

**A COMPREHENSIVE
Guide from**



***On Installing & Tuning a Subwoofer to
your factory system with the***

R2G/R2P + Wāvtech

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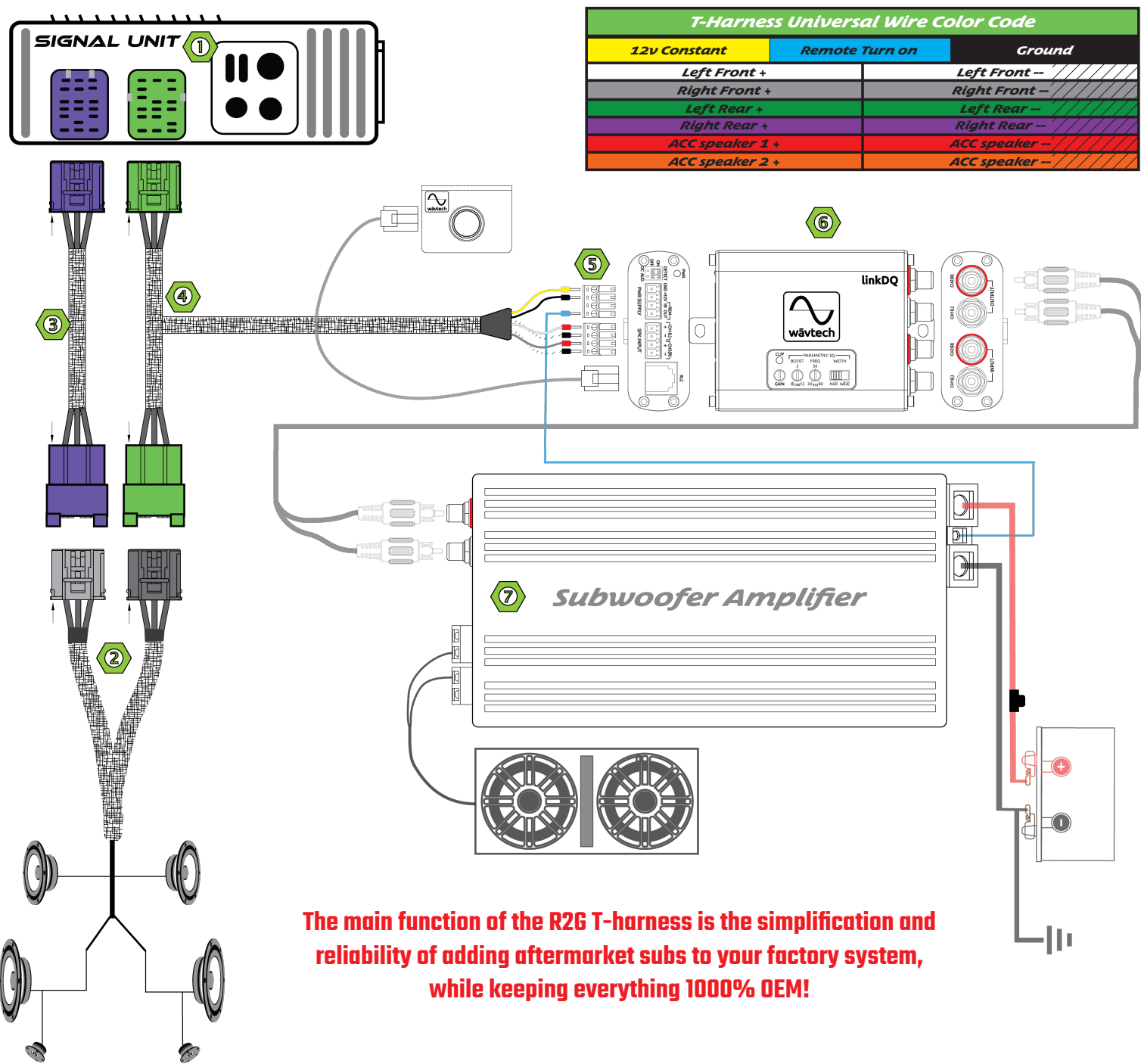
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Text/Call:(480) 290-5050

www.T-harness.com

Introduction to R2G T-harness & LinkDQ



The main function of the R2G T-harness is the simplification and reliability of adding aftermarket subs to your factory system, while keeping everything 1000% OEM!

Parts Index and Explanation

1 Signal Source - This refers to the source of the audio signal. It can be a factory radio or the factory amplifier. Some units are called HMI, ECM or Human Machine Interface. This is where the input from antennas or other audio mediums come into the vehicle and are translated into high level speaker signal that is sent to the speakers. (AC volts)

2 Factory Harness - The factory harness is detached from the signal source and connected back into the T-harness's male plug. The purpose is to tap the signal required and to leave all other wires as is. The T-harness is then plugged back into the same location the factory harness was in.

3 ANC Bypass Harness - ANC or Active Noise Cancellation is an active manipulation of the factory audio frequency. The microphone signals are sent to an Electronic Control Unit, which is essentially a computer system responsible for processing the incoming noise data.

Depending on the information received from the microphones, the ECU generates anti-noise signals. These signals are essentially sound waves with the same amplitude as the detected noise but with an inverted phase. The anti-noise signals are played through the vehicle's speakers, effectively canceling out the unwanted noise by creating destructive interference. When the anti-noise signals combine with the original noise, they result in a cancellation effect, reducing the overall noise level in the cabin.

Our ANC bypass harness will disrupt the communication from the microphones to the ECU and prevent the low frequency from the subwoofer, from rumbling back through the system. **NOT ALL Vehicles have ANC.** The best way to know is by scanning the OEM QR Code for that vehicle and looking for the RPO code. Look for the microphones in the headliner behind the front row seats.

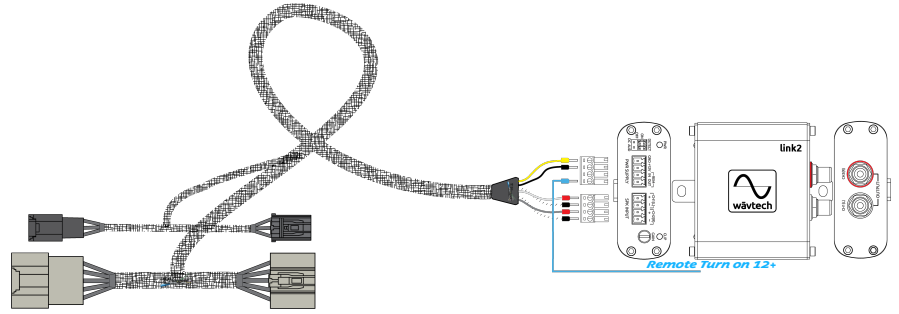
4 R2G T-Harness - The main function of the R2G is to provide the required signal along with the power & ground needed by the LOC to produce the required pre-amp signal output for the amplifier (low level). The T-harness will carry the high level output from the factory source unit via the twisted pair preventing, any Electrical Magnetic Interference (noise) from entering the audio signal that will be amplified.

The harness will also have a 12v constant and ground that can be used with any LOC, DSP or crossover system that takes no more than 10 amps of draw. The signal pair will provide the LEFT and RIGHT audio signal that has the best presence of bass frequencies to ensure ease of use, optimal performance and minimal alterations.

R2G T-harness and Link2 Selection

5) LOC Connection- Connection to the LOC is based on that units capabilities and demands. Active LOC units require 12v constant and ground as where cheap passive LOC units do not. When adding a sub-woofer to the vehicle it is best to use a Left and Right signal and not just a Left or Right. This will ensure that your subs hit every frequency as intended by the recorded audio. Using the factory sub signal does not always mean you are getting the best frequency range to amplify. After all, factory systems have subsonic filters in place to make frequencies below 20Hz, to protect the factory sub from distortion.

Keep in mind that audio signal is measured in AC volts and the power/ground is measured in DC volts. Always make sure you dont exceed the input of your LOC/DSP especially when connecting to a factory amplifier that can output 18+ Vrms of high level signal.



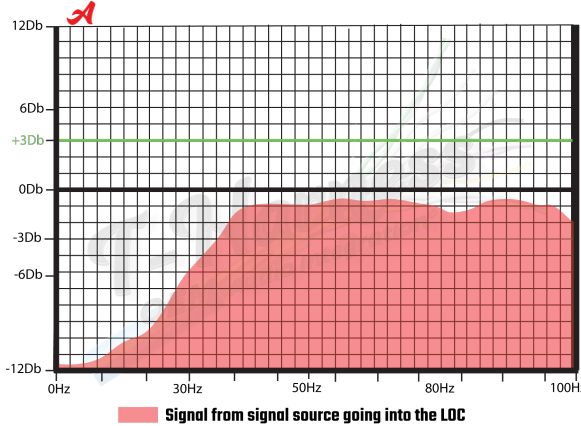
6) LOC Unit- This is the second most important choice in your audio project for proper integration. You will need to select a unit that has the specifications that meet the requirements for both the factory system and the results you expect. Wāvtech is hands down the best when it comes to integration. The Link2, LinkDQ, and BassRESTOR are all exceptional yet unique LOC units and have their place depending on your needs and taste in audio recreation. A few key features shared across all of them are:

- Differential Balanced Inputs
- Up to 40v Speaker level input
- Low Impedance Outputs
- Variable Gain Adjustments w/Clip LEDs
- Auto-Turn On via DC-Offset or Audio Signal Detect
- Generated +12V Remote Output
- OEM Load Detect Compatible
- Locking Detachable Power/Speaker Terminals
- Professional Grade Panel Mount RCA's
- Compact Aluminum Chassis
- Output Voltage (Max)- >10Vrms
- Output Impedance- <50Ω
- Input Sensitivity- 2-20Vrms, 4-40Vrms
- Max Input Voltage- 40Vrms
- Frequency Response- <10 Hz to >100kHz
- THD+N SPK- <0.01%
- S/N SPK- >110dB

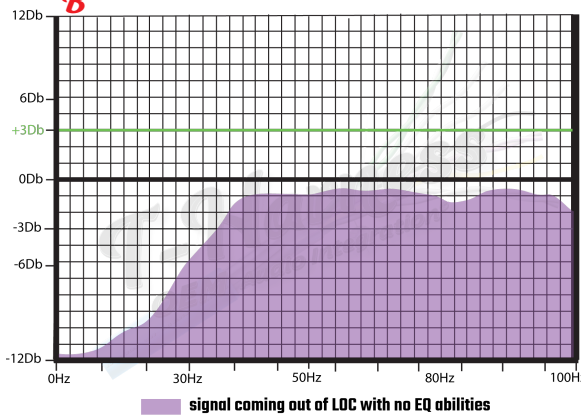
Brand names dont make good LOC units, specs do! Having a unit that offers the features like clip detection and an input of 40Vrms is nothing special but having the playable frequency range of 10Hz to 100kHz, balanced outputs, and OEM load detection is. Advanced LOC units like the LinkDQ and BassRESTOR go a few steps further and give you a DSP like power to extract, modify and revive the audio that factory systems limit. This can be seen as bass roll-off or blocking frequencies all together. Units like this let you fix the deficiency in the bass frequency and get the best audio quality you can from your factory audio or amplifier. (Reference Graph on PAGE 2-3 for an example)

7) Aftermarket Mono Amplifier- A mono amplifier does exactly that, it takes the mono signal and amplifies it to the demand of the Subwoofer/s. Make sure that the amplifier can output the desired Watts RMS at the proper Ohm load that the sub is configured to. A good mono amplifier delivers ample power, low distortion, high signal-to-noise ratio, stability, and reliable performance. It should be designed with quality components and construction to ensure long-term durability. Additionally, features like adjustable crossovers and built in audio processor abilities like the LINK500.1 and 1000.1's parametric EQ can save you money and simplify your installation while providing the benefits of proper signal tuning.

Some mono amplifiers can take a high level input rendering the need for an LOC optional (see page 7). If you plan to run multiple amplifiers for multiple subs it would be more useful to use a constant and central source for the signal. In this case the use for a Y-adaptor from a LinkDQ or BassRESTOR would be ideal.

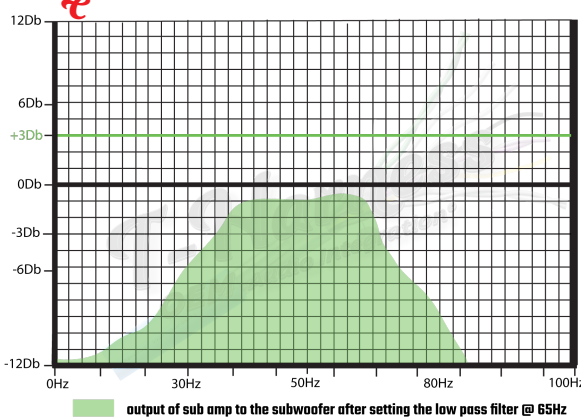


In graph A you will see a depiction of what the audio signal from a typical radio or factory amplifier will output via the factory speaker wires (left & right). You can see that the Bass Frequencies start to slope down at around 38Hz. But at 34Hz your slope falls below the -3dB or F3 line. This indicates the start of the LPF. A -3dB indicates the halving of audible signal produced by the LOC and sent to the amplifier.



Shown on graph B is the output of the Link2. This unit does not offer any ability to alter the audio signal only to limit the output voltage strength (gain) and provide a (pre-amp) voltage output 0.2-10v. However, this unit also has clip detection and balanced signal output and that's a big advantage over all passive LOC units.

Lower end amplifiers always require a pre-amp voltage as to not damage the input capabilities of the amp, you should always check what the input max is. Make sure to not go over it.



Clipping is another very important part of your installation to keep an eye on. If your signal is clipping you will introduce noise like harshness, buzzing, or rattling in the speakers. This can create heat in the cone and damage the speaker.

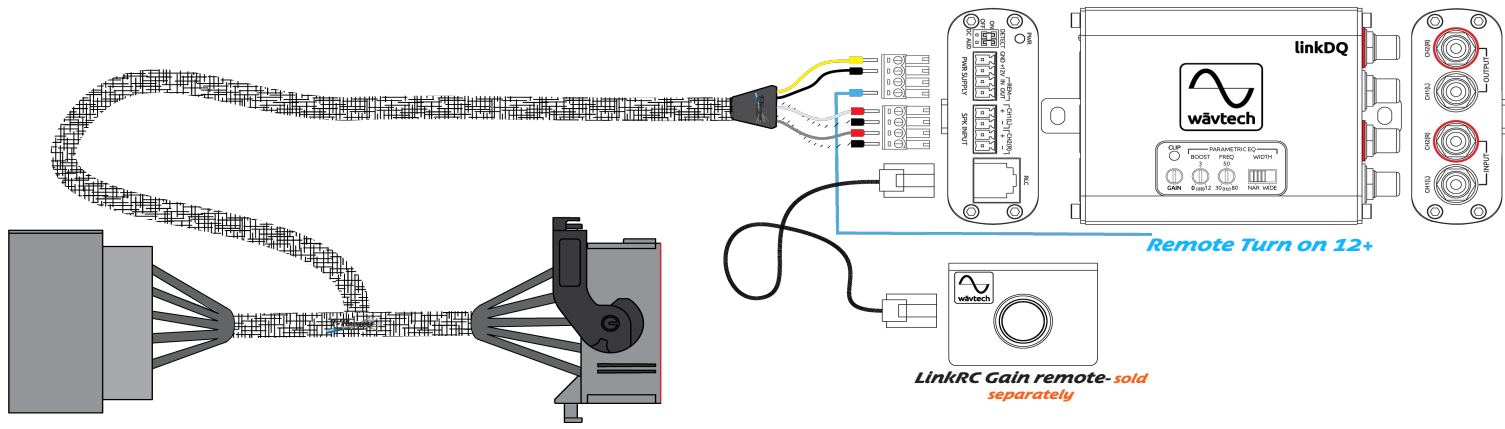
Gain control on an LOC helps match the output voltage from the LOC to the input sensitivity of the connected amplifier. This ensures that the amplifier receives an appropriate level of signal for optimal performance. (See page 7)

Tuning and frequency selection. The LOC (regardless of model or brand) needs to be used in conjunction with a Low-Pass Filter (LPF). In the case of graph C you can see what the amplifier will be sending out to the subwoofer, the LPF is used to prevent anything past 76Hz from playing through the sub. 37Hz-76Hz WILL play.

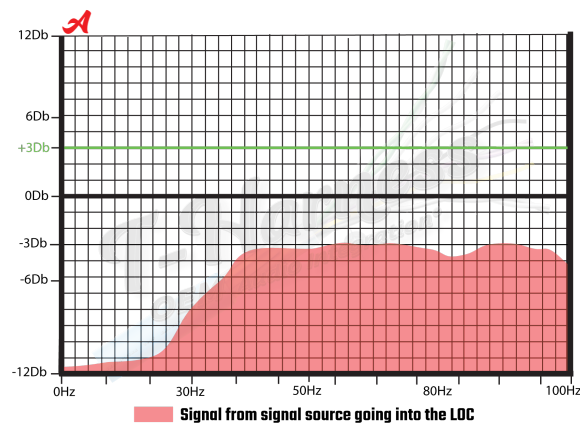
A low-pass filter allows frequencies below a certain cutoff point to pass through while attenuating frequencies above that point. It essentially "passes" low frequencies and "blocks" high frequencies. They make sure the amplifier sends only low-frequency signals to the subwoofers, preventing higher frequencies from reaching the subwoofer and ensuring it reproduces only bass frequencies.

In the next page we will go over frequency repair (LinkDQ) and frequency restoration (BassRESTOR)

R2G T-harness and LinkDQ Selection

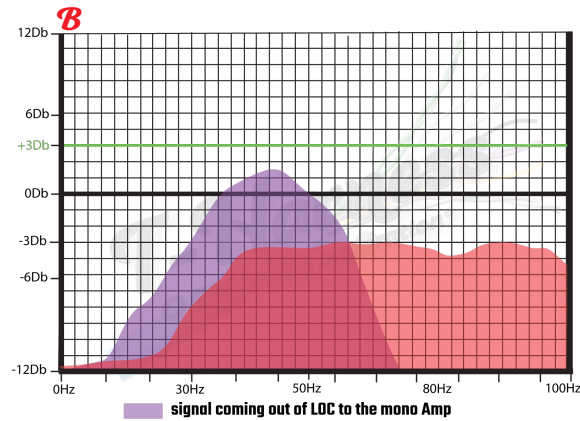


Bass Roll-off repair LinkDQ



↻ The LinkDQ is an advanced LOC with a PARAMETRIC EQ. In Graph A you will see a depiction of what the audio signal from a typical radio or factory amplifier will output at 2/4 audio output with Bass Roll-off in effect via the factory speaker wires (left & right). You can see that the Bass Frequencies start to slope down at around 38Hz.

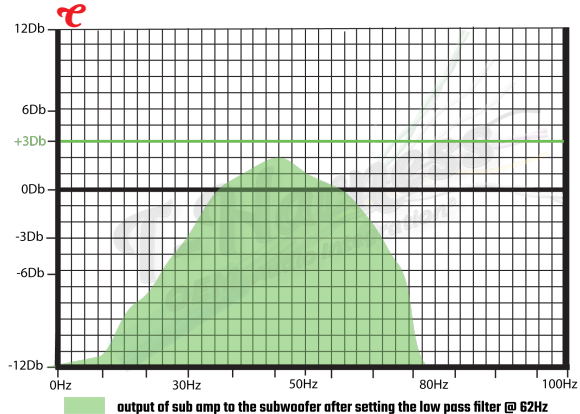
At 34Hz the slope falls below the -4db line that means that the audible signal strength is cut by half. At -6db a 2:1 ratio for every 6db loss of gain in electrical power signal takes place. The LinkDQ works by taking the EXISTING loss in frequency and pre-amplifying the frequency while maintaining its integrity via the (boost). We will go into this in more detail on page 5-6.



Graph B shows the repaired frequency response provided by the FREQ selection of 43Hz combined with WIDE and a boost of +4dB. This boost of +4db will stay consistent in the selected frequency range and will not diminish based on the volume level input from the head unit like accubass does. Accubass requires that very specific parameters are met and has a drop out point of 10 seconds if the volume is lowered to a point where the audio signal fails to meet the frequency difference below 50Hz.

This means that even after gain matching your system properly you will run into situations where the factory radio will not trigger the accubass and thus disabling the correction in deficiency. In short, this means that the gain setting on the mono amp will not always match or respond the same at different volume levels.

The Paarmetric EQ accurately and reliably maintains the setting you set regardless of the input from the radio or volume (voltage) going into the LOC from the signal source.



Graph C shows the repaired frequency and the Low Pass Filter in affect. The LPF will be set on the mono amplifier. This makes sure that only the frequencies you want will be played by your subwoofer. In this case, we see 30Hz-70Hz is above the -3db line and 41-47hz are well over the 0 or flat with a +2DB. In this situation the sub and enclosure are tuned to 45Hz.

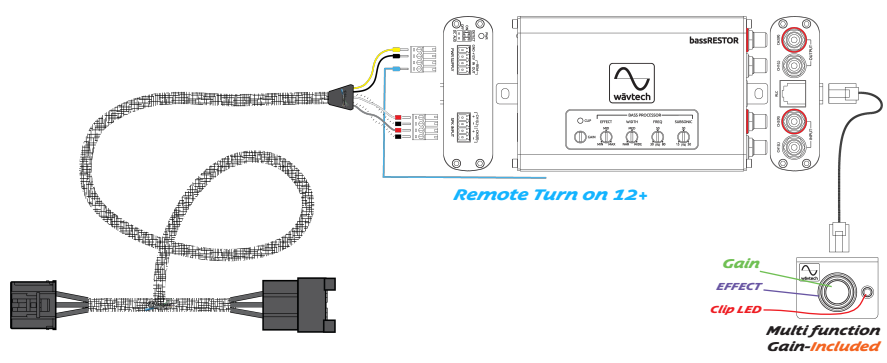
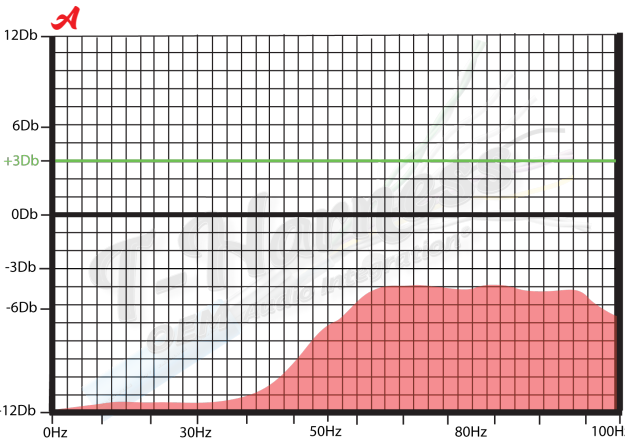
The current configuration from the LinkDQ and the LPF from the mono amp are sending the perfect range of frequencies to the subwoofer. This is the whole point of any installation done to upgrade the factory system. Especially if you are planning to use a custom box that is built around a specific frequency tuning (port frequency) this is an important step to know.

TRICK/TIP: If you play the target frequency through your source unit and monitor it via a multimeter at the RCA outputs, you will see the voltage go up as you repair and then increase the output with the LOC gain to match the amplifiers input voltage.

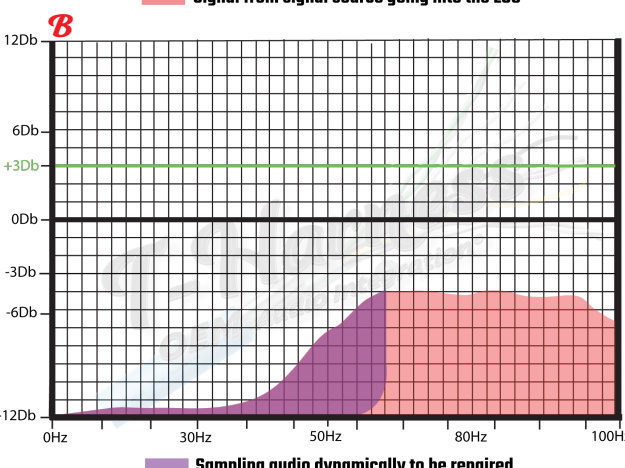
Mono amplifier gain setup

↻ Once your LOC is set up and configured the final step is setting your gain output to match the subs watts RMS and OHM needs. All Wavtech LOC's are line-drivers, so the gain on the amplifier should almost always be set all the way down and use the gain on the LOC as the master gain since it can drive any way to full power even when the amp's gain is all the way down. Think Wavtech LOC's as the source, so it's always best to have the source signal as high as possible. This will sound much better by providing the widest volume range, most dynamic range and best signal-to-noise. There is a small math formula that needs to be done to get the estimated voltage output set correctly. See page 7

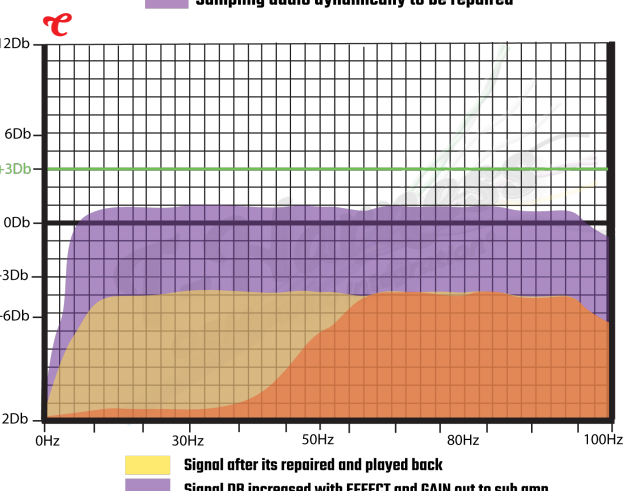
R2G T-harness and BassRESTOR Selection



Audio signal restoration

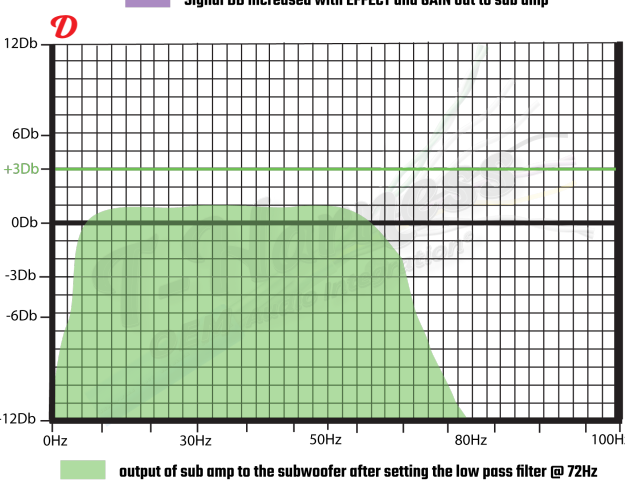


Audio frequency BOOST is completely different than RESTORATION. True audio restoration happens when the audio recording is sampled by the processor (shown on graph B), the processor then takes that sample and adds the missing frequency to the recording by then playing it back in-place of the original audio. The bassRESTOR is the only processor that can work with either high-passed signals lacking bass or low-passed signals (e.g. factory sub channel) without upper frequencies. Graph A shows what the audio looks like from the source, you can see that the bass roll off slope starts at 60Hz and drops to a point where the signal is very weak and ONLY boosting it could introduce distortion into the mix. In this type of situation it is best to use frequency restoration to revive the low end that was not present in the original recording. This all happens in real time.



In graph C you can see the remastered frequency is introduced into the recording and is now equal to the rest of the audio signal from the source unit. Once the audio is played back within the BassRESTOR system it is ready to be sent to the amplifier. An adjustable subsonic filter is also placed on the BassRESTOR unit to prevent extremely low end frequencies below 20Hz from passing on to the subwoofer that may not be built to play below that frequency and damaging it. Some knowledge to have:

- By eliminating very low frequencies that may not contribute significantly to the audible bass output, the subsonic filter allows the subwoofer and amplifier to operate more efficiently. It ensures that amplifier power is focused on frequencies that are within the subwoofers optimal operating range.



With all this in mind, its important to remember that you're adding a sub and not a full system. That means you dont need 20-20khz. Ideally you want to look at your subwoofer and your box and determine a 30-80Hz frequency range you want to hear/feel from your subwoofer. A lower frequency is more feel than audible sound, 30-80HZ is a good range to aim for. Once your signal is clean and ready to use, you will use an LPF (explained on pg.2) to limit the playable frequency on the high end of your playable frequencys. This will prevent vocals from the high end or instruments from the mid range from playing through the sub when set accordingly.

Graph D is a demonstration of properly configuring the LPF (70Hz for this example) in combination with the restored signal from the BassRESTOR. You can also see an even pre-amplification of signal difference between graph B at -7db and graph C's above flat +1db shown by the purple frequency range.

TRICK/TIP: If you play the target frequency through your source unit and monitor it via a multimeter at the RCA outputs, you will see the voltage go up as you repair and then increase the output with the gain on the LOC to match the amplifiers input voltage.

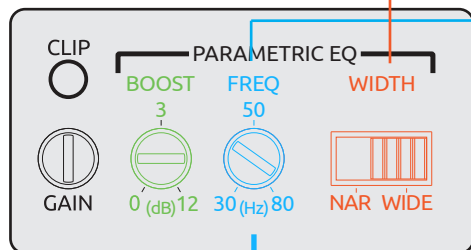
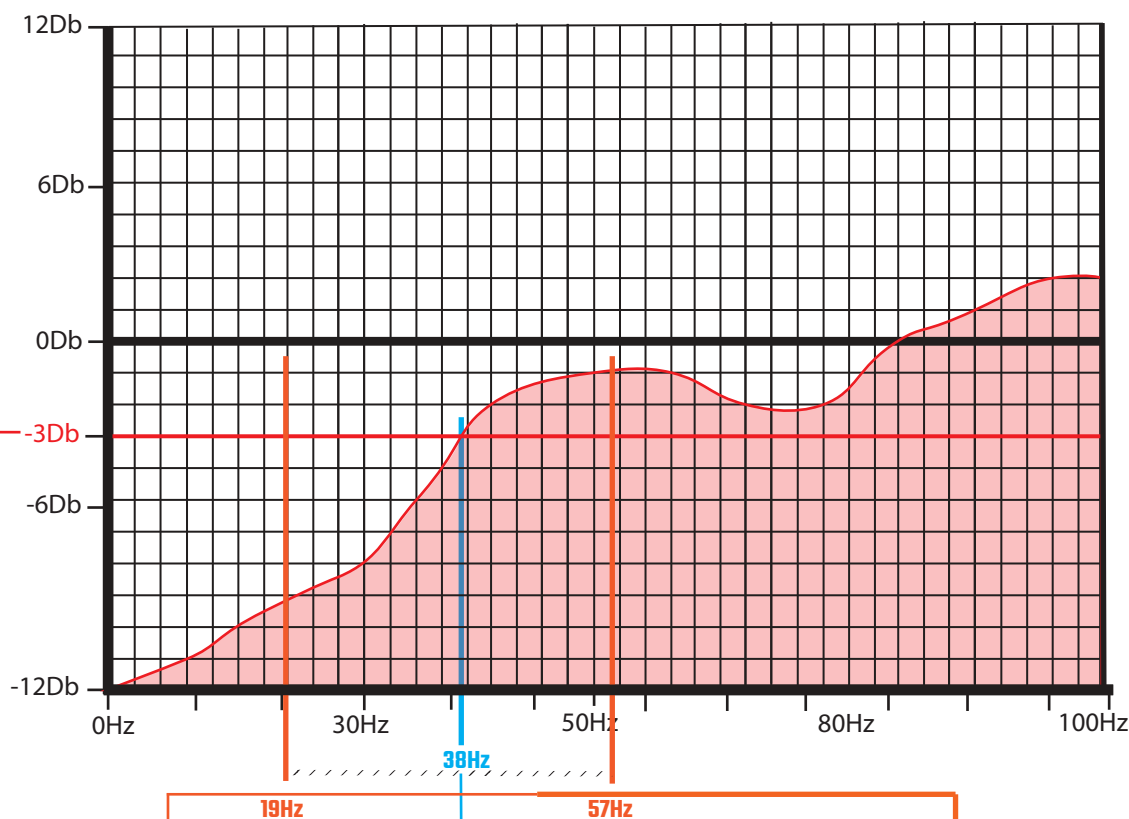
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Benefits and configuration of the Parametric EQ

DB's and why they matter!— A decrease of 3 dB could represent a loss of power or signal strength. In audio signal, a decrease of 3 dB might be perceived as a slight reduction in volume. A decrease in signal strength may impact the signal-to-noise ratio (SNR) of the audio system. If the signal level is reduced, then relative contribution of background noise becomes more significant in comparison. This could potentially affect the overall audio quality. A -3 dB decrease from 0 or FLAT in the signal strength, would result in a slight reduction in volume at a 2:1 ratio when the audio signal is sent to the amplifier.

Example 1— on the graph the BASS ROLLOFF starts at around 42hz this means that the strength of any frequency below 42Hz that is affected by the -3 Db will suffer a loss of half its input to your amplifier. This means the amp will need to work harder to output the required levels of bass.

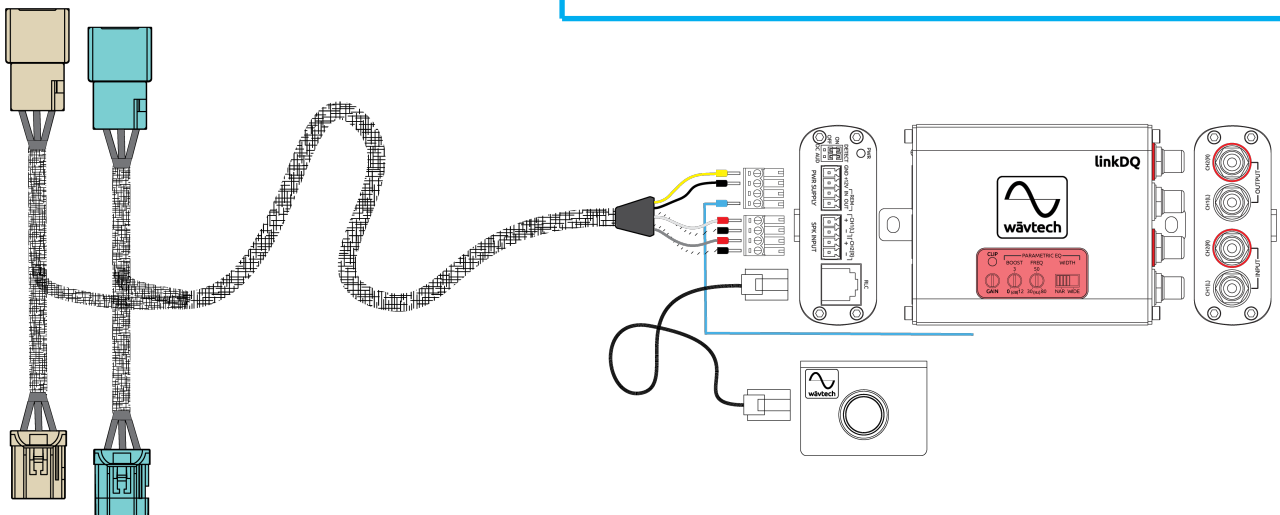
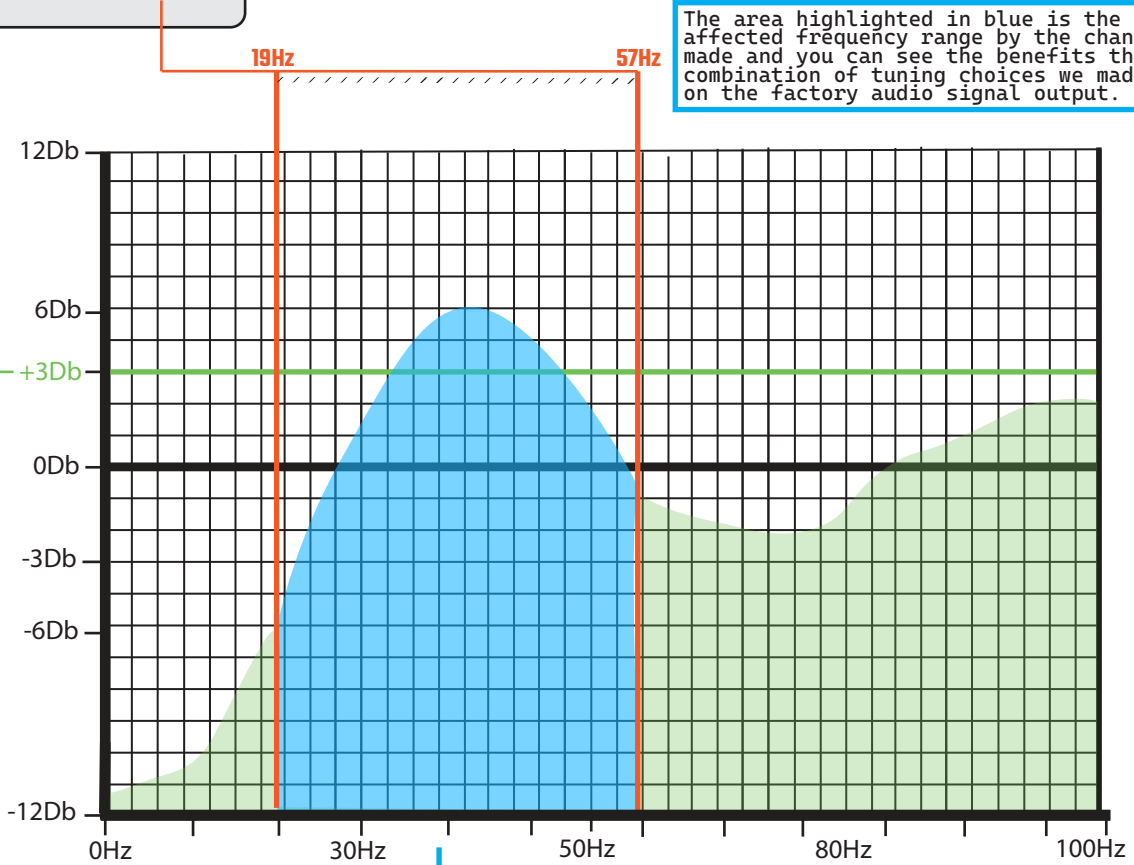
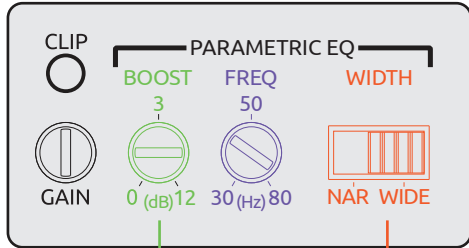


How to solve it— With the Parametric EQ on the LinkDQ you can use the **FREQ** function to target the frequency you want to repair. (Ideally you want to select a range that is near your enclosures tuned at Frequency(HZ). **Lets target 38Hz**

Step 2— **WIDTH** this is a simple selection of how many frequencies (F_c) to the left and right of the selected frequency (Hz) you want to be affected by the boost. **NAR** or narrow ($Q=5$) and **WIDE** for..well Wide ($Q=2$). Some math $BW = F_c / Q$ **NAR** = 7.6Hz **BW** left and right (30.4Hz-45.6Hz) is affected, OR **WIDE** = 19Hz **BW** so (19Hz-57Hz). More is not always better.

Benefits and configuration of the Parametric EQ

Step 3: BOOST is the “correction”. This will boost the selected range of frequencies by the selected Db from +1-12 Db. In this example we boosted the selected 38Hz by 8Db. Using a 3db boost to help you get to 0 or flat and then an increase of +6Db over the 0 line will increase the strength of the frequency signal going from the LOC into the amp. This will increase the performance of the amplifier. It will also boost the subwoofers response.



R2P T-harness & Mono Amplifier Tuning

Mono amplifier gain to sub tuning

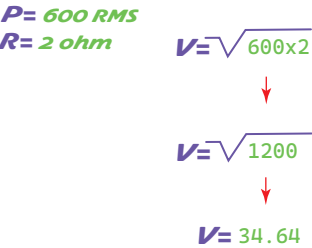
➤ Matching the mono amplifiers output to the subwoofers RMS input is how you prevent damage to your sub and produce a quality audio reproduction. This requires some math and OHMS law. Below is the formula and an example along with a few things to know before hand.

Subwoofer Information- if you have a single sub:1 sub

Total Watts RMS: 600 RMS
Final/total OHM Load/impedance: 2ohm

The formula for power (P), voltage (V), and resistance (R) in a DC circuit is. $P=V^2/R$

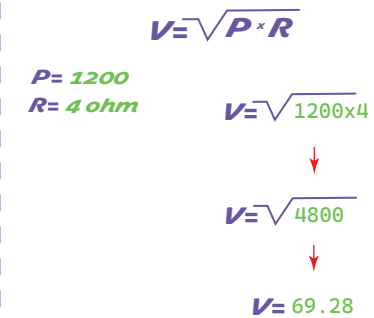
But we need to know the Voltage out of the amp so we will use: $V=\sqrt{P \cdot R}$



After getting the square root of 1200, you will get the answer to the AC voltage that the mono amplifier should be set to. 34.00

Subwoofer Information- if you have multiple subs this is an example:2 subs

Total Watts RMS: 600+600=1200 RMS
Final/total OHM Load/impedance: 2ohm+2ohm= 1ohm or 4ohm depending on parallel or series wiring.(we will use 4ohm)



Pro Tip: You can Google "what is the square root of (4800)" and get the answer. Make sure to use a 50Hz test tone when metering.

Our R2P or Ready 2 Power T-harness will provide the left and right signal needed by the pre-selected amps we have paired them with. The harness is 20' feet long from base to wire ferrule. With the twisted wire design we use you can run the harness and amplifier power wire together.

Wävtech amplifiers have an advanced version of their LinkDQ built in, the information on tuning the LinkDQ can be used here (see pages 4-6 for more details).

A Speaker level or high level: This is a reference to the voltage that is put out by the factory radio/amplifier. The down side to using this type of signal is that it may come with a need to repair any factory EQ. The benefits when paired with the proper equipment are signal strength and quality.

B The days of finding a fuse to tap are gone. With DC offset the LOC/amp is monitoring for the 1/2 battery voltage (5v-7.2v) that rides on the speaker level signal. Pop noise is another matter, which generally comes from a timing conflict between factory radio boot up and amp turn-on time. All Wävtechs LOCs have about a 2-3sec turn-on delay, which mostly eliminates such issues. This can trigger when the vehicle is off due to the alarm system. This also happens when the key fob is near.

Audio Detection: is more reliable and doesn't trigger when the vehicle is off. It senses when the speaker wires has AC voltage thus only triggering the unit on when the radio itself is on. This also prevents popping or booming from the subs that DC offset can create.

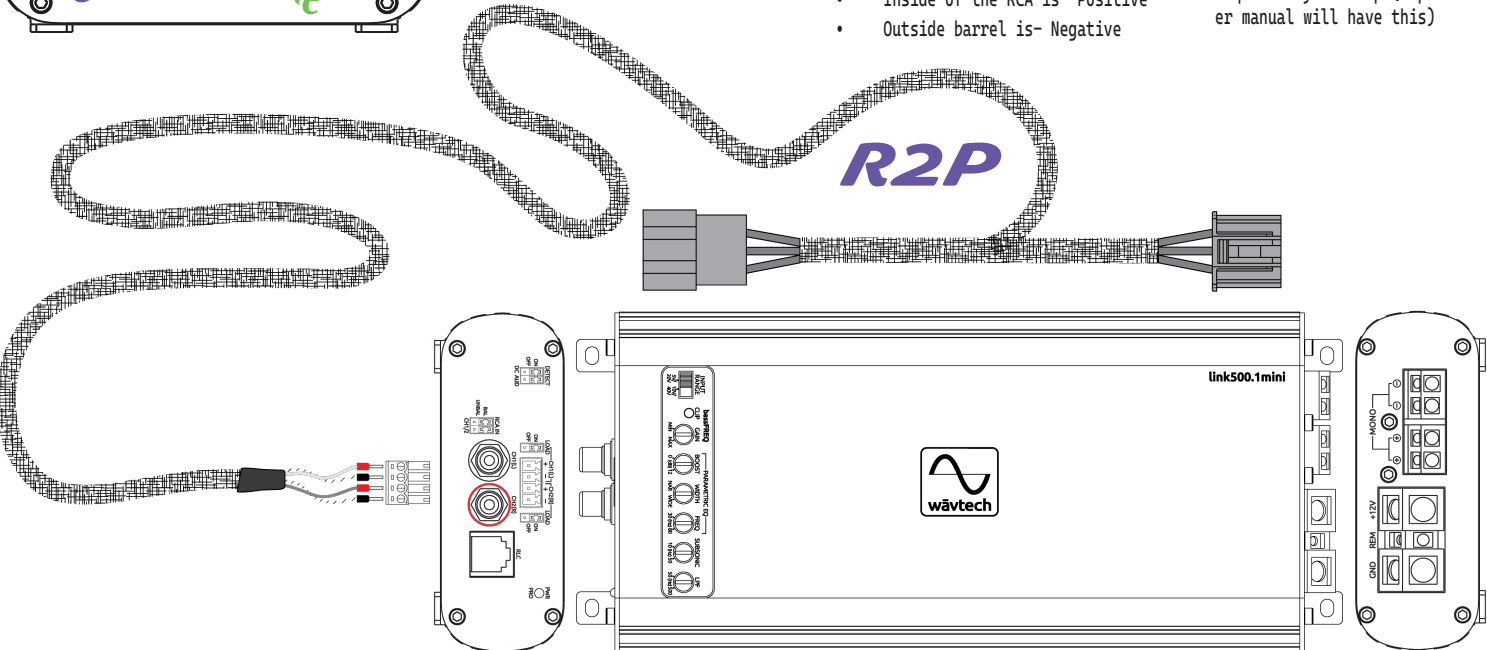
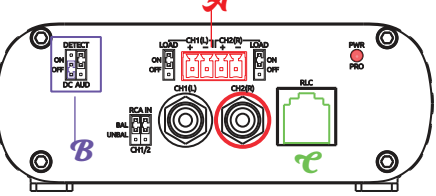
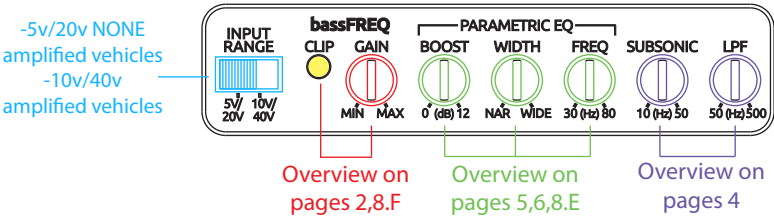
(linkRC): A volume knob remotely allows you to manage the pre-set gain of the LOC/amp. To set this up properly AFTER you set your amplifiers gain to not clip:

1. Set the volume/gain remote to the lowest setting
2. Run the linkRC cable
3. Mount your knob (verify its at the lowest setting)
4. Lastly connect the cable into the LinkRC

Doing this will ensure that the pre-set gain at the amp and the linkRC are in sync.

Info to know

- Battery power is DC voltage
- Audio is AC voltage
- Inside of the RCA is- Positive
- Outside barrel is- Negative
- Fuse at the battery should be equal to the total fuse required by the amp.(amplifier manual will have this)



Summary

Proper gain matching helps optimize the system's performance and prevents issues such as distortion, noise, or insufficient volume. Listed below are a few facts and scenarios that will help you better understand gain matching and the importance it plays in audio tuning.

A. Understanding Input and Output Levels:

- **Factory Radio Output:** Factory radios typically provide speaker-level outputs, which are higher in voltage than the line-level inputs required by aftermarket amplifiers.
- **Amplifier Input:** Aftermarket amplifiers expect line-level signals, usually around 0.5 to 4 volts, depending on the amplifier. Some amplifiers can take in Speaker level or High level input. EX: A Link1000.1 can take both types of signal inputs, most other mono amplifiers do not.

B. Selecting the right LOC:

- Choose an LOC that suits your specific car audio setup. Different LOCs have varying features, such as adjustable gain, signal sensing, and frequency response adjustments. Other features included in the Link Line are:
 - Differential Balanced Inputs
 - Low Impedance Outputs
 - Variable Gain Adjustments w/Clip LEDs
 - Auto-Turn On via DC-Offset or Audio Signal Detect
 - Generated +12V Remote Output
 - OEM Load Detect Compatible
 - Locking Detachable Power/Speaker Terminals
 - Professional Grade Panel Mount RCA's
 - Compact Aluminum Chassis w/Detachable Mounting Tabs

C. Using the R2G T-Harness:

- Normally you would need to find a pair of speaker wires along with a 12v and ground source that would feed the LOC. Having the proper signal going into the LOC can make the difference between having a properly tuned system and wasting your money and time.
- The T-Harness is made with twisted wire to maintain the signal integrity. It will also deliver the 12v power and ground to power the LOC. The harness will deliver the best available frequencies for subwoofers installation available in the vehicle. Using the proper left and right signal means you never miss a beat.

D. Connecting the LOC:

- Connect the speaker-level outputs from the factory radio or amplifier to the input side of the LOC, along with the power and ground provided by the T-harness. The wires are colored and labeled to match the LOC's input configuration.
- Connect the output side of the LOC to the aftermarket amplifier using a quality set of RCA cables. The further the run, the better the RCA cables should be. This connection provides a line-level signal to the amplifier.

E. Adjusting Gain on the LOC:

- Start with the gain set to its minimum position.
- The gain control on an LOC provides a means to adjust the output level of the preamp signal to match the requirements of the connected amplifier, ensuring optimal performance and preventing issues like distortion or clipping in the audio signal.

F. Adjusting Gain on the Amplifier:

- 1) Start with the gains on both amplifier and LOC at minimum.
- 2) Set the radio volume to just before it distorts, usually 3/4, and play some typical music or a -10dBFS sinewave if speakers are not connected and setting by voltage.
- 3) Increase the gain of the LOC until the amplifier's output distorts or reaches the target AC voltage based on the sub's power handling or amp mfg's recommendation.

Note-1: The clip LED on Wāvtech LOC's only comes on when it has reached full output, or about 10Vrms. This is usually too much for most amps except for a few that have high/low range switch like JL and Kicker. Therefore, the clip LED on our LOC's will not come on in most setups.

Note-2: The only reason to add gain at the amp when using one of our LOC's is for multi-channel systems. Where a volume difference such as between front/rear or sub is desired when using a single pre-amp's signal y-split between them.

- Properly setting the gain helps prevent distortion. If the gain is set too high, the amplifier may amplify the signal beyond its capabilities, leading to distortion or clipping. Setting the gain correctly ensures a clean and undistorted amplification of the audio signal.

G. Testing the System:

- Test the entire audio system with various types of music and audio sources to ensure that the gain settings are appropriate for different scenarios.

Boosting Bass Frequencies:

- **Scenario:** A recording lacks depth and warmth in the low-frequency range.
- **Solution:** Use a low-frequency EQ to boost the bass frequencies, restoring a fuller and more impactful low end.

Enhancing Presence in Vocals:

- **Scenario:** Vocals in a recording lack clarity or presence.
- **Solution:** Apply a mid-range EQ boost to highlight the frequencies associated with the human voice, improving intelligibility and bringing the vocals forward in the mix.