which will bring up the following screen.



The target screen contains the following items:

Target Filters – the target filters are used to construct the target curves. In many situations the target filters are automatically selected from the values entered in the bass management panels, which is the default setup for Blue Sky speakers using bass management.

If the target curves are not appropriate for your application, you can construct a custom target curve using any or all filters.

NOTE: Not all the values in the boxes are used for all filters. For example, the slope, dB/oct, and Q are not used for HPBW4, etc. If you change a value and there is no change in the graph, that parameter is not used. Also, the HP Shelf and Low Pass Shelf are not "real" shelving filters but special target filters. "Real" low pass and high pass filters have roll-offs that are multiples of 6 dB /oct. For an example, in post-production, near-field monitors used for editing may require a 3 dB/oct roll-off above 4 kHz so the sound matches speakers on the dubbing stage. Although a 3 dB target curve can be constructed with conventional filters, it may take 6 or more separate filters and a lot of experimentation to get the target curve you want. However, with the special target shelf filters, it is much easier.

Target Scale Low and High Freq – the software uses the frequencies between these to calculate the avg. microphone level and this is used to adjust the target curve so it "floats' with the drive level. These frequencies are usually selected to be in a flat portion of the measured curve.

Low and High Target Freq – the optimizer only works in the frequency range located between these two points. Any frequencies outside this range are excluded from the optimization process, allowing you to limit the range of optimization. For example, you may not want to try to optimize a subwoofer flat to 20 kHz. Or, for instance, you might only want to optimize for a narrow area between 100 Hz to 500 Hz.

The Graph – The graph shows the current target curve. Any change you make automatically updates the graph.

Optimizing

Check the speaker you want to optimize.

Click the OPTIMIZE button, which will start optimization.

During the process, a pop-up screen will show the current results. The optimization process calculates the least squared error between the target curve and the corrected frequency response over the range between the two yellows lines. The program will not try to optimize any filters or areas outside of the yellow lines.

NOTE: The locations of the yellow lines can be changed on the Target screen.

Once optimization is complete the EQ page will show the current EQ applied. If you click on the EQ page you can manually adjust the filters.

If you are happy with the results, click the **SAVE PRESET** button (on the Main panel) to save the EQ value to the flash memory of the AMC.

If you are measuring and optimizing more than one speaker, the optimization process will balance the level of each channel and correct the time alignment for each speaker. Those values will show in the Ch Delay (ms) and Calibration (dB) on the main AMC control.

Note: The only live control on the AMC remote that will show status when the AMC program is running is the gain control. Therefore when you have the AMC control program running make all changes, like selecting presets, using the control software program and not the remote.

When the Optimization process is complete, the program will take you back to the SRO screen. From there you can click on any of the graphs to get an expanded view so you can make any adjustments if necessary.

You are done.

Remember to save the preset so the values are written to the flash memory inside the AMC.