

**FMR Audio A.R.C.
Owner's Manual
V1.00**

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ACKNOWLEDGEMENT

If you're anything like me (just smarter and better looking...but I digress), when I get a new piece of audio gear I get excited and anxious to start playing with it to see what it can do for *the sound*. I hope that you too are excited and anxious to plug in your new FMR Audio A.R.C.! Before you jump in, however, I'd like to take a short moment to say something important: I know that you can choose to spend your money on any of a myriad of other available products. Whether by chance or coercion, you've chosen ours. For this, I'm grateful and would like to express a sincere...

THANK YOU!

I appreciate you putting your trust and hard-earned cash into one of FMR Audio's products (or at least giving us a shot by demoing them)! Even though all of us here at FMR Audio are very proud of our products, the point of what we do is to give *you* the opportunity to *make music* without excessively draining your bank account or making you feel that you must make excuses for the sonic results! I hope that the A.R.C. helps you realize, at least in some small way, your artistic vision...



Mark A. McQuilken
Designer & Co-owner

****CAUTION!****

The FMR Audio A.R.C. has the ability to daisychain its power connection. ***Using this feature correctly and effectively requires specific technical knowledge and should not be attempted by the casual user without the advice and direction of properly skilled personnel!*** Without the proper knowledge and appropriate action, it's possible to damage or destroy other devices, property and/or cause minor personal injury. For example, without the proper knowledge and appropriate action, it's possible to:

- Damage or destroy the A.R.C. and other equipment such as power supplies, pedals, amplifiers and speakers!
- Cause loud, ear-damaging noise!
- Blow mains breakers or fuses!

If you are unsure about or do not understand the fundamentals of electronics and power distribution, DO NOT ATTEMPT TO POWER OTHER DEVICES VIA THE A.R.C.

INTRODUCTION

This is the FMR Audio A.R.C. QuickStart Guide. The purpose of this document is to:

- Describe the overall features of the FMR Audio A.R.C.
- Describe the basic connection of the A.R.C. to your system.
- Describe the top/rear panel controls and connections.
- Present the A.R.C. specifications.

FUNCTIONAL DESCRIPTION

A.R.C. Overview

The FMR Audio A.R.C.—an acronym for “Articulation, Resonance and Clarity”—is named for its perceived effects on the sound of many instruments. The A.R.C. allows you to easily alter how more transient notes “stand out” against sustained ones (articulation, resonance), while increasing the overall perceived clarity of the sound. The A.R.C. offers sonic performance, along with a unique combination of other features, that you will find equally useful in the studio or on the stage. Specifically, the FMR Audio A.R.C. provides:

- 1) A *boost* function that buffers and amplifies instrument signals to a higher level.
- 2) A *compressor* that enhances your instrument’s tone and dynamics.
- 3) A *direct box* to interface your instrument to live or recording studio equipment.
- 4) A *studio effect* that may be used to process audio tracks from your favorite Digital Audio Workstation (DAW) or recorder.

It does all this with a minimum set of controls and a look that entices you to plug it in and turn the knobs!

A Brief History

The FMR Audio A.R.C. is based upon our *very yellow* and *nicely* tonal PBC-6A. With the ‘6A, I found that I could make guitar tracks, especially acoustic guitar tracks, sound sweeter, fuller, and punchier with the right combination of PBC-6A control settings. A friend pointed out that his guitar’s sustain was being enhanced in a “totally *natural* way”—like the guitar amp was just resonating a little more—without the *suck-and-swell* characteristics we experienced with stompbox sustainers or compressors. Although I suspect that our ‘6A customers are using it on guitar tracks of all kinds (among other things), the ‘6A is a studio effect with a physical footprint that would be awkward for the performing musician outside of the studio. In addition, the nine adjustable parameters on the ‘6A just *might* be overkill in a stompbox application. What to do, what to do...

We spent many hours *head-scratchin'* and *prototypin'* to find the right features. We wore out our fingers and face muscles *pickin'* and *grinnin'* to achieve just the right sound. After many long months (*and* apostrophes), the result is the **FMR Audio A.R.C.**...and this manual. With only three controls (plus bypass), it provides PBC-6A tonality in a more convenient, easy-to-use format, with features more appropriate to support both live and studio instrumentalists.

What's cool about the A.R.C.?

This is the part of the manual where I trade-in my design hat for my recordist's hat by telling you what I think are the cool aspects of our products...in this case, the A.R.C.:

- **4-in-1 Useful Effects** — The A.R.C. provides a really nice sounding, high-impedance ($1M\Omega$...to avoid tone suckage) BOOST pedal followed by a special, tone-extracting and tone-enhancing COMPRESSOR. Pro-level power permits both the A.R.C.'s usage as a DIRECT BOX for impedance-matching as well as the ability to drive the relatively low-impedance inputs of recording/live mixing boards. The pro-level power also allows the pedal to be used as wide dynamic range STUDIO EFFECT.
- **Subtle & Sweet Compression** — For many players, pedal-based compressors are too over-the-top because they exhibit a *suck-and-swell* type compression. This works well for some special effects, but discourages one of the major uses of compressors/dynamic processors: to help balance the tone, presence and performance of an instrument, particularly when it must compete or blend with other sounds. The A.R.C. works well with electrified acoustic instruments in a live setting—where the subtleties of the instruments tend to get lost—by allowing the player to electronically balance articulation, resonance and clarity of the instrument. If you love the sound of your instrument in an intimate, solo setting, then you'll appreciate how the A.R.C. helps you achieve that experience in both live and studio performance settings!
- **Fidelity** — Although the A.R.C. is an effect, the audio electronics are designed so that the statically measured output signal very closely resembles the input signal—a paraphrased definition of fidelity. Each A.R.C. is hand-trimmed for minimum distortion, typically to less than 0.005% Total Harmonic Distortion plus Noise (THD+N).
- **Dynamic Range** — The A.R.C.'s 110dB dynamic range exceeds the dynamic range of many recording studio devices, not to mention the smaller dynamic ranges of the myriad of available *stompbox* effects. The additional dynamic range of the A.R.C. means more of your instrument can be heard with less noise and clipping.

- **Studio Effect Power** — Many guitar effects operate with a limited dynamic range determined by the use of a plain 9V power supply. Such a low voltage limits the technological choices for the analog electronics, forcing reliance on noisy and distorted out-of-date devices. The A.R.C. uses the incoming 9V to create a 30V internal supply ($\pm 15V$)! This permits the use of state-of-the-art devices to achieve low-noise, wide dynamic range performance.
- **Many Power Supply Choices** — We specify the A.R.C. to work with the industry-standard BOSS PS-120 type power supply. This center-negative, 2.1mm barrel connector, DC power supply is used by many effect pedals and is quite easily found on-line or in local guitar shops. The A.R.C., however, goes one better: it will run from voltages ranging from 9 to 12V, either AC, or DC of either polarity!
- **All Analog Signal Path** — From the input to output connectors, your instrument's sound is not converted to digital and back to analog. It comes into the A.R.C. as analog and stays analog all the way to the output jack! The result is a richer, higher-fidelity effect. The A.R.C.'s main signal path is all analog and is only assisted by digital/software processes in the power supply and sidechain circuits.
- **Hard-wired Bypass with a Twist** — Many effects pedal users insist that their pedals have a hard-wired bypass (i.e., "true bypass"). The A.R.C. provides this as well, but with a twist: in the rare case of a pedal or power supply malfunction, the A.R.C. will default to a BYPASS condition no matter what the position of the bypass switch! The idea is to keep things *rockin*, even under the rare case of a failure.
- **Daisy-chained Power Jacks** — To help keep things neat, there are two power jacks on the A.R.C. that allow power to be fed into the A.R.C., out of the A.R.C., and into another effect (see "**Control Descriptions**" starting on page 11).
- **Minimum Controls, Maximum Effect** — There are only three controls on the A.R.C.: preamp gain (INPUT), amplifier output level (AMP), and the drive control (DRIVE). Yet, by using combinations of the INPUT and the DRIVE controls, you can achieve many unique tones. The AMP control allows you to reduce the differences between the processed and the unprocessed levels.
- **Cool Blue Light-Emitting Diode (LED)** — This blindingly-blue light displays the amount of processing being done to the audio. The brighter the glow, the more processing. But, does it really matter? It just looks sooooo cool...

- **Perdy Knobs** — We designed the knobs to be locally built here in central Texas. They're custom-designed. They're custom-built. They're solid anodized aluminum and will last a couple of lifetimes.
- **THAT2181 VCAs** — These are the same VCAs used in scores of professional audio compressors, gates and other dynamic processors. We can use these without compromise, in part, because of the higher-than-normal power supply rails (see "Studio Effect Power", page 3).
- **Steel Cabinet** — There are a lot of really good effects pedals out there that are housed in the "standard" Hammond Manufacturing cast aluminum enclosure. We considered that type of cabinet as well, but decided that the A.R.C. was a little too different to package it the same ol' way. Instead, we designed a custom, two-piece cold-rolled-steel enclosure with a sloping front and room for the instrumentalist with prehensile feet. It's electroplated and covered in a hard polyurethane-based paint to last a good long time.
- **Made in Austin, Texas U.S.A.** — We want you to know that we do our own manufacturing here in beautiful Austin, Texas 'cause: (a) We live here. We're control freaks. We need things done to standards that are very specific and loftier than most. Manufacturing products here helps us to control important costs and reduce waste. All this helps ensure that your A.R.C. will retain its value and continue working for many years to come, (b) Austin's resources and culture—from a very lively music scene to lots of high-tech companies/products—help inspire and maintain our commitment to music and technology, and, (c) In order to help others, here and abroad, we believe we've got to be vital and capable ourselves. Our first choice is to employ as many U.S.-based resources as possible in the design, manufacture and distribution of our products.

What sucks about the A.R.C.?

In each product guide, I try to summarize the product's strengths (see "*What's cool about the A.R.C.?*" starting on page 2) and weaknesses from my view as the designer and user. This is no exception:

- **Few Panel Controls** — Many recording studio signal processors have lots of panel controls to afford maximum flexibility to the recording engineer. It's almost a requirement for the studio environment. For an effects pedal, lots of controls can be an unnecessary complication for many musicians. We tried to balance complexity of controls and ease-of-use and gave the A.R.C. three rotary controls and a bypass switch. Some will find this complement of controls to be too few, while others may find it to be *just right*.

- **Large & Heavy Enclosure** — As previously mentioned, we decided to use a non-standard enclosure for the A.R.C. This will be a problem for some musicians since it'll be more difficult to make room on a crowded pedal board for a larger-than-normal enclosure and, for even smaller set-ups, the larger enclosure will add more weight than most. Despite these concerns we chose this path for a couple of reasons: (1) there are more electronics in the A.R.C. than normal that, without resorting to more esoteric/expensive electronic assembly techniques, require more spatial volume, (2) we wanted enough panel space to permit control adjustments with your *prehensile* feet, and, (3) wanted a slanted top to make reading and adjusting the controls a tad easier.
- **Confusing Bypass Indicator** — This one will trip up some of you: when the A.R.C. is engaged, the GREEN light is lit and when the A.R.C. is BYPASSED, the RED light is lit. Technically, with this kind of presentation, the control should be labeled SYSTEM STATUS with GREEN indicating ENGAGED and RED indicating BYPASSED. Since SYSTEM STATUS sounds really pompous and nerdy, I opted to just label it BYPASS. Why the two LEDs? Primarily to combine the engaged/bypassed indication with an ad hoc power indicator. Besides, watching the LEDs go off and on in response to the footswitch is cool.

HOOKING UP THE A.R.C.

To use the A.R.C. as intended, there are three things you must do in roughly this order:

- Apply power to the A.R.C.
- Connect the audio source and destination(s) to the A.R.C.
- Play!

Connecting the A.R.C.

Here's some specific details about hooking the A.R.C. up:

- 1) **Connect the Power Supply** — Using a BOSS PSA-120/230 type power source, plug the power supply into the jack marked "Power In". We recommend applying power to the A.R.C. before any audio cabling is connected to avoid any "pops" occurring downstream when the power supply is connected. Although this is rarely injurious, it is annoying! If you're thinking about using the "daisy-chain power" feature of the A.R.C., please refer to the section "**Control Descriptions**" starting on page 11. Please be sure to heed all the warnings and *only* use this feature with proper consultation/supervision and/or hire someone to config-

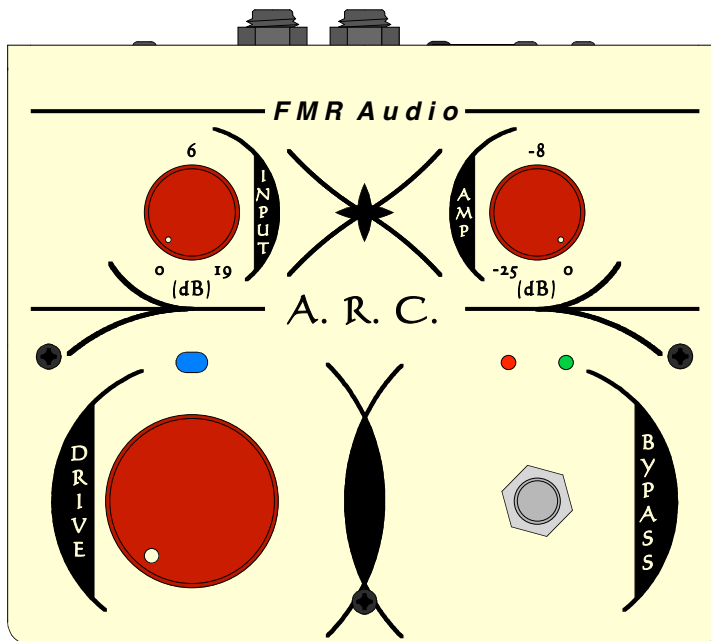
ure it for you!

- 2) **Connect the Source** — The A.R.C.'s input is a 1/4" unbalanced, high impedance (Hi-Z) phone jack. Because of the A.R.C.'s BOOST feature its high-Z nature, we recommend that your instrument be directly connected to the A.R.C.'s input for best results. The A.R.C. may also be inserted further along in your instrument's signal chain without ill effect. So, for example, if you've got your favorite XYZ pedal that you plug into first, just put the A.R.C. in the chain where you'd like it to be using a regular 1/4" phone plug cable. Remember, since the A.R.C. has a wide dynamic range, you may also use the A.R.C. as a studio effect! In that case, just hook it up with an unbalanced cable as you would any other studio effect.

- 3) **Connect the Output(s)** — There are two outputs on the A.R.C.: a 1/4" unbalanced phone jack and an XLR connector. For a regular instrument set-up, use the 1/4" output to go to your instrument amp. Should you also need a separate feed for stage monitors and/or front-of-house (FOH) applications, you may additionally use the XLR balanced connector by hooking up a regular microphone cable from the A.R.C.'s XLR connector to a mixing board. You can use the A.R.C. as a direct box in either a studio or live environment by using the XLR connector to connect the A.R.C. with a mixer or A-to-D converter.

You don't have to do things in the order listed above for everything to work. The above order is only a suggestion and has worked well for us.

Figure 1: The A.R.C.'s controls



OPERATING THE CONTROLS

Control & Indicator Descriptions

There are four top panel controls on the A.R.C. (see Figure 1):

- **INPUT LEVEL** — This knob controls the gain of the input preamplifier. This control is used in combination with the DRIVE control to change how the A.R.C. will affect your instrument's sound. This control will affect: the XLR output, the 1/4" output and the amount of input signal to the compressor.
- **AMP LEVEL** — The 1/4" output jack is intended to drive the input to an instrument amplifier. This control affects only this output and allows you to match the level coming out of the processing circuits in the A.R.C. with the level you get when the A.R.C. is bypassed. *This control doesn't affect the XLR's output level.*
- **DRIVE** — This knob sets the gain and mix levels of the internal compressor. When used in combination with the INPUT LEVEL control, this control will change how the A.R.C. will affect your instrument's sound. This control will increase the aggressiveness of the compressor and the amount that the compressor's output is blended with the unprocessed signal.
- **BYPASS** — When the GREEN light is on, the audio at the output connector is taken from the A.R.C.'s main signal path. When the RED light is on, the A.R.C.'s internal circuits are not engaged and it's as though you've plugged your instrument directly to whatever you've got connected to the output jack of the A.R.C., typically your amplifier.
- **PROCESS LED** — Simply put: the brighter this light, the more processing that's being done by the compressor. Even though it's not a multi-segment meter, with a little practice, this LED becomes a quick and useful indicator to help you judge how much the A.R.C. is processing your signal.

By the way, you might be wondering about the size of the knob on the DRIVE control: we figure that the most used control will be the DRIVE knob, so we made it a little bigger than the others!

Initial Settings

Although the A.R.C. can achieve a wide range of sounds with minimum controls, it's still impossible for us to specify exact settings for all the possibilities you may have for the A.R.C. Despite this, we *can* give a recommended starting set-up. For these initial settings, we'll assume that you're using an instrument, such as a guitar, plugged into the A.R.C and that the output of the A.R.C. is connected to an instrument amplifier. With this set-up in mind:

- Set the AMP level to the most clockwise position, the INPUT and DRIVE controls to the fully counterclockwise positions and make sure the A.R.C. is bypassed (i.e., the RED bypass light is lit).
- Set the volume of your guitar and amplifier as you normally would with the A.R.C. bypassed. Since the A.R.C. is starting in the *bypassed* condition, setting the volume of your instrument and amplifier is as though the A.R.C. is not in your signal chain.
- Engage the A.R.C. and adjust the DRIVE and INPUT controls to give you the desired effect (see “**Application Configurations**” starting on page 8). While playing, alternate between bypassed and engaged. When the A.R.C. is engaged, adjust the AMP control *so that the loudest parts of the musical passage are the same in both the engaged and bypassed conditions*.

Now we're ready to see how the controls vary the depth and character of the effect on your instrument!

Taking Control

As already mentioned, although we can't give you specific settings for the INPUT and DRIVE controls, there are a couple of guidelines that we can give you to help you more effectively pilot the A.R.C.:

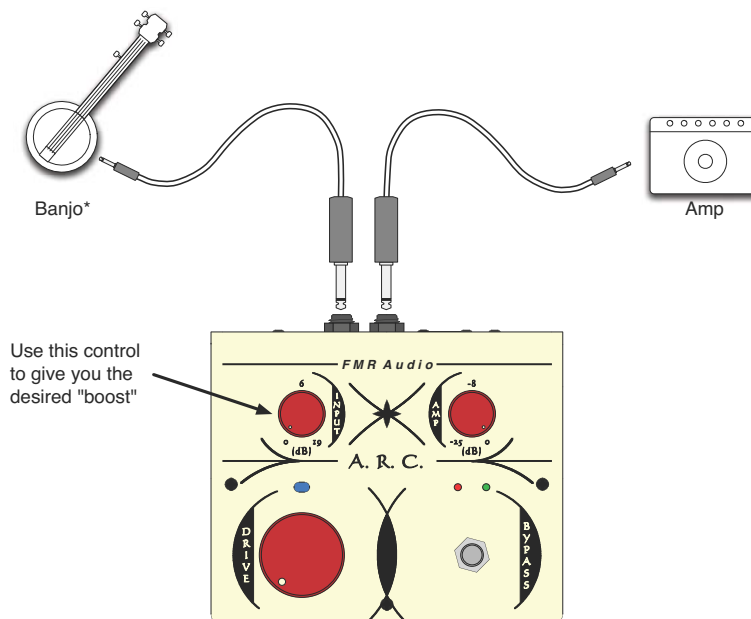
- 1) When the DRIVE control is fully counterclockwise (CCW), the A.R.C. acts mostly like a preamp and the compressor's effect is minimized. In this configuration, the INPUT and AMP controls dominate.
- 2) Regardless of the INPUT control's position, as the DRIVE control is rotated clockwise (CW), the A.R.C.'s compression action will be increased and the balance between the unprocessed/compressed signals will increasingly favor the compressor.
- 3) The XLR output of the A.R.C. is always active when power is applied. No matter what you're functionally using the A.R.C. for, the XLR output is available!

APPLICATION CONFIGURATIONS

The A.R.C. as a “boost” pedal

In this configuration, we don't want the A.R.C. to do much more than just amplify your instrument's signal. To use the A.R.C. as a boost pedal, keep the DRIVE control set to a minimum, the AMP control to “0” (i.e., fully CW), and use the INPUT control to give you the desired level

Figure 2: Using the A.R.C. as a BOOST Pedal



* — the banjo is shown for illustrative purposes only. The A.R.C. works with many instruments, stringed or otherwise, *including* the banjo.

The A.R.C. as a direct box

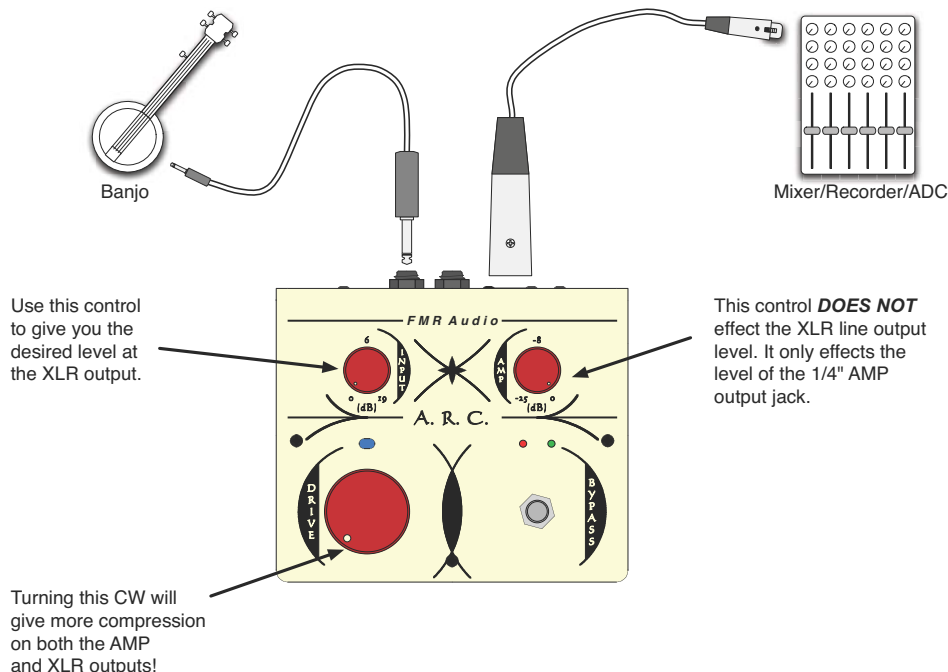
A “direct box”, also known as a “direct input” (D.I.), is primarily used to permit the connection of an instrument-level device to a line-level device, such as a live/studio mixer, analog-to-digital converter (ADC) or recorder. The A.R.C. provides this function whenever it’s engaged because the XLR output is always active. The D.I. signal is affected by both the INPUT and DRIVE controls, but not the AMP control. The AMP knob only controls the A.R.C.’s output level to the 1/4" output jack.

To set up for the D.I. function, generally you’ll want to get as much signal to the mixer/recorder that’s required for a good signal-to-noise ratio. With the gain control on the mixer/recorder set to “0dB” (consult your mixer/recorder’s manual for the details), adjust the A.R.C.’s INPUT control to give you the desired level.

The A.R.C. as a compressor

Set the A.R.C. up as described in *Initial Settings* and for either boost and/or D.I. function(s). To add compression, merely rotate the DRIVE control CW from it’s fully CCW position until you’re hearing the amount of compression you’d like. The DRIVE control will both change the amount of compression as well as the balance of the compressed signal with the uncompressed signal. In general, the settings to the left of the 12 o’clock position are relatively subtle. Beyond that, the compression effect becomes more pronounced and may be too extreme except for a “special effect”. Find the balance that’s good for your circumstance.

Figure 3: Using the A.R.C. as a D.I.



The A.R.C. as a studio effect

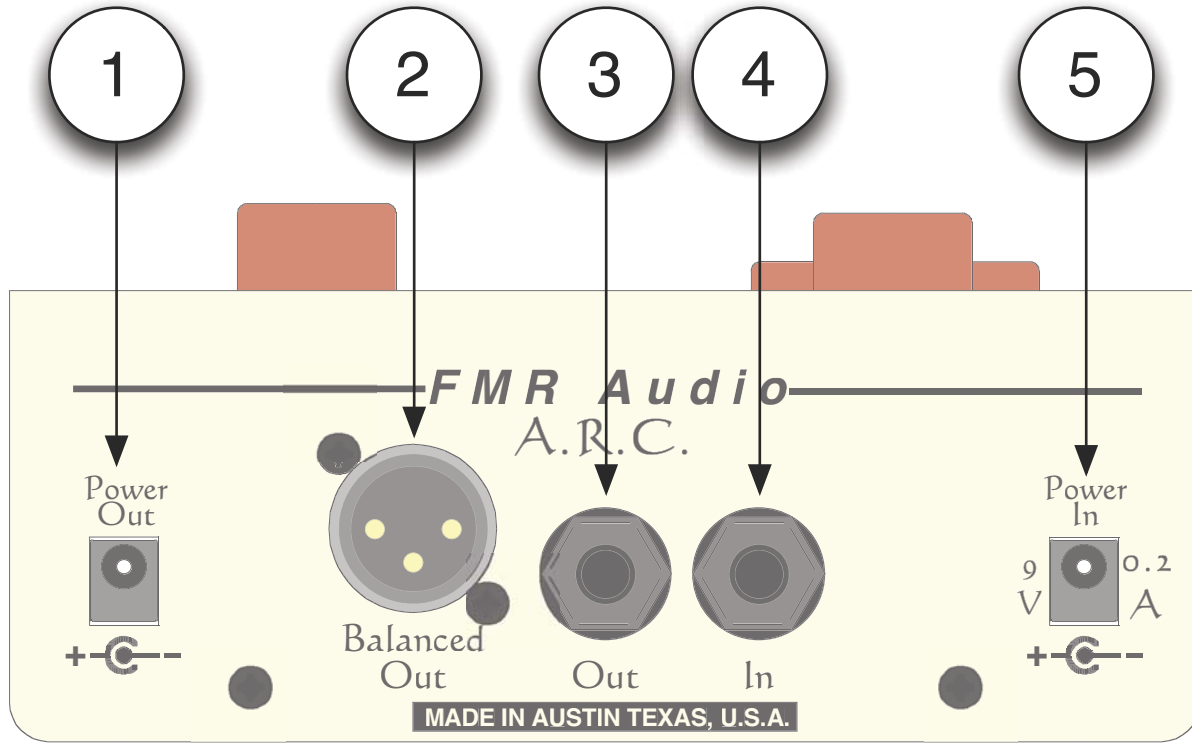
Hook up the A.R.C. as you would a dedicated studio effect. For example, let's say you've recorded a vocal track in your DAW and want to process it with the A.R.C. instead of a software plug-in. There are two parts to this: setting up the software and setting up the hardware (you'll need to confer with your DAW's manual for routing an external "insert"). To use the A.R.C. as an external effect, plug an appropriately configured digital-to-analog converter (DAC) channel from your interface into the A.R.C.'s input jack using a standard 1/4"-to-1/4" phone plug cable. Then, connect the A.R.C.'s output, either 1/4" jack or XLR jack, with an appropriate cable into a channel on your analog-to-digital converter (ADC).

CLOSING THOUGHTS

The FMR Audio A.R.C. is compact, 4-in-1 effects box that can positively enhance the sound of most sound sources: from stringed instruments like mandolin, dobro, acoustic guitar and fiddle all the way to drum tracks, vocals and even the two-mix (!), there's hardly a sound that doesn't sound better coming out of it. Whether you're a live performer or a studio cat, the A.R.C. can truly add some Articulation, Resonance and Clarity to your performances!

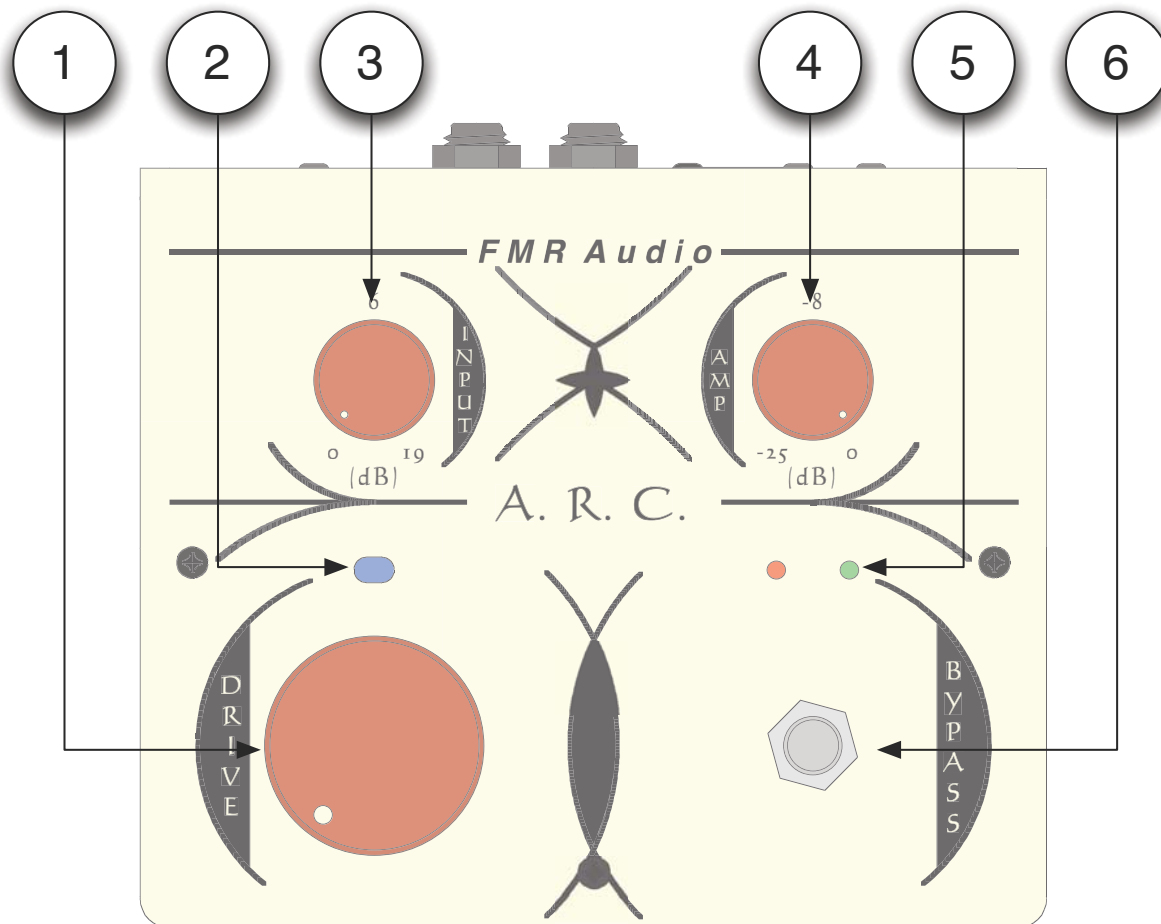
CONTROL DESCRIPTIONS

Figure 4: A.R.C.Rear Panel



#	Control Description
1	Power Out Jack — This jack is actually wired in parallel with the POWER-IN jack and is intended to permit the “daisy-chaining” of the A.R.C.’s power source to other effects pedals. <i>Although either may be used as an input or output, BE CAREFUL to observe the detailed electrical requirements of the other effects you’ll be connecting to.</i>
2	Balanced Output (XLR) — This output will product up to +20dBu of level in a fully balanced, differential manner. Use this output when you want to interface with equipment that uses XLR connectors for their inputs. This connector emits a signal whenever the A.R.C. is <i>active</i> (i.e., unbypassed).
3	Out (unbalanced to instrument amplifier) — Connect this jack to your instrument’s amp. This output is affected by all of the controls on the A.R.C.: DRIVE, INPUT, AMP and BYPASS.
4	In (unbalanced) — Connect your instrument into this jack with a “standard” instrument cable, i.e., 1/4" phone plug-to-1/4" phone plug.
5	Power In Jack — This jack is wired in parallel with the POWER-OUT jack. See “Power Out Jack” (above) for more details.

Figure 5: A.R.C. Top Panel



#	Control Description
1	DRIVE Knob — This control increases both the amount of compression as well as increases the mix between the compressed signal versus the uncompressed. When turned clockwise (CW), the unprocessed signal is decreased in relation to the processed signal and the compressor forced to simultaneously increase compression levels and ratios. In the fully counterclockwise (CCW) position, no measurable compression occurs.
2	DRIVE Level Indicator — This bright blue LED proportionally varies its intensity with the amount of signal compression. This feature is additional proof of the A.R.C.'s utility: the LED is so bright that with the right DRIVE level and musical performance, the A.R.C. may be used as a flashlight or, if engaged in official activities with SETI (www.seti.org), as a tool to aid in the search for extraterrestrial intelligence! We do not warranty the A.R.C. for such uses, however.
3	INPUT Gain Knob — This control changes the gain of the preamp stage from 0dB to almost 20dB. This is <i>not</i> an input attenuator. This control actually varies the first amplifier stage's gain. In this way, gain is applied only as needed and signal-to-noise ratio can be maximized.

#	Control Description
4	AMP Attenuator Knob — This is the gain control in the last stage feeding the OUTPUT jack, but it only causes signal attenuation. This control varies the signal present at the “Out” jack signal from 0 to 25dB of attenuation.
5	BYPASS Indicator — These two LEDs show whether the “Out” signal is coming from the A.R.C.’s circuits or from the source signal connected to the A.R.C.’s input jack. When the “Out” signal is taken from the “In” jack, the red LED illuminates indicating a BYPASSED condition. When the “Out” signal is taken from the A.R.C.’s circuits, the green LED illuminates indicating the ACTIVE condition.
6	BYPASS Switch — This switch causes the A.R.C. to alternate between the BYPASSED and ACTIVE conditions.

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**Appendix A:
Understanding and Using the A.R.C.'s
Power Out feature**

PURPOSE OF THIS DOCUMENT

The FMR Audio A.R.C. offers the ability to provide power to another “downstream” device without requiring another, power supply. This appendix was written to:

- Inform the user about the A.R.C.’s power circuit in sufficient detail to allow the successful powering of other pedals via the A.R.C.
- Alert the user about some potential problems when using this feature.
- Recommend a general method for evaluating and properly applying this feature.

WHO SHOULD READ THIS

This is written for those that understand electrical/electronic fundamentals and have a need to power at least one other device from the A.R.C.’s power daisychain feature. As mentioned in the warning at the beginning of this manual (see ****CAUTION!****), we recommend against using this A.R.C. feature unless you are quite skilled-in-the-art of electronic design, development and/or troubleshooting. If you’re not an electronics professional, please let a professional daisychain A.R.C. power to other devices!

THE SCOPE OF THIS DOCUMENT

This document assumes that the A.R.C. will provide power for only one additional device. Given the sheer number of effects pedals available, it’s likely there are other application issues lurking that have not been anticipated in this document. For this and other reasons, this document is not a substitute for the education and experience required to safely interface electronic devices!

POWER CIRCUIT DETAILS

The POWER IN and POWER OUT jacks are actually paralleled connections. Although marked as IN and OUT, these labels are intended to simplify hook-up for the general user by reducing apparent connection options. Obviously, IN and OUT designations for parallel connections are either really dogmatic or nonsensical. In this application, either jack may be connected *to* the power source, while distributing power *from* the remaining jack.

There is one 0.47 μ F/25V ceramic (X7R) cap in parallel with each set of coax jack terminals, physically located at each jack. The coax jack(s), in turn, feed(s) the AC terminals of a full-wave bridge rectifier (Schottky barrier type for low forward voltage). The “negative” of the bridge rectifier is the internal reference for the A.R.C., while the “positive” of the bridge rectifier feeds the power converter. The “internal” side of the bridge rectifier is bidirectionally filtered to tamp down HF noise in both directions. That is, this filtering is intended to reduce noise signals outside the A.R.C. from adversely affecting the A.R.C., and also any internal A.R.C. noise from adversely affecting outside devices.

The audio and power references are connected to the A.R.C.’s chassis. Since the incoming power supply reference and the internal references are connected through the bridge rectifier, there is a mechanism for a

potential difference to exist between a downstream device's audio reference and the A.R.C.'s. Should such a ground loop exist and should it create problems, the A.R.C.'s power reference connection to the chassis can be defeated to reduce the effects of such a potential difference (see "**Ground Loop Reduction**").

OPERATIONAL PRECAUTIONS

Voltage Polarity

The A.R.C.'s bridge rectifier allows either DC polarity power to be used or, if desired, an AC power source. Many effects pedals, however, do not allow for such a variety of power types and voltage levels. *It's possible that a power supply that works fine with the A.R.C. may actually present an injurious voltage and/or polarity to any other pedal "downstream" from the A.R.C. if connected via the A.R.C.'s daisy-chained-power feature.* For example, a power supply whose center pin is positive would work fine with the A.R.C. The A.R.C. would "pass along" this polarity to the A.R.C.'s other power jack. Clearly, this *could be* problematic and/or destructive to an effects pedal requiring a "center negative" connection only! The final voltage polarity for a daisy-chained system should be determined by the downstream device, not the A.R.C.

Voltage Range

The A.R.C. can operate over a range of voltages from 9V to 12V, either AC or DC while many pedals can only use 9VDC for their power. In general, the final power supply selection must be made for the device, either the A.R.C. or downstream device, with the most narrow voltage requirement that overlaps with the A.R.C.'s input voltage range. For a "typical" pedal this would be 9VDC.

Total Current Draw

Since a single power supply in the daisy-chained configuration would be feeding the A.R.C. in addition to downstream devices, the total current consumption must be considered. While the A.R.C. is specified to operate on as little as 200mA, be aware that it may actually require more current depending upon actual operational conditions. There are two additional considerations for the A.R.C.'s total current draw:

- The A.R.C. uses a THAT1646 line driver that's capable of +27dBm levels. This output level magnitude will obviously impact the total current draw and is *not* included in the specified 200mA average. In addition, because the A.R.C. is actually operating from $\pm 15V$ internally—levels developed by a switching power converter—one cannot merely add the increased current to the 200mA input current. The following simple expression, however, can be used to estimate the additional worst-case input current required for driving a line to +27dBm levels:

$$\Delta I_{xlr} = \frac{1.19}{V_{in}}$$

In this case, the ΔI_{xlr} denotes the change in current seen by the external power supply due to driving the XLR output to maximum levels into 600Ω , while V_{in} denotes the voltage of the external power supply (i.e., 9 to 12 V).

- The A.R.C.'s very blue Drive Level Indicator can also consume significant currents. It's actually driven by an opamp operating from the internal $\pm 15\text{V}$, so that the effect on the incoming current is a little more complex to calculate. After factoring power conversion efficiencies and the like, the additional current load on the incoming power supply is given approximately by:

$$\Delta I_{LED} = \frac{0.314}{V_{in}}$$

where, ΔI_{LED} is the additional incoming power supply current resulting from a maximum brightness LED and V_{in} is the voltage of the external power supply.

So, these two additional sources should be added to the A.R.C.'s 200mA current consumption at 9VDC (1.8W) in addition to the total current required by the downstream device that you're powering.

Ground Loops

Normally, when you're trying to power multiple audio devices from mains voltages, the isolating nature of the internal power transformers (and other circuits) helps prevent multiple ground paths that can result in signal interference and audio performance degradation. For a variety of reasons—including the lack of standards, ad hoc assembly practices, and a bare bones “design” approach—the typical effects pedal doesn't have isolation between the power terminals and the signal references. As long as the effects pedal is operated with a separate, isolated power source, interconnecting audio signals wouldn't create any problems. However, once you attempt to power two or more effects from a signal supply source, the shortcomings of such a powering scheme become evident. The A.R.C.'s daisy chaining power can be a convenient feature that, unfortunately, can uncover ground-related problems.

The accommodations that we've made for dealing with these problems are:

- The A.R.C.'s internal supply not only performs the power translation from the incoming 9-12V levels to $\pm 15\text{V}$, but adds an increased level of isolation between the power supply “reference” and the audio reference.
- The A.R.C.'s audio reference is optionally separable from the incoming power supply reference by a “ground lift” mechanism.

DAISYCHAIN CHECKLIST

Preflight

Before hooking up the A.R.C. to the downstream pedal or the power supply:

- Identify the power requirements of the downstream device, i.e., voltage, voltage polarity, current and connector characteristics.
- Select the operating voltage for the entire chain by picking the highest down-

stream device voltage that's within the A.R.C.'s root-mean-square (RMS) voltage range. This becomes the required V_{supply} .

- Calculate the total additional power required by the A.R.C. as discussed in "**Total Current Draw**" of this appendix.
- Add the A.R.C.'s total current requirement to the downstream pedal's maximum estimated current consumption. This becomes I_{supply} .
- Make sure that the power supply you've sourced is rated to provide V_{supply} at I_{supply} via a 2.1mm coaxial connector with the polarity required by the downstream device.
- Hook up the downstream device with a cable that has a 2.1mm coaxial connector on one end (to connect to the A.R.C.'s power jack) and whatever connector is required to interface to the downstream device power jack.

Now, the A.R.C. and the downstream device have their power connections made. At this point, interconnect the audio of all devices as you would normally. Carefully power up the system and verify expected audio performance. If there are any unexpected hums, buzzes or excess noise that seem to be related to the A.R.C. and the rest of the system, consider the following section, "**Ground Loop Reduction**".

Ground Loop Reduction

One of the most troublesome noise issues in a given set up can often be caused by so-called *ground loops*. This is a category of signal interference caused by the flow of unwanted currents, usually due to multiple return paths. When all other external mechanisms for reducing ground loop effects have been exhausted:

- Reduce the coupling between the signal and power references in the A.R.C. by completely removing the screw on the right side of the cabinet. Please note that "right side" reference is relative to the view as seen in the manual with the audio connections toward the top of the page and the knobs facing you (see **Figure 1: "The A.R.C.'s controls"** on page 6 of the main manual).
- In place of the removed screw, carefully put in the provided Nylon screw. Finger tighten this screw only.

Conclusion

By applying sound electronic interfacing principles, the following guidelines presented in this appendix and using the features present in the A.R.C., another effects pedal can be adequately powered while maintaining acceptable-to-excellent audio performance.