3SIXTY° Set Up Guide

First, before anything else you need to ensure the audio connections are correct and that you have tested and documented the maximum useable output voltage and volume position of the source unit, either aftermarket or OEM. It does not matter if you are connecting your signal outputs from the source unit to a the 3Sixty through high level or preamp level (RCA) inputs. No matter which way you go, you need a "reference" level and volume position on which other subsequent settings are based. If you are not sure where you are starting in the level setting process then you will never fully know if you are maximizing the potential of the audio system you have installed. It all starts with ensuring the first building block in the system is "clean".

1) Identify and verify correct left and right channel configuration by using **Track 3** of the RTTI/3Sixty set up disc. If fading via front and rear connections are enabled, verify this as well. See notes about Sub and Center channels in the attached System Set Up Worksheet. **Once L and R channels are verified correctly, unplug all 3Sixty outputs.**

2) Find the Maximum Output Level (MOL) of the source unit. To do this you must connect an oscilloscope to the output of the source unit and use the RTTI/3Sixty set up disc on **Track 7** for a reference sine wave. Record the maximum unclipped output of the source unit on the attached System Set Up Worksheet.

3) Perform an audio signal polarity check by using **Tracks 4 or 5** of the RTTI/3Sixty set up disc.

4) Set the input levels on the 3Sixty using **Track 1** of the RTTI/3Sixty set up disc. Increase the input controls until they just begin to blink red.

5) Establish a Bluetooth® link with 3Sixty through a PC or hand held device. Remember the default pass code is 0000.

6) Run the "OEM Integration" or "New Setup" routine at this time depending on your source unit. Follow the steps on the screen for either routine. Note: Sub and Center channel outputs **only** become active after running either routine.

7) Set the final gain levels at the amplifier(s) and implement the appropriate amount of gain overlap. Use Tracks **6-17** of the RTTI/3Sixty set up disc to do this. See the attached System Set Up Worksheet for more information.

3SIXTY° Tuning Guide

Next, with the system properly set up you can proceed to tuning the system using the powerful DSP engine of 3Sixty.

8) Set the crossovers. Remember that both the crossover frequency and the slope are adjustable. Of course you can also specify whether the crossover is HP/LP/BP, or AP (All Pass). You can link the left and right channels so the crossover settings are the same for each channel (this is easiest) or you can set the channels independent of one another.

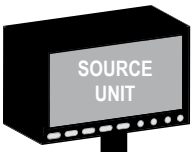
9) Set the time alignment for Front, Rear, and Center channels. You can compensate for speaker placement between 0-5 feet away from the listening position(s). Adjustments are in 2 inch increments. Remember that the channels for left and right are independent and do not link, even if it's set for linking on the crossovers and levels. Time alignment is always independent.

10) Set the equalization. Remember with equalization it's most important to use smooth transitions from band to band. If you have a big peak or dip in the frequency response, sliding the EQ up or down all the way is not the way to fix it. Those issues are most likely phase related. If you can't move the speakers or get it fixed with time delay, you may consider inverting polarity of the sub relative to the other speakers so you can get the best result with which to begin your equalization. 3Sixty will let you hear, in real time, what effect the setting you choose has on the sound.

11) Save the file and note the file name on the attached System Set Up Worksheet. This will allow you to establish a known good reference point for this vehicle and you can load that same file in vehicles of the same type as a quick starting point and refine the tuning from there.

12) Now all that's left is to enjoy the killer sound system you just installed and tuned!

System Set Up Worksheet



DEVICE MAKE/MODEL: _____ DEVICE LOCATION: _____

UNDISTORTED F/R MOL : _____ VOLTS AC VOLUME POSITION @ MOL : _____

SUB PREOUT @ MOL : _____ VOLTS AC SUB REFERENCE LEVEL +/- : _____

SUB PREOUT XOVER : _____ Hz SUB PREOUT PHASE : _____ TRADITIONAL FADER OPERATION : YES / NO

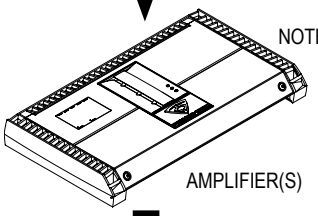
NOTES (SETTINGS, ETC.): _____

3SIXTY° LOCATION: _____ FILE NAME: _____

UNDISTORTED F/R INPUT LEVEL : _____ VOLTS AC UNDISTORTED SUB INPUT LEVEL: _____ VOLTS AC

UNDISTORTED F/R OUTPUT LEVEL : _____ VOLTS AC UNDISTORTED SUB OUTPUT LEVEL : _____ VOLTS AC

NOTES ON EQ / XOVER / DELAY SETTINGS / POSITION OF LEVEL CONTROLS: _____



AMPLIFIER(S)

AMP #1 (or CHANNELS 1&2)

DEVICE MAKE/MODEL: _____

UNDISTORTED MOL : _____ VOLTS AC

○ STEREO ○ BRIDGED LOAD : _____ Ω

SPEAKER(S) : _____

NOTES ON EQ / XOVER SETTINGS: _____

AMP #2 (or CHANNELS 3&4)

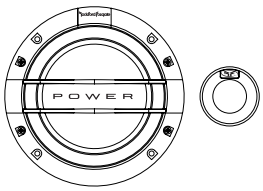
DEVICE MAKE/MODEL: _____

UNDISTORTED MOL : _____ VOLTS AC

○ STEREO ○ BRIDGED LOAD : _____ Ω

SPEAKER(S) : _____

NOTES ON EQ / XOVER SETTINGS: _____



AMP #3 (or CHANNELS 5&6)

DEVICE MAKE/MODEL: _____

UNDISTORTED MOL : _____ VOLTS AC

○ STEREO ○ BRIDGED LOAD : _____ Ω

SPEAKER(S) : _____

NOTES ON EQ / XOVER SETTINGS: _____

AMP #4 (or CHANNELS 7&8)

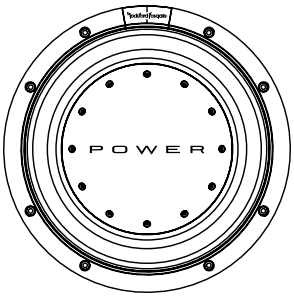
DEVICE MAKE/MODEL: _____

UNDISTORTED MOL : _____ VOLTS AC

○ STEREO ○ BRIDGED LOAD : _____ Ω

SPEAKER(S) : _____

NOTES ON EQ / XOVER SETTINGS: _____



SPEAKERS

FRONT SPKR MAKE/MODEL: _____ PASSIVE XOVER LOCATION(S): _____ TWEETER LEVEL: _____ dB

REAR SPKR MAKE/MODEL: _____ PASSIVE XOVER LOCATION(S): _____ TWEETER LEVEL: _____ dB

OTHER SPKR MAKE/MODEL: _____ PASSIVE XOVER LOCATION(S): _____ TWEETER LEVEL: _____ dB

SUBWOOFER(S) MAKE/MODEL: _____ ENCLOSURE TYPE / SIZE: _____

OTHER SPEAKER NOTES: _____

System Set Up Tips

Step One - Identify and Verify Channel Configuration

- Use **Track 3** of the RTTI/3Sixty set up disc to verify position of Left, Right, and Center outputs of the 3Sixty.
- Verify operation of the fader if inputs to 3Sixty are connected to Front and Rear outputs of the source unit.
- Until the 3Sixty is set up, only left and right channels will be evident. Sub and Center outputs will **only** become active after Step Six (setting up the 3Sixty) because you have to configure them.

Step Two - Measure the Maximum Output Level of the Source Unit

TIPS before starting:

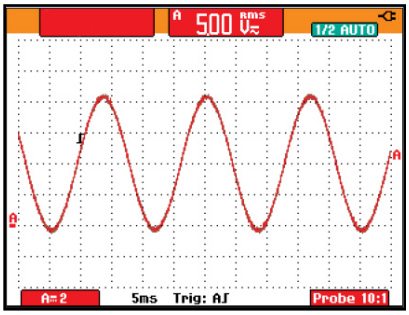
- Always set Bass and Treble to "FLAT" and any loudness feature to "OFF". Balance and fader to "CENTER".
- De-emphasize or disable any equalization wherever possible (either factory source units or aftermarket). Often with some "premium sound" OEM audio systems there is a menu selection for this.
- If volume is numeric, be sure to note the maximum listenable "number" of the volume position. Nearly every aftermarket source unit has some numeric or visual indicator of the volume position.
- If there is no volume reference on a factory source unit (such as rotary encoders that just free spin once it reaches maximum and do not show a volume count) it's best that you can achieve full volume before visible distortion with the scope. This is a case where it would be better to get the output in the location where volume is able to go maximum with little or no distortion. Sometimes, in a factory audio system, this will be between the source unit and the amp. Generally though, you will find going to the factory amplifier output is the best strategy because it also provides a pretty robust output voltage compared to the output voltage from the source unit.
- Disconnect the outputs of the 3Sixty at this time!!!

a) Connect the O-scope probes to the source unit's audio output. With an aftermarket source unit, you can connect right to the preamp output with an RCA "breakout" you make yourself. With an OEM source unit, this may be at the source unit itself or at the factory amplifier (either the input or output side). Generally with an OEM system, you want to start at the **factory amplifier output**.

b) Place the RTTI/3Sixty set up disc into the player and select **Track 7** (1kHz tone at 0dBFS). This assumes a full range output, but you can always play an alternative low frequency 0dBFS track for subwoofer or very high frequency outputs when checking output of a factory installed source unit or amplifier (Track 6 or 8).

c) Play the track and adjust the volume on the source unit until you see distortion on the scope. Soft clipping is okay, but you don't want to reference a hard clip. If the O-scope is not auto ranging, you will need to dial in the resolution once the signal starts to play.

d) Read and record the voltage level of the scope on that output. Repeat this process with the appropriate test tones in each of the necessary bandwidths or on other outputs that will be connected to 3Sixty. This process will give you the "reference level" of the source unit.



The sine wave test tone on the O-scope should look similar to this example. If the top and bottom of the wave form is flattened off, that indicates clipping. The maximum useable output level will be where the onset of clipping just begins.

Step Three - Identify and Verify Signal Polarity

TIP - Information about Evaluating Polarity (Electrical/Mechanical)

With speakers there would appear not to be too much concern on the topic of electrical connections. Nothing could be further from the truth. The reason this is the case is that you are dealing with speakers – plural. If you only had one speaker in the whole audio system to consider, you couldn't hook up the wiring wrong (or at least your ears wouldn't know the difference). When you add that second speaker (and every one thereafter), you have to consider the phase of each speaker **with respect to the others**. Since speakers move out and in (a series of pressure and vacuum), you can either have those speakers working together or working against each other. Speakers are said to be in "absolute phase" when they are all working together acoustically. This yields the most focused placement of instruments, singers, and sound effects as they were originally recorded and allows for the most accurate low frequency response. When one or more speakers are "out-of-phase" with other speakers, the result is destructive interference (just like that air leak problem when mounting, only the interference isn't between the front and back of one speaker, it's from opposing speakers "fighting" each other).

There are only two ways to connect speakers (or audio signal inputs); "correct polarity" or "reversed polarity". The acoustic effect of wiring one speaker (or preamp level input) correctly and one reversed creates the out-of-phase condition. One speaker cone is moving out while the other is moving in – so it's a wash. They are essentially trading energy so there's not much left to produce impressive sound. So even though there's only two wires to worry about at each speaker, you can see how getting it backward in an OEM integration situation can really make a negative impact on what is supposed to be better sound. Once additional speakers are added, including subwoofers, the importance of absolute phase only increases.

- Use **Tracks 4 and 5** of the RTTI/3Sixty set up disc to verify polarity of audio signal connections.

- To check electrical polarity of preamp or speaker level signals before they get to the speaker, use track 5 and connect the O-scope throughout the signal path. Start at the output of the 3Sixty (assuming you have already verified the inputs to 3Sixty are correctly polarized). Connect the positive probe of the scope (or center tip) to the center pin of the RCA connector or the positive speaker wire. Connect the negative probe of the scope (or clip to the probe) to the outer shield of the RCA connector or the negative speaker wire. This will set the scope up to look for the track 5 signal as a sine wave on top and a clipped sine wave on the bottom. If it's backward you either have your positive and negative signal wires reversed.

- To check the electrical polarity after the signal leaves the speaker, use track 4 along with a polarity detector device. The track has 3 positive pulses, followed by one negative pulse. If wired in absolute polarity, the polarity detector device will show 3 green lights followed by 1 red light. If this occurs in reverse, you have that speaker wired backward or somewhere else in the signal chain polarity is inverted.

Step Four - Bluetooth® Connections

- Remember Bluetooth has a working range of 30 Feet (10 meters) in direct line of sight. The preference is to have no obstructions (such as walls) in the way.
- Default pass code is 0000.
- Always check www.rockfordfosgate.com for the latest control software updates on 3Sixty.

Windows® based 3Sixty software for the PC is perfect for tuning with a Bluetooth® enabled laptop because you can see all the tuning attributes in one screen!

Step Five - Set the 3Sixty Input Levels

- Follow the on-screen instructions using **Track 1** of the RTTI/3Sixty set up disc.
- Red LEDs should just be blinking, but not solid red.

Step Six - Run OEM Integration or New Setup

TIPS before starting an OEM Integration or New Setup Routine:

- Ensure Balance Left to Right is correct on all channels on 3Sixty inputs and the Fader operational (where applicable).
- Ensure all signals are in Absolute Polarity into 3Sixty. This part is REALLY important for 3Sixty to correctly perform corrections on the factory EQ curve in an OEM Integration setup.
- If you have bandwidth limitations on some channels, use 3Sixty to sum a full range signal.
- Set any Bass and Treble to Flat, Loudness and signal processing "effects" set to OFF before running either routine.

Step Seven - Set the Amplifier Levels

a) Reconnect the RCA outputs of the 3Sixty to the system amplifier(s).

b) You will now be measuring/calibrating the first amplifier. Disconnect the speakers from the amplifier(s) at this time.

c) Connect the O-scope probes to the amplifier output of one of the channels. If the amplifier has separate gain controls for each left and right channel or you are using separate amplifiers (dual mono configuration for stereo pairs), you will need to repeat this for this process for each channel. If (like many amplifiers) left and right have a single gain control, choosing either channel for this measurement will be sufficient.

d) Select and play the appropriate track from the RTTI/3Sixty set up disc. **Track 7** (1kHz) for most full range or midrange signals, Track 6 or 8 for active tweeter or sub channels.

e) With the source unit and previously calibrated devices at the maximum output, adjust the amplifier gain until you see the onset of distortion of the signal on the scope.

f) Read and record the voltage level of the scope on that output. This will be an important number that you will need to reference later so make sure it's reasonably accurate!

g) Repeat this process for each subsequent amplifier in the system using an appropriate test tone (Track 6, 7, or 8).

TIP - Adding Gain Overlap ***Speakers are still disconnected for this step*
Now you will be adding some gain back into the system to account for listening to music (rather than test tones). Rockford Fosgate recommends only adding gain overlap at the amplifiers (rather than upstream in the preamp level signal) because 3Sixty has already established its reference input levels.

h) This example demonstrates a 5dB gain overlap process. Select and play the appropriate track from RTTI/3Sixty set up disc that is -5dB down. **Track 9 (40Hz) for low frequency, Track 10 (1kHz) for full range or midrange, Track 11 (4kHz) for high frequency.**

i) With the source unit and previously calibrated devices at the maximum output, adjust the gain of the amplifier until you see PREVIOUSLY RECORDED MEASUREMENT value. Basically you are matching the number you achieved beforehand when you calibrated the output at 0dBFS in (Step "f" above). The attenuated signal of the test tone allows a safe increase, adding 5dB.

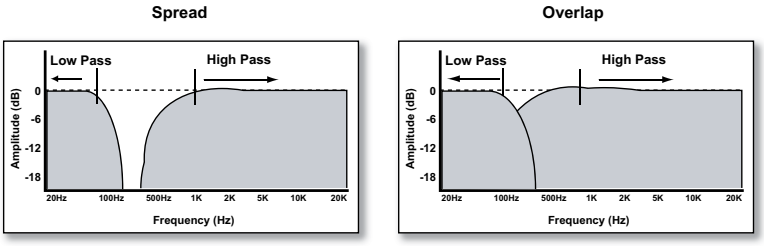
j) Read the "Gain Overlap" section for more information about why you do this step.

k) Now re-connect the speakers to the amplifiers, turn it on and enjoy! EQ and adjust crossovers as needed to fine tune.

Step Eight - Set/Adjust the Crossovers

TIP - Choosing and Tweaking Crossover Points
In most installations, front speakers will get a high pass (HP) treatment while the subwoofer will get a low pass (LP) treatment. Recall that the generalization is that most subwoofer to midbass/midrange crossover points occur between 80-120Hz. The main purpose for that range is to help trade the audio work load from one speaker to the next as frequency increases, but the other residual value is that it can help to provide the illusion of the bass coming more from the front of the car. This is the trick of blending crossover points **in real time - while you are listening - instead if just guessing.** Using the flexibility of adjustments on 3Sixty can really bring the power of sound entertainment to the vehicle, as opposed to just sounding louder than before. That's why just guessing or using "standard" values is not always going to get the best results.

If you do not implement a full range input signal to the aftermarket side of the system and rely upon factory crossover points, you will have to be satisfied with what will probably be simple fixed HP and LP crossover points. Thankfully 3Sixty provides both summing and an adjustable crossover point for each of the channels, which will allow you to fine tune the point at which the speaker groups "hand off" to one another. A great example is that sometimes you may find that while 80Hz low pass may be good for the subwoofer, the front speakers perform better (and blend better) with a 120Hz setting. This is called a "**spread**" in the crossover point. The opposite can also be true where the low pass is higher than the high pass crossover point and that is called an "**overlap**" in the crossover point. It all depends on speaker positioning and the vehicle. This is why it's so important to have a good ear and well recorded reference music with which to make your evaluations. It's the part of the audio system installation that can make a big difference yet many technicians don't make the effort.



Steps Nine and Ten - Set the Time Correction and EQ to taste

- Adjust the Time Correction relative to the distance from each channel.
- When setting the EQ, having an RTA will be helpful. Remember to "cut" peaks rather than "boost" dips! It's a lot more sensible to cut away what is already there than to try and boost what isn't there to begin with.

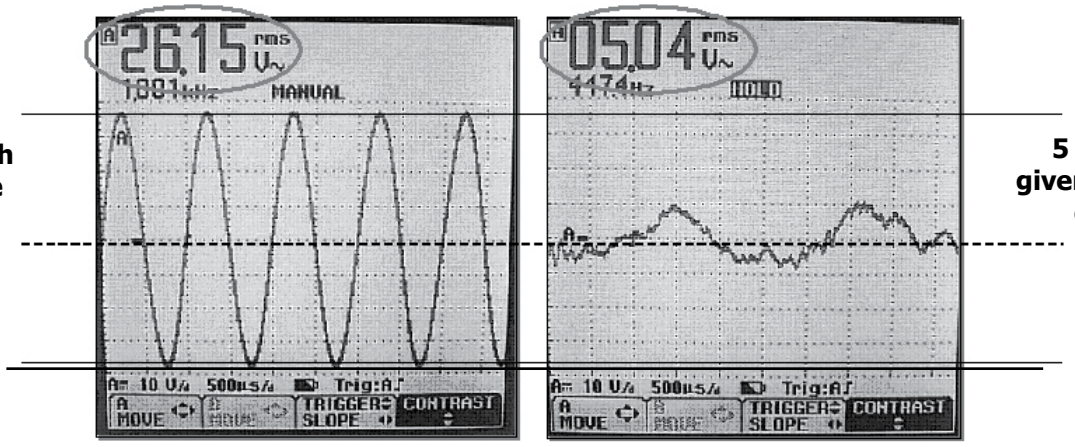
Steps Eleven and Twelve - Save the File and Enjoy!

- Name and save the file for this system. You will thank yourself later!
- Enjoy the killer system you just tuned!

Gain Overlap

Gain overlap is a compensation mechanism to account for the fact that we don't listen to test tones in mobile audio systems, rather we listen to music. Test tones are great for setting up the input levels on each component of the signal chain, but test tones are constant levels all of the time. Music has levels that simply are not constant all of the time. There are loud passages and soft passages in music, and these are constantly changing. Due to this fact, the maximum unclipped output levels determined by test tones will seem as if the system doesn't play very loud. Certainly it's free of clipping and audible distortion, but it's not as loud as it seems like it could be overall. This process allows a measured amount of increase to be implemented without "guessing" by just turning up the gain controls on a random piece of equipment. Adding extra gain to the signal chain whether it's at an upstream signal processor or at the amplifier at this point is a trade-off of benefits and drawbacks. Most people find that there is a good compromise of these trade-offs.

26 Volts with a Test Tone



5 Volts on a given "snapshot" of music

- When you **raise the gain** above the levels achieved with a test tone, you will **lower the signal to noise ratio** of the system. In this scenario, the trade-off is higher output at maximum levels trading off for more hiss and system noise with the volume at lower levels. There is always an acceptable compromise.

- Additionally, when you **raise the gain** above the levels achieved with a test tone, you will **increase audible distortion** of the system. In this scenario, the trade-off is higher output at maximum levels trading off for more frequent moments of "clipping" with **both the volume and the music** at their maximum levels. Check out the amount of time that there is added distortion in the signal based on the amount of gain overlap added. Once again, there is always an acceptable compromise.

- Add in 5dB of gain overlap to achieve a higher volume with music (rather than test tones). It's a safe compromise between slightly increased distortion (Less than 0.1%) and louder output (nearly 5dB). Less critical listeners could tolerate 10dB of gain overlap, but look what happens to the distortion increase. Some people will easily hear that with a great set of mid and high frequency speakers (certainly more evident on compressed audio tracks as well). Reserve 15dB of gain overlap for subs, if at all. If you are using this setting, chances are you can go to a bigger amp for better sounding results at the same volume levels with less distortion and more headroom.

Gain Overlap	Voltage Increase	dBv Increase	Distortion Increase	Should you do it?
5dB	Reference x 1.8	4.9dB	0.03%	Definitely
10dB	Reference x 3.16	9.4dB	3.0%	Okay for less critical listeners
15dB	Reference x 5.6	13.3dB	15.0%	Use only for subwoofers

- Use the gain overlap tracks on the RTTI/3Sixty set up disc to achieve the gain overlap safely without causing damage to the speakers. Simply play the same frequency (HP/BP/LP) as before and increase the voltage levels to the same place the recorded measurements were at 0dB levels for 5dB of overlap. If you use the 0dB tracks to increase the output voltages to do this, you will almost certainly damage the speakers if not using load resistors.

- Don't forget to disconnect the speakers when setting up gain overlap!!!!