The *Ariane* Stereo Audio Leveler

User's Manual

v1.2, 5/2002

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Contents

Thanks!

In April 2001 the *Ariane* won a coveted ***Cool Stuff Award*** from Radio World Magazine. Our sales skyrocketed, and we sold every Ariane we could assemble. Engineers from all fields of broadcast and audio had nothing but kind words for our product. It's been another great year! Thanks to all the believers!

The *Ariane* is the culmination of a lot of thinking and a lot of input from some very knowledgeable and generous people. From the pioneering CBS Labs crew of the 1950s and 60s: Emil Torick, Benjamin Bauer, Peter Goldmark and others whose names I never knew. To the processing gurus such as Bob Orban, Ray Dolby and Glen Clark, who took broadcast audio processing a few great steps forward. Especially to Frank Foti, mentor and friend, who showed me *it can be done.*

To Greg Strickland, for introducing me to nuance and finesse in audio. To Jim Huste for being a great business partner in TransLanTech Sound, LLC, not to mention a truly great friend. To Gary Blau for getting me into New York radio long ago, and for offering to try the *Ariane* on the air in Miami. To Marc Augis of Skyrock/Paris, who was first to take the chance to try the *Ariane* in the real world of competitive radio. To Matt Connor, for helping get the *Ariane* out the door, and Gary Kline for putting it in so many racks. To mentor Richard Williams, to Terry Hesters and other unsung audio processing gurus whose days have gone by, who offered help and wisdom, only asking that I pass it on. An especially big *Thank You* to Dave, Chris, Kerry and the others at Broadcaster's General Store who helped make the *Ariane* project a reality. To my family, who will never understand what I do, never mind understand *why* I do what I do.

To Ariane Reaves, for being my life partner and the inspiration to create the product that carries her name.

David P. Reaves, III

TransLanTech Sound, LLC

Spring 2002

PS

This latest version of the *Ariane User's Manual* reflects many hours of work. Though it is certainly not perfect, every effort has been made to be clear and complete. If you see a mistake or wonder about a particular point I tried to make, please let me know.

Listen to *Ariane!*

The *Ariane Stereo Audio Leveler* was designed to automatically adjust wide-ranging audio input levels to within a user-defined output range, without adding undue processing artifacts. The concept is based on some classic tried-and-true audio processing schemes, with a few twists added in. While many of the individual building blocks of the design are well established, this particularly powerful combination of ideas is totally new. We've taken advantage of the robustness and simplicity of products from the maturing analog VCA design/manufacturing industry to build a processor that is clean, consistent, stable and easy to understand and use. Best of all, it's great just to *listen* to it!

Ariane's Main Features

• *Ariane's* **intelligent dynamic range control** concept can be traced way back to CBS Laboratories' *Audimax's* with its "gain platforming with release gating and gated gain stabilization," a proprietary gain control scheme from the 1960s. The concept was groundbreaking at the time, and is still valid.

• **RMS detection** makes the *Ariane's* control circuitry more natural-sounding than typical *peak* detection, because it is more like the way the human ear/brain hears sound.

• **Feed-forward control** allows the *Ariane* to be consistent over an extremely wide dynamic control range.

• **Multi-band design** makes the *Ariane* more open sounding by making its control much less obtrusive.

• **Stereo Matrix (L+R/L-R) control** means you have control over not only the levels, but also the *stereo stage* image as well.

• *Ariane's* circuitry uses **linear control voltages** to allow the user to make decibel-accurate changes, so adjustments and settings will be consistent, predictable and repeatable: unit to unit, channel to channel, band-to-band, time after time!

Included in this User's Manual:

• Pictures and descriptions of the connectors and controls on the front and rear panels and the chassis interior with internal settings;

• How to connect your Ariane and set it up;

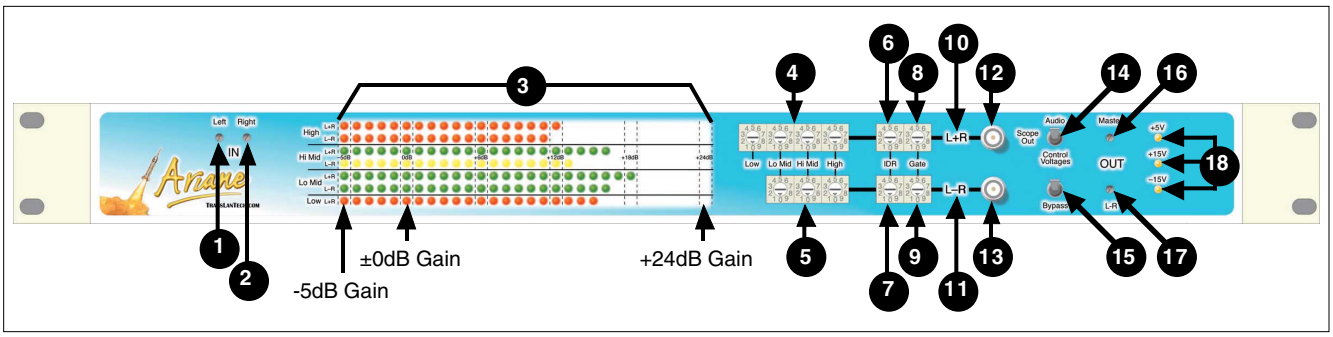
• How to use the *Ariane's* controls;

• How to integrate the *Ariane* into your existing system;

• A block diagram with circuit function and detailed descriptions and specifications;

• Recommended factory settings;

• A glossary to acquaint you with the terms we use frequently in the Manual.



Ariane's Front Panel

Starting from the left to right, here are the controls and indicators on the *Ariane's* front panel. See illustration above; numbers in circles refer to descriptions below:

(1) ***Left*** *and* **(2)** ***Right Channel input controls:*** Used in conjunction with the *LED multi-band gain metering array* to properly set input drive to the *Ariane.* Continuous adjustment from -10dBV to +10dBV (-30dBV to -10dBV when internal "+20" jumpers are installed)

(3) ***LED multi-band gain metering array:*** a 210 LED multicolor array, used to indicate the gain and control status for each of the four L+R and three L-R audio bands. Each horizontal row corresponds to the **audio gain** in one band; each LED equals one dB of gain, over a range of 30dB, from one LED lit (-5dB gain, the same as a five dB *loss*)... to +24dB gain, which is represented by all 30 LEDs being lit. So when more LEDs are lit, more gain is occurring in that band.

The **color** of the LEDs indicates the **status** of that band: **Green = Release,** gain is *increasing;* **Yellow = *IDR* Hold,** audio is within *IDR* (*I*nstantaneous *D*ynamic *R*ange) *window,* gain is *unchanged;* **Red = Release Gate,** audio is below useful level, gain is *unchanged.* After 10 seconds of inactivity *(Gate)* in any band, the gain in that band will return to ±0 dB *(zero reference)* gain, six LEDs lit.

(4) ***L+R*** *and* **(5)** ***L-R individual band output level controls:*** dB-linear rotary switch controls for mixing output levels from each band's *APE (A*riane *P*rocessor *E*ngine). One dB per switch click-step, from ±0 to +9dB.

(6) ***L+R*** *and* **(7)** ***L-R IDR controls:*** set the *I*nstantaneous *D*ynamic *R*ange (or *density)* of the *APE*s. These are rotary switches, adjustable in ten increments of 1.5 dB, from 1.5 ("0" switch setting) to 15dB ("9") of *IDR.* Lower number settings will yield more aggressive control. Higher switch numbers allow a wider dynamic range with less processing.

(8) ***L+R*** *and* **(9)** ***L-R Gate controls:*** set the release gate sensitivity thresholds. When the RMS level of the audio in a particular band is *below* this threshold, that band's *APE* goes in to *Gate* mode (to hold the gain where it was). The controls are rotary switches, adjustable in ten steps of 2 dB, from -35dB ("0" switch setting) up to –17dB ("9") below the *zero reference* of ±0dB gain operating level. Lower switch setting numbers mean more aggressive control. Higher switch numbers present a higher threshold with more gating, and therefore less processing. NOTE: This is *not* an audio gate, but rather a control to prevent the processor from releasing and unnecessarily adding gain in the absence of useful audio.

(10) ***L+R overload LED:*** to the immediate right of the L+R *Gate* control switch; the "L+R" is back-illuminated in red when the *Ariane's* L+R output approaches clipping.

(11) ***L-R energy level LED:*** to the immediate right of the L-R *Gate* control switch; indicates in blue when there is substantial L-R energy (greater than -10dBV) in the output signal.

(12) ***L+R and*** **(13)** ***L-R BNC test jacks and*** **(14)** ***Scope Out toggle switch:*** with the upper toggle switch in *Audio* position, BNC jacks present buffered audio samples of the processed L+R and L-R outputs for monitoring. In the *Control Voltages* toggle position, the BNCs present multiplexed control voltages for monitoring using a dual-trace oscilloscope.

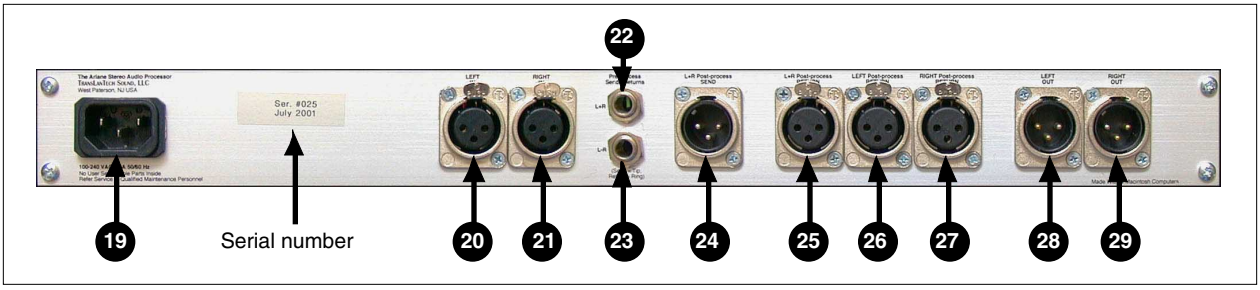
(15) ***Bypass toggle switch:*** when flipped down in *Bypass* position, removes energizing voltage from the *Bypass relay,* routing audio directly from the *Ariane's* input jacks to the output jacks. This relay also disengages when power is removed, providing *fail-safe* operation should there ever be an internal or external power problem with the *Ariane.*

(16) ***Master (L+R/L-R) Output control:*** sets main output levels of the processed L+R and L-R (and decoded Left and Right outputs). Adjusts nominal output level from about -10dBV to +10 dBV.

(17) ***L-R Output injection control:*** determines how much L-R energy is added to the *Master (L+R/L-R) Output* to send to the stereo (Left and Right) outputs of the *Ariane*. Continuous adjustment over the range of approximately -12dB below L+R level up to ±0dB, with center setting being 'normal' gain.

Pull my finger: Just checking to see whether you're paying attention. <grin>

(18) ***Power supply voltage indicators:*** glow brightly when all three supply voltages are at their proper levels. If one or more is not lit or is very dim, there is a problem with that portion of the power supply or the circuitry connected to it.



Ariane's Rear Panel Ports

(19) ***IEC standard power connector*** Accepts any international power cable, and any voltage, 85-240 V AC/DC.

(20) ***Left Channel and*** **(21)** ***Right Channel Main Stereo Inputs:*** Balanced XLR female connectors, pin 2 hot, to accept a nominal operating level from about -10 to +10 dBV (front panel adjustment). Inside the *Ariane,* there are *input gain* jumpers to optionally add 20dB more input gain. When front panel *Bypass* switch is engaged, or in case of loss of AC power or failure of internal power supply, input audio is routed directly via relay from input jacks to output jacks (28) and (29).

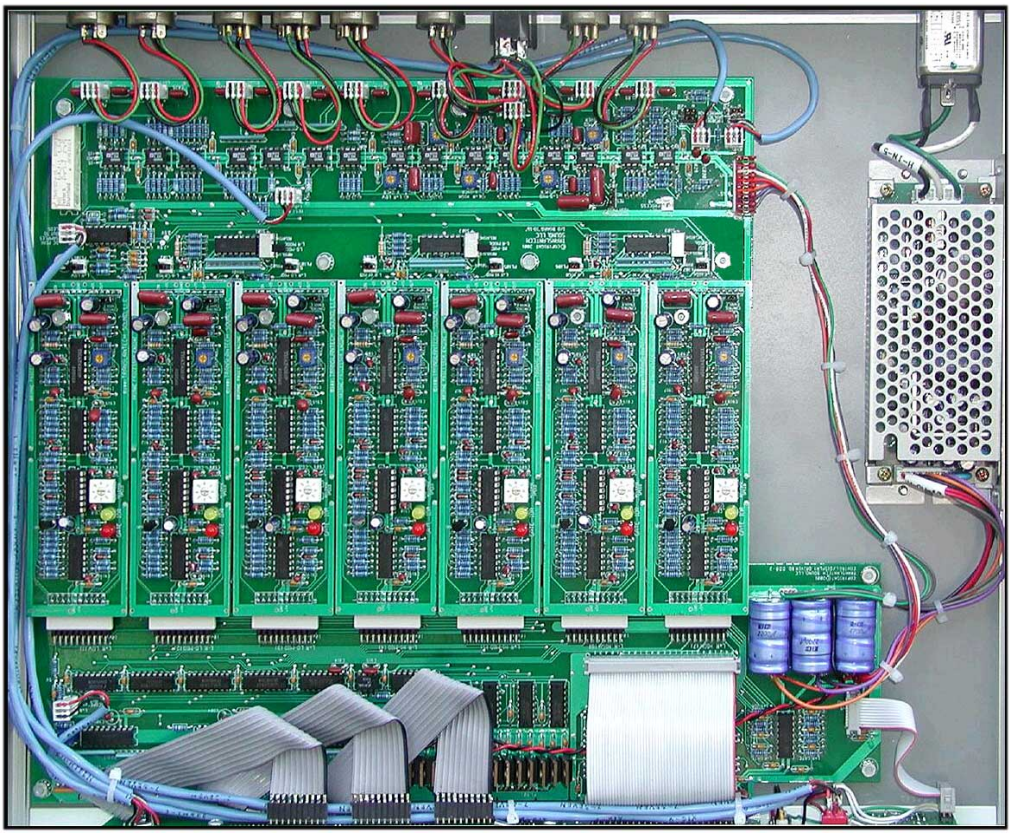
(22) ***L+R and*** **(23)** ***L-R Pre-processing insert jacks:*** Unbalanced on separate, normalled 1/4" female phone jacks. *Send* is on tip, *Return* is on ring, shield is common. Nominal 0dbV level.

(24) ***Post-process L+R send output:*** XLR male connector, useful for driving reverberation sidechain, etc. Changing the *Master (L+R/L-R) Output* control on the front panel will alter the level at this output. Line level nominal -10 to +10dBV, balanced, pin 2 hot.

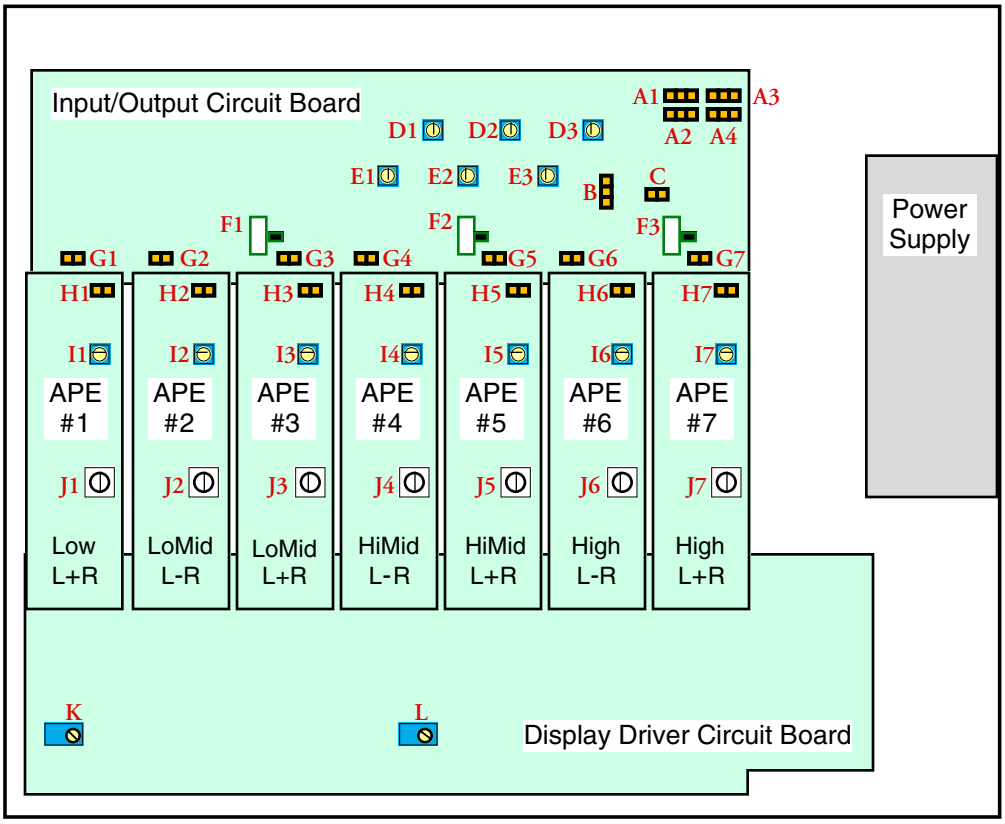
(25) ***Post-process L+R insert (return) input:*** XLR female connector, for summing additional mono programming such as microphones into the processed signal. It is decoded along with the processed L+R, to send equal levels to the Left and Right main outputs. Its level at the outputs is unaffected by the *Master (L+R/L-R) Output* control on the front panel. Line level nominal 0dbv, balanced, unity gain, pin 2 hot.

(26) ***Left and*** **(27)** ***Right post-process stereo insert (return) inputs:*** XLR female connectors, for summing additional stereo programming such as reverb return, etc., to the processed signal; its level at the output us unaffected by the *Master (L+R/L-R) Output* control on the front panel. Line level nominal 0dbv, balanced, unity gain, pin 2 hot.

(28) ***Left Channel and*** **(29)** ***Right Channel Main Stereo Outputs:*** XLR male connectors, pin 2 hot, balanced, nominal line level from about -10 to +10 dbV (front panel adjustment); approx. 24 dbV peak at clipping. Output maintains absolute phase polarity relationship to input.



(Rear)



Front Panel

Interior Layout

The various printed circuit boards inside the *Ariane* are divided by function:

Input/Output circuit board: This is where the audio comes initially, where it is split up using crossovers, and then re-summed for output again. It is the large board at the rear of the *Ariane* chassis.

APE (Ariane Processor Engine) Compressor Cards: There are seven of these, piggybacked between the *Input/Output* circuit board and the *Display Driver* circuit board.

Display Driver circuit board: Has all circuitry associated with the front panel display, and the reference signal generating circuitry to set the operating parameters for the *APE* compressor cards. This is the large board at the front of the chassis.

Front Panel circuit boards: Three boards; the leftmost holds the input control potentiometers and the *LED multi-band gain metering array*. The middle board has all the step-switches for band gains, *IDR* and Gate controls, and L+R and L-R peak indicator LEDs. The far right front panel board has the output controls and the three power supply indicator LEDs.

Power Supply: This is a Cosel 15-Watt, modular, universal-input, triple output power supply. It is at the far right (when viewed from the front of the *Ariane*) of the chassis. The rear plug connects to the rear panel's IEC power jack/RF filter, and the front plug connects to a wire harness that goes to the *Display Driver* circuit board.

Ariane **Internal User Settings**

Inside the *Ariane* are numerous controls, jumpers and switches whose settings will affect its operation and therefore its sound. These settings won't need to be changed often, which is why there are located internally. See the diagram on the previous page to locate these control options.

Input/Output circuit board:

• *Input Gain jumpers (A1, A2):* Toward the rear panel, on the large *Input/Output* circuit board toward the end nearest the power supply, there are headers with jumpers that set the input gain of each channel. The headers are labeled for the amount of gain they add: '0' dB and '20' dB. If you find you have too little input gain (or too much), see if the jumpers are in the proper position for your needs. The *Ariane* is shipped set to '0' dB gain. *All four jumpers must be changed together for proper operation.*

• *L+R Resonant High-pass Filter jumper (B):* In the normal *Yes* position, this jumper enables a high-pass filter on the L+R only. The *No* position bypasses it. This filter is a second-order resonant design, with a 'bump' of 5dB at 37Hz. Its purpose is dual: first, to remove extreme low frequency noise or DC from the processors, second, to add a subtle yet full hint of very low bass.

• *L+R source (C):* For test purposes, this header provides the L+R signal directly out of the L+R matrix. By connecting a wire jumper from this point to any of the *individual band input* headers (G1-G7) this signal can be used to troubleshoot the individual *APE* cards. For normal operation, there is no connection to this header and no jumper needs to be on it.

• *L-R Crossover Frequency controls (D1-D3); L+R Crossover Frequency controls (E1-E3):* There are six trim pot controls for crossover frequencies on the *Input/Output* circuit board. They're labeled L+R Low, L+R Mid, L+R High, L-R Low, L-R Mid and L-R High. These controls determine where in the spectrum the audio is split to be sent to the *APE* cards. The adjustment is clockwise for higher frequency, and set at the factory to mid-scale. For audio with a rather well balanced frequency spectrum these settings put nearly equal energy into each band, therefore a similar amount of gain control occurs in each band. This provides a spectral balance at the output that is very similar to that at the input.

• *Absolute/Relative L-R mode slide switches (F1-F3):* The L-R circuitry can operate either in conjunction with or separately from the L+R control circuitry. Each of the three L-R bands has a small slide switch associated with it, located on the *Input/Output* circuit board. When a band's switch is set for *Absolute* mode it will operate independent* of the L+R band. When the switch for that band is set to *Relative* mode it will operate in relation to what the L+R band is doing. The *Relative* setting keeps the L-R control system coordinated with the L+R, to keep a nearly constant energy ratio between them, in turn creating a more consistent stereo stage.

*The *Gate* signal from the L+R is hard-wired to OR into the L-R's Gate signal in either switch position. This means that the L-R will *always* gate with lack of audio in either the L-R *OR* the L+R.

• *Individual band input headers/jumpers (G1-G7):* Should there ever be need to troubleshoot the *Ariane,* it may be desirable to disable the audio going to one or more of the *APE* cards. These headers allow that. For proper operation, all seven of these jumpers *must* be in place!

APE circuit boards:

• *Control Voltage enable jumper (H1-H7):* To disable the control function of an *APE* card, remove the jumper from this header. Once the gain stabilizes (after about one minute), it will allow audio to pass through at ±0 dB *(zero reference)* gain. All seven of these jumpers *must* be in place for normal operation!

• *VCA Distortion null control (I1-I7):* This is factory set, and typically will be at about mid-range. For proper test procedure, consult TransLanTech Sound, LLC.

• *Release Time rotary switch (J1-J7):* On each of the seven Ariane Processor Engine *(APE)* cards there is a white rotary switch very much like the ones on the front panel. This switch controls the Release time of that card. "0" is very short (fast), and "7" is the longest (slowest). The Ariane is delivered set to "2", a very useful compromise position. [On the very first Arianes, there are three DIP headers, labeled '1', '2' and '5'. By adding shorting jumpers, you perform exactly the same function as the switch. All jumpers "off" is fastest (store the jumper by pushing it onto just one post of the header) and all jumpers "on" is slowest. A combination of jumpers results on eight possible settings, as with the rotary switch. The early *Arianes* were delivered with one jumper on the '1' header.]

Display Driver circuit board:

• *Metering "0" calibration control (K); Metering "Low" calibration control (L):* The front panel *LED multi-band gain metering array* uses a comparator circuit to determine which LEDs to light for which amount of gain. Trim pots for fine adjustment are at each end of the comparator strings, underneath the ribbon cables on the *Display Driver* circuit board (the large horizontally placed board located just behind the front panel). One pot ("Low") controls the maximum gain calibration and the other pot ("0") controls the ±0dB *(zero reference)* gain position. Adjustment of these controls does not affect the sound of the *Ariane*, and we suggest you leave them alone unless you have a precise audio generating and metering test set at your disposal. For proper test procedure, please consult TransLanTech Sound, LLC.

Pre-Flight Check

After you take the Ariane out of the shipping box, look to see if there has been any damage. If so, please contact your shipper.

Initially, it's a good idea to bring the controls to nominal settings (the Factory Stock settings for all front panel and internal controls are detailed in the back of this manual).

Use a small screwdriver, ('greenie') to do the following:

• Turn the *Left Input* control (located at far left of the front panel, to the left of the big LED array) all the way down counterclockwise, then carefully turn it halfway up. Do exactly the same with the *Right Input* control.

• Set all seven of the front panel *individual band output level* control rotary switches to "0." These switches are the little white square boxes directly to the right of the *LED multi-band gain metering array.* There are four (upper) for the L+R bands, three (lower) for the L-R bands.

• Go to the next switches to the right. Set the L+R *IDR* switch control (the upper one) to "4" and L-R (lower switch) to "3". These settings correspond to a 7.5 dB *I*nstantaneous *D*ynamic *R*ange for the L+R, and 6.0dB *IDR* for the L-R bands.

• Moving further to the right, Set the *Gate* step switches for both L+R and L-R to "0" (which corresponds to a -35db *Release Gate* threshold)

• Flip the lower toggle switch down, to *Bypass.*

• As you did with the input controls, turn both the *Master (L+R/L-R) Output* and *L-R Output* controls all the way down counterclockwise, then carefully halfway back. These controls are located at the far right of the front panel, just to the left of the Power Supply indicator LEDs.

All the processing step switches are now at a good starting point, all the input and output pots are at their halfway points, and any audio coming into the *Ariane* is being bypassed directly to the output.

System Setup and Operating Procedure

We recommend that before you integrate the *Ariane* into your broadcast equipment chain, you hook up some audio and listen to it for a while. The best, most complete introductory listening setup will include 1) a quality audio source, such as a CD player or other programming source; 2) the best set of speakers you can get your hands on, 3) an amplifier that can drive them to the levels you are comfortable listening to, 4) a means to visually monitor levels with metering or, preferably, an oscilloscope. Being able to switch the source material to mono will simplify initial adjustment. Here's how to do a complete setup:

Looking at the rear panel, connect balanced, line level audio into the two leftmost female XLRs *(Left* and *Right Main inputs).*

The *Left* and *Right Main outputs* (balanced, line level) are available from the two rightmost male XLRs on the rear panel. Connect a suitable monitoring system to these outputs, such as in a studio or control room. You should listen in a comfortable monitoring space, and try to avoid interruptions as you get acquainted with operating the *Ariane*.

Plug the power cord in the IEC connector on the rear panel and power it up (the *Ariane* features a universal multi-voltage internal supply, and is capable of operation with most power systems around the world). The three power indicator LEDs at the far right of the front panel should illuminate.

After a few minutes (with no audio on the inputs), the LEDs on the front panel *LED multi-band gain metering array* will stabilize with six LEDs lit in each horizontal row, ±0 *(zero reference)* gain.

Flip the *Bypass* switch up, to put the *Ariane* on line.

Play some CDs you know well, or listen to a known program source. If levels are about right, the front panel *LED multi-band gain metering array* will show most of the bands' LEDs to be hovering around ±0 dB *(zero reference)* gain, six LEDs from the left, the proper operating range for a normal audio input. You will probably see a lot of color changes and varying gain indications that follow the music or programming. If all the LEDs are *red,* the inputs are too low, or not properly connected; try turning the *input* controls up. If *no* LEDs are lit (though the power supply LEDS at right *are* lit), you're probably overdriving the *Ariane.* Turn *down* the input controls. You may need to change the internal *input gain* jumpers if you can't get the levels right (see page 7 and 8 for diagram and instructions).

Input and Output Calibration

To increase or decrease the drive to the *Ariane,* use the *Left and Right channel input* controls at the left of the front panel. For a well-balanced input signal both controls should be about the same position. Absolute levels are not critical but should be matched, Left *vs.* Right, as best as possible.

To accurately balance the Left and Right channel input controls:

First, *switch your signal source to mono,* so audio is identical at both the Left and Right inputs jacks.

Second, temporarily turn the *Master (L+R/L-R) Output* and *L-R Output* controls (at the right on the front panel) all the way clockwise, to exaggerate the difference between left and right audio. Set the L+R and L-R *Gate* and L+R and L-R *IDR* controls all to "0".

Use one of the four following methods to complete the input balance setup procedure:

Method 1: Attach a pair of calibrated audio meters of known accuracy to the output of the Ariane. Alternately adjust the Left and Right input controls, to keep the *LED multi-band gain metering array* ranging around ±0 dB *(zero reference)* gain, six LEDS in each horizontal row), while noting the channel balance on the meters. Once levels are balanced, return the output controls to mid-rotation.

Method 2: There is a *L-R energy level* blue LED hidden under the front panel *L-R* label, between the L-R *Gate* control rotary switch and the *Bypass* toggle switch. Adjust the Left and Right input controls, to keep the *LED multi-band gain metering array* ranging around ±0 dB *(zero reference)* gain, six LEDS lit in each horizontal row. Adjusting input balance to minimize the activity on the blue LED ensures that Left and Right inputs are very nearly equal. You may note that with perfect mono input balance the metering LEDs for the three L-R bands are *red,* indicating that the L-R level is below the gate threshold. Return the output controls to mid-rotation.

Method 3: Another way to adjust balance is to monitor the *Ariane's* L-R (lower) front panel BNC test jack with an AC voltmeter. With the upper *Scope Out* toggle switch flipped to *Audio*, use the meter to balance the Left and Right input controls for a *minimum* AC voltage at this jack. You may need to set your meter to its most sensitive scale. Once you are done, return the output controls to mid-rotation.

Method 4: Use two BNC-to-BNC cables with an oscilloscope set up for *X-Y (Lissajous)* display. Plug one cable from the top (L+R) Ariane BNC test jack into the Vertical input of the scope, and the lower (L-R) Ariane BNC into the Horizontal input. With the Ariane's upper *Scope Out* toggle switch set to the *Audio* position, adjust both scope channels for equal sensitivity. Perfect mono will yield a vertical line, and any unbalance will show a line at an angle. Once satisfied, return the Ariane's output controls to mid-rotation.

Setting the Output Level

You should now adjust the *Master (L+R/L-R) Output* control, dependent upon the level requirements of whatever equipment you are driving with the *Ariane's* output. The Ariane puts out about ±0dBV when the *Master (L+R/L-R) Output* control is centered. About +10dBV is reached at full setting. Output levels will be slightly hotter when using lower (more aggressive) *IDR* settings. We last left the *IDR* controls at "0," so you may want to go to a higher setting to make your sound a little more open.

Setting the L-R Level

Change to *stereo* source material.

With the L-R Output injection control at about mid-rotation, the stereo stage is fairly 'normal' sounding. The amount of L-R you use will depend on your taste, the aggressiveness of processing and/or your particular technical requirements. See ***Integrating Into Your Broadcast Air Chain*** (page 16) for more on this subject.

The input and output controls should rarely need readjustment (Once you have got the input levels in the ballpark, the *Ariane* will handle any typical variations. After all, that is what is was designed to do!).

FYI:

When you turn the L-R Output pot all the way down (counterclockwise) you will see equal levels from both left and right outputs. The output balance of the *Ariane* is very accurate. With a mono input and the L-R Output control minimized, the channel matching should be within one-tenth of a decibel.

IDR Adjustments

Clearly, the two most powerful controls on the Ariane are the L+R and L-R *IDR* (*I*nstantaneous *D*ynamic *R*ange) controls, (the upper for L+R, and lower L-R). Dialing these rotary step-switches clockwise *increases* the dynamic range, which in turn *reduces* the amount of processing. Since there is no stop on these switches, you can go all the way around to where you started…

With the *IDR* set at "1" or "2", the *Ariane* will control levels aggressively, all the while still sounding open and transparent. If you set the two *IDR* switches to "4" (which is 7.5dB *IDR*), it becomes harder to distinguish the output from input. This is a powerful but entirely open-sounding setting, appropriate for most formats. Of course you can try any setting you please, and set the L-R different from that of the L+R. The Ariane is shipped with the L+R and L-R *IDR*s set to "4" and "3," respectively.

Switch setting	*IDR*	Switch setting	*IDR*
"0"	1.5dB	"5"	9.0dB
"1"	3.0dB	"6"	10.5dB
"2"	4.5dB	"7"	12.0dB
"3"	6.0dB	"8"	13.5dB
"4"	7.5dB	"9"	15.0dB

Gate Adjustments

To further customize the processing action of the *Ariane,* determine and set your optimum *Gate* threshold. As with the *IDR* controls, the higher switch number settings will reduce the processing activity of the *Ariane*. You will want to set the *Gate* threshold so that the *Ariane* ignores audio that you consider too low to be processed. If you hear low-level material being boosted more than you like, set the *Gate* control to a higher threshold, at a higher switch setting. If the Ariane does not bring up low levels enough, try a lower switch setting. The Ariane ships with both Gate switches set to "0." If the nature of your audio is to have a low noise floor, and if you do not use a disproportionate amount of processing following the Ariane, this will be fine.

Switch setting	*Gate*	Switch setting	*Gate*
"0"	-35dB	"5"	-25dB
"1"	-33dB	"6"	-23dB
"2"	-31dB	"7"	-21dB
"3"	-29dB	"8"	-19dB
"4"	-27dB	"9"	-17dB

FYI:

Keep in mind that the *Release Gate* as implemented in the *Ariane* is NOT the same as an *Audio Gate* used with studio/musician dynamic controllers. We are not turning off the audio when we gate! We are halting the release of the compressors' gain controls, so as to freeze the control voltages wherever they were when the *Gate* command was received. Low-level audio will continue to be heard, albeit with no dynamic gain control.

Setting the Output Mix Controls

Using the *L+R and L-R individual band output level controls*, you can adjust the spectrum to suit your needs or taste. These controls are very straightforward: If they are set to "0" they are *flat*. To raise the level of a particular band, dial its rotary click-switch. The numbers are a direct decibel correlation: If you set a switch to "6" that band's output will be 6 dB louder than it was at the "0" position.

Caveat #1: There are no *negative* dB settings, so if you want to reduce only one band, you must instead increase all the other bands. But everything is relative, so if you start with all switches set to, for example, "5," you could then increase any output as much as 4 dB (to position "9") or decrease as much as 5 dB (to "0")

Caveat #2: When you turn up a level, you are reducing the headroom before clipping. To compensate, you should turn down the *Master (L+R/L-R) Output control* a small amount.

The numbers tell you where your settings are. But use your ears to make adjustments! Typically, most users will keep the L+R and L-R settings nearly the same. However, feel free to experiment!

Integrating Into Your Broadcast Air Chain

The *Ariane* sounds wonderful by itself! But when you put it into an air chain with other pieces of audio processing equipment, you'll probably have to makes some changes. Most of these changes will be with the other equipment.

Dump the broadband: Because the *Ariane* is an excellent wide-range leveler, you will *not* need any broadband (i.e., single band) leveling compressor ahead of it. The *Ariane* was specifically designed to eliminate the need for it, and will actually work best with a raw, completely unprocessed mix. And you will most likely want to disable or minimize any broadband leveling in subsequent equipment, except as you might desire purely for its effect.

Scale back your other processors: The *Ariane* is easily capable of more than 20 dB of gain alteration, sometimes as much as 30 dB. If you simply cascade more processors which may have another 30 dB or more of gain reduction available, you have a potential of over 60 dB dynamic gain change! This is *Too Much,* and that starts with *"T"* and *"T"* stands for *Trouble!* (with a kind tip of the hat to *The Music Man)*

We suggest you judiciously lower the amount of gain control in the other processor(s), with the goal of having them do less leveling (which is *Ariane's* strong suit) and focus their efforts more on peak limiting. We've found that a total of about 10-15 dB of control after the *Ariane* should be more than sufficient for even the most competitively aggressive markets (been there, done that). You may also find it useful to slow down the subsequent processor's release times.

Keep in mind that the *Ariane* is not a *loudness* box. It a *consistency* box. If you are using the *Ariane's* processed signal to feed your favorite Loudness Generating Device, you will find that you need less processing with your loudness monster.

If Supreme Loudness is *not* your Holy Grail (say *Hallelujah!)* then the *Ariane* can do the bulk of control, with your other processor doing peak limiting of about 5-10dB. You will sound incredible. We promise.

Digging Deeper

L-R Processing

Once you have set up the *Ariane* to work cozily with your other processing, you might try playing with the *stereo stage* via the *Ariane's* L-R processing controls. Here are some suggestions:

L-R mode control: Change each band's L-R processing mode from *Absolute* to *Relative,* or vice versa. These are internal adjustments, the three *Absolute/Relative L-R mode slide switches* on the *Input/Output* circuit board. Just throw the three switches to the position you prefer (see page 9). We recommend that you set all bands to the same mode, but it's your choice.

Controlling the width of the stereo stage: To set the stereo width, use the *L-R Output* injection pot (below the *Master (L+R/L-R) Output* control on the front panel). We suggest listening to lots of material, focusing upon how much the center material relates to the Left and Right stereo extremes on the stereo stage. Too much L-R sounds bizarre, and it's easy to overdo it. Turn up the *L-R Output* until the center material (e.g., a singer or lead instrument) recedes from you, then back out the control a bit to allow the center to come forward again. Rinse, repeat.

L-R Monitoring: Hook up an oscilloscope to the front panel *L+R* and *L-R* BNC test jacks on the *Ariane*, and flip the front panel *Scope Out* (upper) toggle switch to *Audio.* Set your scope to *X-Y* mode, so you can view the *Lissajous* pattern of stereo music. If you've never seen this before, get ready for an

awakening, as this is the best way that we know to visually monitor the *stereo stage.* If you are already familiar with this type of display, you can see how the *Ariane* affects stereo signals.

With the gain of both scope channels set the same you can see that, for what sounds like a rather wide stereo spread(a rather fat cigar shape on the scope trace), you needn't have the L-R's levels nearly as high as the L+R's. As a matter of fact, you can have considerably *less* L-R with the *Ariane's* processed audio than you did before, and still have a very convincing stereo presence on the radio dial. With the *Ariane*, this stereo width will remain much more consistent song-to-song than without it. We might add that since our control is multi-band and has the capability to lower as well as raise L-R levels depending on the program material, the stereo effect of the *Ariane* is much more consistent than any other single-purpose stereo effects box on the market.

Adjusting the L-R spectrum: Multi-band control in the L-R also means you can tailor the spectrum of the L-R to suit special applications. One might want to use the L-R's *individual band output level* controls to either reduce the high frequencies or punch up the midrange, to alleviate multipath problems or create a signature sound. You can set the *IDR* of the L-R to be really aggressive or quite relaxed, with more subtle yet powerful results than would be possible with a traditional pure Left-Right control system.

The *Ariane's* L-R control system uses the same windowing release concept as its L+R circuitry, so even when it's working hard with low *IDR* settings, the sound is open and unconstrained. The width of the stereo stage is controlled, but it not does not wander or swim.

APE Release Times

To change the release time of any or all seven *APE*s (*A*riane *P*rocessing *E*ngines), there is an 8-position rotary switch control on each *APE* card inside the *Ariane.* The shortest (fastest) release time comes with the lowest setting, "0," on each *APE.* This would be *very* aggressive. Conversely, setting all seven *APE*s to "9" is appropriate for the most demanding classical format. The settings around the fast to medium ("1" to "3") range will be most useful for most formats; we ship with all set to "2." Speaking of usefulness, we believe the release time settings take a back seat to the *IDR* settings, which is why we put the release controls inside and the *IDR* controls on the front panel. Once you have the release times set about right, the *IDR* is the more elegant – and powerful – way to control the amount of processing.

[Early Ariane processors' *APE* cards have a set of DIP jumpers labeled '1' '2' and '5'. Adding a jumper slows release time for that band by a corresponding amount. The rotary switch in the newer units performs exactly the same function, binarily switching the three settings for eight possible combinations: 000, *no* jumpers, to 111, *all* jumpers]

We recommend keeping all bands' release time the same. Nothing sounds quite so peculiar as hearing a spectral shift as a record fades, which happens when one part of the spectrum is processed differently from another. But, rules were made to be broken. That's why we put in the release time controls.

Crossover frequencies

Each crossover that splits the L+R and L-R into multiple bands is variable, with a 2-octave range. The frequencies are adjusted by trimmer pots that are located on the *Input/Output* circuit board. Mid-scale (the factory setting, if you want to return to stock) provides roughly equal energy to each band's *APE*, when using typical high-quality source material. While you should feel free to experiment with different crossover frequencies, we would recommend that you visually match the positions of the pots of the corresponding L+R and L-R crossover frequencies. Though not critical, these settings do influence the sound, and it's best to match the bands, particularly if you are using the *Relative* L-R mode.

After you have become familiar with the way the *Ariane* works with your particular programming, if you notice that one band consistently has more or less gain than the others you might try moving the crossover(s) to compensate.

Mono Operation

Because it does its processing in a L+R/L-R matrix, the Ariane is ideal for programming that must provide mono-compatibility. But the Ariane can also be used in a *mono-only* environment, such as in an AM or TV station that provides only monaural programming.

For use in a strictly mono environment, the L-R circuitry is unnecessary. Since sending audio *only* to the Left *or* Right input would put equal energy into the L+R *and* L-R processing sections, this must be avoided. There are two simple ways to avoid this:

1) Parallel the Left and Right inputs by sending mono source audio to a "Y" cable with two male XLRs, which are plugged in to the *Ariane's* Left and Right inputs as normal. You must adjust the front panel Left and Right input controls to be identical. *Or…*
2) Plug a dummy (no wires connected) 1/4" phone plug all the way into the *L-R pre-processing insert* jack on the rear panel. This interrupts any L-R signal, and only L+R can get to the processing.

Properly operating mono-only, all three of the L-R bands' metering LEDs will stay red, at the ±0 dB (reference) gain level. All other details in this manual that pertain to *L+R setup* will also pertain to a *Mono setup.*

FYI:

Why we don't recommend setting up using tones:

In operation the *Ariane* depends upon the dynamics of the program material, and tones have no dynamics whatsoever. With the *Ariane,* incoming program audio has a range (the *IDR)* within which it may vary considerably without activating release or attack circuitry. Where the audio is in relation to the window is dependent upon recent variations in the level of the audio.

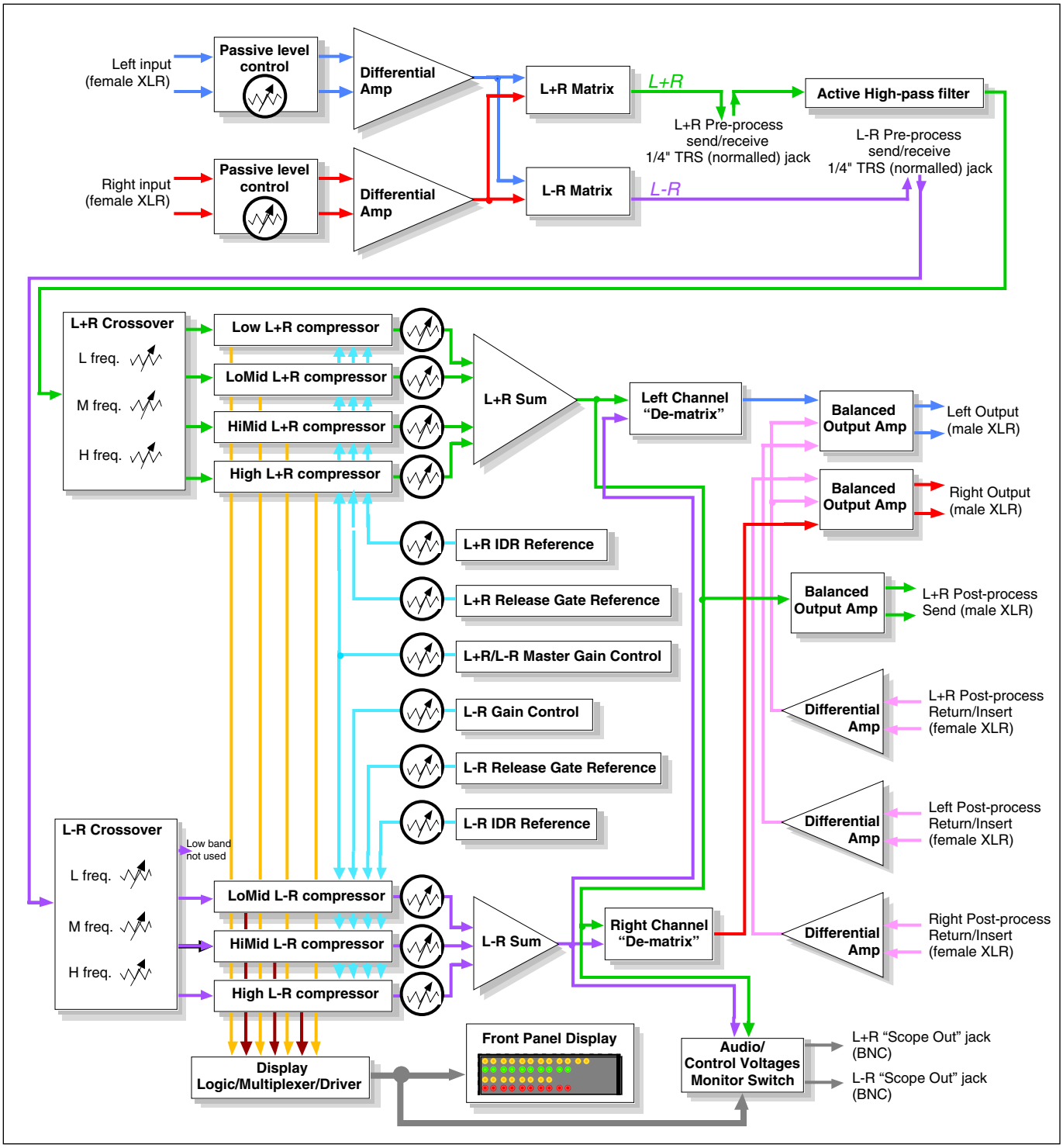
When you send a tone below the Gate threshold and continue to raise its level, it will eventually come to the 'top' of the dynamic control *(IDR)* window. Continuing to raise the level will result in a 4:1 compression at the output, the top of the window following the input upwards. At this point, if you *reduce* the tone while still keeping its level in the *IDR* window, *the processing will not follow it.* As you continue to reduce it, ultimately the tone will meet the 'bottom' of the *IDR* window. The processing will follow, pushing the bottom downward, at the 4:1 compression ratio. There's absolutely NO compression inside the window, and without 'touching' the tone to one edge of the window or the other, there's no way to determine exactly where in the window the tone is.

Somewhat reluctantly, we offer a way you can set up with a tone:

• Send a low-level (below *Gate* threshold) 1KHz setup tone, slowly raising it until you see the *LED multi-band gain metering array* reacting. Keep raising the tone's level until the band with the LEAST gain (the least number of LEDs lit) reaches the ±0dB reference gain level (i.e., six LEDs lit). Hold the input level there.

• Note your *IDR* switch setting and convert it to decibels (see table on page 14); divide that number by two. (For example, an *IDR* setting of "4" equals a 7.5 decibel wide *IDR.* Dividing 7.5 by 2 equals 3.75). Watching the Ariane's output level with an accurate dB meter, slowly reduce your tone generator's level until the output level of the Ariane is reduced by that amount you just determined (in our example, 3.75dB). This ensures that the tone is now right in the middle of the *IDR* window.

• Adjust the Ariane's *Master (L+R/L-R) Output* control to your specific operating level.



Left channel Audio
Right Channel Audio
L+R Audio
L-R Audio
L+R Dynamic Control Voltages
L-R Dynamic Control Voltages
Auxiliary Audio
Multiplexed Control Voltages
System Reference and Adjustable Control Voltages
Front Panel Control

Circuit Overview

Use the block diagram on the previous page to trace the signal flow through the Ariane.

Left and Right audio comes into the *Ariane* via *Left Channel and Right Channel Main Stereo input XLR jacks* on the rear panel. Balanced audio goes directly to four sets of normally-closed contacts on the *Bypass Relay* and also to the passive variable front panel input attenuators (the front panel *Left Channel* and *Right Channel Input controls)* which are located before any active circuitry. This input design helps the user prevent the *Ariane* from being overloaded by levels that are too high. User-strappable internal *input gain jumpers (Input/Output* circuit board) offer an extra 20dB gain in the input stages, if needed.

After differential input amplifiers, the left and right channels are sent to a *matrix* to create separate Left-plus-Right ***sum*** and Left-minus-Right ***difference*** signals. These matrixed, pre-processing signals are available for custom purposes at rear panel *L+R and L-R pre-processing insert jacks.*

The L+R from the matrix (via the *Insert* jack) goes to the *L+R resonant high-pass filter,* to remove infrasonic material and to provide a fairly narrow boost of about 5 dB at the extreme low end, centered just below 40Hz. The *L+R Resonant High-pass Filter jumper (Input/Output* circuit board) is provided to allow bypassing this filter.

The L+R signal continues to a four-way c*rossover,* to create four bands of audio: ***Low, LoMid, HiMid*** and ***High.*** The L-R channel is similarly crossed over, except that the audio from its low band is discarded.

The crossover frequencies are variable via the *L+R and L-R Crossover Frequency control* trim pots. Each crossover frequency can be user-adjusted across a range of over two octaves. Normally the three crossover frequencies for the L-R should be set to the same frequencies as those for the L+R signal path.

Each of the four L+R bands and three L-R bands' audio goes to its own ***APE*** *(Ariane Processing Engine),* for dynamics control. Each *APE* uses the THAT Corporation 4301 *Audio Engine*®, which incorporates RMS detection, VCA and utility opamps, all temperature coupled onboard one chip.

The *APE* intelligently controls levels according to a complex interaction of the RMS energy of the incoming audio, recent history of the energy of that audio, and various reference levels set by the user.

Each *APE*'s output level is controlled by a sum of the front panel *Master (L+R/L-R) Output* control, the *individual band output level control* for that band and, in the case of the L-R *APE*s, the front panel *L-R Output injection* control.

The output audio signals of the L+R *APE*s are summed and, along with the separate sum of the L-R's *APE*s, sent to the second *matrix* to return the audio to the discrete Left and Right audio channels which are sent via the *Bypass* relay ultimately to the *Main Stereo Left Channel and Right Channel output jacks.*

Samples of the summed L+R and L-R are buffered and sent to the front panel *L+R* and *L-R* BNC test jacks for monitoring purposes. The summed L+R is also sent to a balanced-output amplifier, available as the *L+R Post-process Send output* signal on a rear panel male XLR connector. This will be useful as a *reverb send* for those who want it.

External L+R and discrete Left and Right signals can be summed into the *Ariane* output using the *L+R Post-process Return, Left Channel Post-process Return* and *Right Channel Post-process Return* balanced XLR jacks on the rear panel. These inserts will be useful for broadcasters who want the *Ariane* itself to process only music, summing speech programming elements from microphones after processing (using the *L+R Post-process Return)* and/or bringing in stereo material post-process, (such as the stereo return from the reverb driven by the *L+R Post-process Send* jack).

Ariane Feature Details

Feedforward processing

This control topology insures that the *Ariane* can operate over an extremely wide dynamic range without a noticeable sweet spot (While the *Ariane* design is entirely capable of a gain control range of well over 60 dB, even today's best source material makes this impractical. So we restricted operation to about 30 dB).

Another advantage of *Feedforward* control is that all the settings and readouts use *linear decibel* control voltages. The important front panel controls are step switches where every click controls exactly the same number of decibels as the next click up or down. The LED indicators on the front panel are also linear-decibel, accurately showing the gain of each band in one-decibel increments, across the entire 30 dB user range.

RMS control

Control signals derived from RMS detection tend to put more emphasis on *power* rather than *voltage.* This is in general accordance with the nature of human hearing. We believe that RMS control sounds more organic, fluid and natural than alternative detection schemes, so that's why each of the *Ariane Processing Engines'* processors start with accurate RMS samples of the incoming audio.

Windowing (or *Platforming)* Release Control Circuitry

The fact is that most program material has been processed before it ever sees the *Ariane's* inputs. Why do it again? Why, indeed! The user (you) can set a defined *Instantaneous Dynamic Range* or ***IDR window*** within which the control voltage of the *Ariane* will hold steady, making no gain change until the limits of the window are exceeded. When the RMS level of the input audio goes outside this *IDR,* the *Ariane* will quickly make a level correction (the release time is user programmable). Then, once again, the *Ariane* goes into its hold mode, with no alteration in levels taking place.

If the incoming level is low, the user-defined *Gate* threshold control will determine whether to go for it, or ignore it. If 10 uninterrupted seconds pass with no signal above the *Gate* threshold, the gain of that band will return to zero dB gain, the nominal operating gain point (when the level of audio is below the *Gate* threshold it is quite likely noisy, so there is reason not to amplify it. Returning the gain to normal, i.e. zero dB gain, is in effect noise reduction).

Your ears will leave you little doubt: This method of processing has almost no impact on the dynamic flavor of the original material. All the while your *Ariane* is seriously and effectively controlling levels.

Multiple bands

Since automatic gain control is effected by the loudest portion of the signal, the quieter portions go along for the ride, so to speak. If the audio signal is spectrally well balanced, this may not be a problem. However, when one portion of the original audio's spectrum is either dominant or reduced in level, there will be *spectral modulation* when one portion of the spectrum overtly controls the level of another part. Using multiple bands reduces this perception. In the *Ariane,* bass, lower midrange, upper midrange and high frequencies are separated and controlled independently.

This allows for an effect referred to as *Dynamic Equalization.* If, say, the high frequencies in a particular song are a bit muffled, the *Ariane* will bring them up, subtly fixing the perceived lack of high end. Conversely, an overly bright-sounding song will have its high frequencies suitably reduced.

Matrix Processing

When stereo audio is encoded to its mono (L+R) and stereo (L-R) components and then dynamically adjusted, it's typically referred to as *Matrix Processing.*

While the *Ariane* is, strictly speaking, a *matrix processor,* it is unlike any of its predecessors.

A basic matrix processor might have a compressor in the L+R channel and another in the L-R, and they would typically be controlled wholly independently of each other (to have the control circuits track each other would obviate the need for matrix processing; the result would be pretty much the same as using tracking left channel and right channel compressors).

Independent control would certainly work and has, historically. Using traditional compressors, however, this has been at the expense of a wandering or *blurred* stereo image. This is likely the main reason why matrix processing has seen little use, and has found downright disfavor in some circles.

The benefit of Matrix Processing is seen in the context of real-world Broadcasting: both Television Stereo and FM Stereo transmit their signals in an L+R/L-R matrix. Why not maximize the levels to best fit the modulation scheme? We believe the appropriate place to do this in the audio processing chain is in a leveling device, before peak limiting. By using RMS detection, multiple audio bands and a windowing release system *(IDR),* we believe the *Ariane* all but eliminates the adverse effects of traditional matrix processing. Note that while the *Ariane's* internal processing is done in the L+R/L-R *matrix* domain, the Main inputs and outputs are discrete Left and Right audio.

Subtractive Crossover Filters

The Ariane's four-way frequency-splitting crossovers are created by starting with a single-pole high-pass filter, which is summed out-of-phase with the original signal to create a corresponding low-pass filter. This method is repeated for the other two crossover frequencies, to create four bands of audio: ***Low, LoMid, HiMid*** and ***High.*** By using this *subtractive* filter design, a summation of all four bands is identical to the original audio. This is the most transparent crossover design we know of, because by design *the summed outputs* ***must*** *equal the inputs.*

The crossover frequencies are variable via the *L+R and L-R Crossover Frequency control* trim pots. To find the optimum crossovers frequencies when designing the Ariane, we used a variety of broad-spectrum programming sources and decided upon frequency-determining components that gave a roughly equal amount of RMS energy in each band. Then we designed the circuit so that each of our optimum crossover frequencies are in the middle of the range of the *L+R and L-R Crossover Frequency control* trim pots. Each crossover frequency can be user-adjusted across a range of over two octaves. Normally the three crossover frequencies for the L-R should be set to the same frequencies as those for the L+R signal path.

Absolute/Relative Matrix Control

The *Ariane* offers two user-programmable modes for the control of each L-R frequency band: The totally independent *Absolute* mode and the *Relative* mode, wherein the L-R signal is controlled in relation to the L+R control.

In *Absolute* mode, there are two almost completely separate control systems for each frequency band's L+R and L-R signals (the *Gate* from the L+R band also controls its L-R counterpart). This mode can create a very dramatic stereo effect but if taken to extreme (fast release, low *IDR*), can sound rather false. It would then be difficult to mentally spot a particular instrument's location on the *stereo stage.*

In the *Relative* mode, however, the *Ariane* applies its windowing technique to attempt to keep the user-set *ratio* of L+R/L-R energy constant. It is a bit more organic and honest-sounding than the strictly

independent *Absolute* mode, and it makes the stereo stage image adhere more closely to the original, but even it may sound rather artificial at extreme settings.

There are merits to either scheme, but the best way to judge is to use your ears!

Multi-LED Front Panel Gain Readout

The front panel readout shows you what the *Ariane* is up to. Each of the seven audio processors operates its own horizontal row of 30 LEDs. The bands are, starting at the bottom row: Low (L+R); LoMid L-R; LoMid L+R; HiMid L-R; HiMid L+R; High L-R; High L+R.

The *number* of lit LEDs indicates how much gain is occurring in that band. Every additional LED that is lit means one more dB of gain in that band. More LEDs, more gain.

The *color* of the LEDs shows you the processing status in that band:

RED means the audio is below useful level, as determined by the front panel *Gate* threshold control setting. Amplification in that band is holding steady or, after 10 seconds, returning to nominal zero dB gain.

ORANGE means the audio is inside the user determined Instantaneous Dynamic Range *(IDR)* window, and amplifier gain is *holding,* with no change.

GREEN means the control circuitry is *releasing,* raising the amount of gain in that band.

The more green you see, the more aggressively the *Ariane* is controlling levels. Orange or red means that the *Ariane* is operating steady state, with absolutely no perceptible gain change.

L+R and L-R BNC test jacks

There are two BNC connectors on the *Ariane's* front panel. The *Scope Out* toggle switch determines their function: With the toggle in the upper *Audio* position, the two jacks present buffered audio samples of the processed L+R (upper BNC) and L-R (lower BNC) outputs for monitoring or viewing on an oscilloscope in *X-Y* format.

In the lower *Control Voltages* toggle position, the BNCs present multiplexed gain control voltages for monitoring using a dual-trace oscilloscope. The four L+R voltages are multiplexed on the top BNC, and the three L-R voltages are multiplexed on the lower BNC, along with a -5V sync signal. When you synchronize the sweep of both 'scope traces to the negative-going L-R sync, you can view all seven control voltages simultaneously. The approximate scale is: 1.0V=10dB of gain change.

Multiple Insert Points

These jacks were added to add flexibility to the Ariane. Most users will find the Ariane's main stereo inputs and stereo outputs to be sufficient for their needs. And of course, only the main ins and outs are required for typical operation. But for those who need them, the Ariane also provides versatile insert connections at numerous points in the circuitry. These connections are on the Ariane's rear panel. When viewing from the back they are, from left to right:

L+R and L-R Pre-processing insert jacks: They allow connection to external processing in the L+R/L-R domain, *before* the Ariane processing.

These are unbalanced, line level (0dBV) normalled 1/4" female phone jacks (upper is L+R, lower is L-R). Get the *send* signal from the *tip* of a 1/4" plug, and put the *return* on the *ring* connection, with sleeve being the common. Any time you put a plug into these jacks, it will interrupt the audio flow. Removing the plug will restore normal operation.

By working with audio in the *sum/difference* mode, one can do things impossible with normal *Left/Right* stereo. Such as put a noise reduction unit in the L-R to clean up noisy old 60s stereo records. Or further reduce the bandwidth of the L-R. Or send secret messages out of phase. Or do funny things with the L+R, such as add a signal enhancer or play with EQ.

Post-process L+R send output: This is a source of processed mono audio. It can be used to drive a reverb that has a monaural input and stereo output. This send can also be used to get a mono output that does not have any audio from the subsequent post-processing inserts. Its level is controlled by the front panel *Master (L+R/L-R) Output* control.

Post-process L+R insert (return) input: There are many radio stations that process the announcers separately from the processing for the music and other programming, and then combine it. This jack allows just that.

While your music runs through the *Ariane's* stereo processing, your externally-processed mono voice audio can come into the final mix at a predetermined level *after* the *Ariane's* processing. The *Ariane* sums it all together, placing the voice dead-on in the center of the mix, by adding it directly to the L+R just before *de-matrixing* into the Left and Right outputs. The Ariane adds no processing on this input, it just sums it into the processed music at unity gain.

Left and Right post-process stereo insert (return) inputs: If you use reverberation, here is where you could sum it into the Ariane's processed audio, in stereo. You could also use these jacks to add in other stereo programming that you do not want to have the Ariane process.

FYI:

The Discarded L-R Low Frequencies

In the *Ariane's* L-R crossover, the audio from its *Low* band is not used. The reason for doing this is that, while there is typically little actual energy in the lowest frequencies in the L-R domain, this is where noise, hum and other non-audio material may likely appear (while present day technology allows most of our media to have full frequency response, older recordings will typically have *nothing* but noise and other garbage in the L-R bass spectrum).

Also, in FM broadcast, low frequencies in the L-R can and will accentuate multipath interference problems in difficult reception areas. Removing the lowest L-R frequencies tends to clean up the difference signal.

Since the human ear's perception of directional cues is poor at bass frequencies anyway, little is given up by removing low frequency directional information. All the while, even a small amount of energy in that region takes up valuable spectrum (i.e., modulation) and since in most media you have a limit as to how much signal you can send, this scheme allows you to 'fill the bucket' with audio that is more useful.

Ariane Specifications

While all specifications are accurate as of publishing date, they are subject to improvement and change.

General:

Control System: RMS detection; multiple *windowing-platform* (hysteresis) release time-constants; release gating; feedforward control; return to nominal unity operating gain *(return to zero)* after 10 seconds of continuous audio inactivity with *Release Gate.*
Operating Domain: Matrix L+R/L-R
Control Range: Greater than 30dB
Number of Audio Bands: Four L+R, three L-R
Crossovers: Single-pole, subtractive ('perfect sum')
Output Signal to Noise: Typically better than 85dB
System Harmonic Distortion: Typically better than 0.05% THD
Power Requirement: 85-240VAC/DC international supply; uses ≤15 Watts

Inputs/Outputs:

Main Inputs; Left, Right: Female XLR, +4dbV nominal balanced, 20dB additional gain internal strap
Pre-process Inserts; L+R, L-R: 1/4" normalling, interrupting TRS phone jack, ±0dBV, unbalanced
Post-process Send Output; L+R: Male XLR, +4dBV nominal, balanced
Post-process Return Inputs; L+R, Left, Right: Female XLR, +4dBm nominal, balanced
Test Outputs; L+R/L-R: Front panel female BNC, ±0dbV nominal
Main Outputs; Left, Right: Male XLR, +4dbV nominal, balanced

Operating Controls:

Input Level Controls; Left, Right: Front panel trim pots; approximately 20dB control range
Output Levels, Main (L+R with L-R tracking): Approximately ±10dB above and below nominal +4dBm level
Output Level, L-R Injection: Approximately -12 to ±0dB with reference to L+R
IDR (density) Control Range; L+R, L-R: 1.5 to 15dB in steps of 1.5dB
Release Gate Threshold; L+R, L-R: -35 to -17dB below nominal operating level; 2dB steps
Individual Band Output Level Controls: ±0 to +9 dB, 1dB steps
Bypass Switch: "Hard" bypass; automatically bypasses with loss of power

Metering:

Front panel 210 LED multicolor array: 1dB gain resolution;
Color determined by control status: *Red* = audio is below *Gate* threshold; *Yellow* = Hold, audio is within *IDR window; Green* = Release, gain increasing
Test Outputs; Multiplexed L+R/L-R Control voltages: Front panel female BNC, Sync on L-R, approx 10dB/V scale

Internal Settings:

Input Gain: Jumpers allow additional 20dB gain
L+R Resonant High Pass Filter: Cuts frequencies below 30Hz; 5dB boost @ 37Hz; jumper bypass
Crossover Frequencies:
Low: variable, 75Hz-325Hz, factory set to 130Hz
Mid: variable, 320Hz-1.6kHz, factory set to 650Hz
High: variable, 1kHz-4.7kHz, factory se to 1.8kHz
Release Time: Eight-position switch; setting independent for each band
L-R Control Mode *(switchable for each L+R/L-R band pair):*
"Relative" to the gain of its L+R counterpart band;
"Absolute" independent control

Stock Factory Settings

We ship each *Ariane* with these settings and header/jumper positions. If you ever get lost, you can always use this page to help get yourself back home.

Front Panel	
Controls (potentiometers)	***Setting***
Left Channel and Right Channel Input controls	Both to mid-scale
Master (L+R/L-R) Output control	Mid-scale
L-R Output injection control	Mid-scale
Switches	***Setting***
Individual band output level controls *(L+R and L-R):*	All seven set to "0" gain
IDR control *(L+R):*	Set to "4" (7.5 dB *IDR)*
IDR control *(L-R):*	Set to "3" (6.0 dB *IDR)*
Gate controls *(L+R and L-R):*	Both set to "0" (-35dB *Gate* threshold)

To locate the following internal adjustments, see the interior layout photo and diagram on page 8.

Internal	
Controls (potentiometers)	***Setting***
Crossover Frequency controls *(L+R and L-R)* *(Input/Output* circuit board)	All six to mid-scale
Metering *"0"* calibration control *(Display Driver* circuit board)	With power applied and no audio for at least 15 minutes, adjust "0" control so all 7 bands' metering indicate 6 LEDs.
Metering *"Low"* calibration control *(Display Driver* circuit board)	Adjust "Low" control for accurate gain indication at 20dB gain (26 LEDs lit) Consult factory for detailed procedure.
VCA Distortion null control *(APE* circuit boards)	Factory adjusted for minimum distortion, or set to mid-scale. Consult factory for detailed procedure.
Switches	***Setting***
Absolute/Relative L-R mode slide switches (*Input/Output* circuit board)	All three set to "Absolute"
Release Time rotary switch *(APE* circuit board)	All seven set to "2"
Headers	***Jumpers***
Input Gain (Input/Output circuit board)	All four in "0" gain position
Control Voltage enable *(APE* circuit boards)	All seven in place
Individual band input headers/jumpers *(Input/Output* circuit board)	All seven in place
L+R Resonant High-pass Filter *(Input/Output* circuit board)	In "Yes" position
Release Time DIP headers (older *APE* circuit boards only)	One jumper in "2" position

Digital vs. Analog

We're not taking sides, so put those fists away! We're aware that it's increasingly a Digital World out there, but yes, the Ariane is totally analog. We think the Ariane will be a useful addition to any studio or radio station, analog or digital, that prides itself in the quality of its sound.

For Analog Users:
The *Ariane's* circuit path was designed with a minimalist approach, to keep the signal as pure as we are able. Every effort was made to keep any possible negative impact on the audio (noise, distortion, spectral aberration) to a minimum.

There are no signal conversions of any type, no sampling, and no switching. All filters were designed to minimize their impact on sound. The crossovers are of a *single pole, subtractive* design, which insures that when adding up all the bands at the output, the signal is very nearly identical to that of the input. The op-amp we chose for the audio path is the OP-275 by Analog Devices. If you must use off the shelf op amps (and we had to, to keep costs reasonable) we believe this is the amp to use.
The VCA in the processor is THAT Corporation's 4301 *Audio Engine®,* which keeps parts count and complexity to a minimum, while keeping the audio quality high and the audio path short.

Absolute phase polarity is maintained through the *Ariane* from input to output.

The front panel metering *is* digital, but it's not in the signal path. Careful, diligent attention was paid to keeping noise generated by the metering out of the audio circuitry.

For Digital users:
The *Ariane,* while being a completely analog design, has very high quality audio specifications. We did not add a D/A converter on the input, or an A/D converter on the output (not with this model, anyway) so that you may provide the converter that is most to your liking. If you are sophisticated enough to insist upon a digital signal path, then we are sure you will be expert enough to choose a good set of converters (we recommend anything by Apogee, such as their *Rosetta*, or the high-end products from Benchmark).

Even with a set of D/A and A/D converters in the path, you will find the *Ariane* to sound very analog sweet. Of course, as with any analog design like the *Ariane,* there are none of the problems you might find that are unique to the digital realm such as latency delay, aliasing, data compression and/or sampling artifacts or odd sounding filters.

Glossary

Ariane Processing Engine (APE) – the name given to the module used for all dynamic processing inside the *Ariane Stereo Audio Leveler.* There are seven *APE*s in each *Ariane*.

Attack – The reaction of an audio processor to an increase in the incoming signal, as it attempts to keep the output constant. The time it takes to react is called the *Attack Time.*

Audio Engine® – the registered name of THAT Corporation's 4301 integrated circuit. This IC includes an RMS converter, VCA and three opamps. Each *APE* uses a 4301 as its main processing device.

Broadband - In audio processing, a processor with one control system for the entire bandwidth of audio (see *multi-band).*

Crossover – a device to split audio into multiple segments of the spectrum.

Density – the inverse of dynamic range, usually referring to a lack of dynamics across the audio spectrum. 2) A name commonly used for the control interface element the user interacts with when setting the amount of dynamic control in an audio processor. In the case of the *Ariane,* the front panel *IDR* controls could also be referred to as *density* controls. Lower *IDR* settings mean more density and therefore less dynamic range.

Gate – a means of cutting off or stopping the flow of one signal by use of another controlling signal or itself. In studio work, an *audio gate* is used to reduce or remove audio in a signal when it is below a specified threshold. In the case of the *Ariane,* the *Gate* is a means to stop the release time constant of the control voltage during low-level audio. While the *Gate* is in effect, the audio is not removed or even reduced, but rather is passed on with no change.

IDR – *I*nstantaneous *D*ynamic *R*ange, a moniker we created to describe the amount of narrow dynamic variation that is present in audio over a short period of time (typically less than one second). We recognized that by preserving the *IDR* while controlling longer-term, wider level variations, the *feel* of the audio would remain virtually unchanged. 2) In the *Ariane,* the name for the portion of the processing circuit that attempts to preserve such dynamics, while restricting longer term, wider dynamics. 3) The name of the front panel control that sets the parameters for these circuits.

Intelligent dynamic range control - A gain control concept championed in the 1960s by CBS Laboratories in their *Audimax* AGC. Their proprietary algorithm "gain platforming with release gating and gated gain stabilization" was one of the first where the circuitry made *intelligent* decisions based upon level and recent dynamic history of the incoming audio. In the 1980s, Texar expanded the concept with their multi-band *Audio Prizm.* The *Ariane* goes several steps further, using *RMS* detection, *feedforward* control and L+R/L-R *matrix* in a high quality audio path.

L+R – in a stereophonic system, the summation of Left channel audio with Right channel audio, a signal which is also called *monophonic (mono,* for short) or *sum*.

L-R – in a stereophonic system, the summation of Left channel audio with inverted Right channel audio, also referred to as *difference*.

Lissajous – "Jules Antoine Lissajous, born March 4, 1822 in Versailles, France, died June 24, 1880. Lissajous was interested in waves and developed an optical method for studying vibrations. He obtained *Lissajous* figures by successively reflecting light from mirrors on two tuning forks vibrating at right angles. The curves are only seen because of persistence of vision in the human eye. Lissajous was awarded the Lacaze Prize in 1873 for his work on the optical observation of vibration."

From the website of *The School of Mathematical and Computational Sciences, University of St. Andrews:*
http://www-groups.dcs.st-and.ac.uk/~history/Mathematicians/Lissajous.html

Isn't the Internet wonderful? Lissajous gives his name to the method with which we use an oscilloscope to observe the interactions of two signals, a procedure also known by the more boring but accurate name, *X-Y.* Viewing a pair of audio signals *X-Y* gives insight into their relations in amplitude and phase, especially useful when monitoring stereo audio that has to be *mono-compatible.*

Matrix – a means of creating signals where outputs can be predicted based on inputs modified by the formula designed into the *matrix.* In the Ariane, our first *matrix* creates L+R and L-R signals from incoming Left and Right audio. After processing, we use another *matrix* to re-convert the L+R and L-R into Left and Right outputs. *2)* Keanu Reeves' only *excellent* movie besides the *Bill & Ted* flicks.

Monophonic – (see *L+R)*

Mono-compatible – Any stereo audio medium that will have a significant number of users listening in *monophonic* must be *mono-compatible,* that is, the *mono sum* of Left and Right audio must be available and usable to the end user. FM stereo, broadcast stereo TV, AM stereo and the Long Player are *mono-compatible* systems. They all use a *matrix* to send a *mono* L+R signal along with a *difference* L-R signal, and every stereo receiver or playback device has a *matrix* decoder to recreate Left and Right. A monophonic receiving/playback device will reproduce the required single mono channel directly using the L+R; it will simply ignore any L-R signal. In any matrixed medium, it is incumbent upon all content creators and those responsible for the integrity of the system to be aware of possible pitfalls, and to produce stereo that is *mono-compatible.* The *Ariane* is a perfectly *mono-compatible* audio processor.

Multi-band – an audio processor characterized by having multiple processors to control discrete portions of audio spectrum.

Peak – the highest amplitude of a waveform.

Peak limiter – an audio processor that derives a control voltage from of the *peaks* of the audio to control its output level. A *peak limiter* forces its output's audio *peaks* to stay below a certain *limit*.

Platform – (see *Window)*

Release – (sometimes called *recovery)* When incoming audio is actively being controlled and then reduces level, a compressor will *release* to add compensating gain, bringing up the audio level in an attempt to keep the output level constant. The time it takes for this to happen is called the *Release Time.* The *Ariane* will release to increase gain *only* when the audio goes *below* the *IDR* window while remaining *above* the *Gate* threshold.

Return to Zero – in the Ariane, when the audio energy in any band goes below and *stays* below the *Gate* threshold for more than about ten seconds, the control circuitry slowly returns the gain in that band to ±0 dB *(zero reference)* gain. The speed of the return is related to the release time of that band's *APE.*

RMS – *R*oot *M*ean *S*quared, a method of creating a useful mathematic average level over time of the absolute value of a detected signal. It reflects the *power* contained in the measured signal. RMS detection in an audio processor, such as that used in the Ariane, controls the audio in a manner that is more like human hearing than that in a *peak-derived* control system.

Stereo – a perceived multi-dimensional space created using two or more sources of information.

Stereo stage – the imaginary horizontal span of audio as perceived in the space between and around a set of speakers or headphones when listening to stereo audio. The *Ariane* allows unprecedented control of the *stereo stage* in a manner that is artistic yet powerful.

Subtractive filter – a pair of high-pass and low-pass filters wherein one is used to create the other, by subtraction from the original signal. It is ideal for a crossover where outputs must sum exactly to create a signal indistinguishable in all ways from the original signal.

Sweet Spot – the certain dynamic range and input level or operating area wherein an audio processor sounds best or can work most effectively. The *Ariane's sweet spot* is extremely wide and, once set, for practical purposes may be ignored. However, the dynamic range at the output of the *Ariane* is ideal to consistently put audio right in the *sweet spot* of a succeeding limiter or other processor.

Window – the operating range within which audio in the *APE* passes through unprocessed, as determined by the *IDR* control setting. The control voltage will not vary as long as the audio's RMS energy remains between the upper and lower thresholds of the window. *Window* is also called *gain platform, dead zone* (or *dead band)* or more scientifically, *hysteresis.*

X-Y – (see *Lissajous)*

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