

Model 2-LA-2
Twin T4 Leveling Amplifier

Universal Audio Part Number 65-00035

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Notice

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Contents of This Box

This package should contain:

- One 2-LA-2 Twin T4 Leveling Amplifier
- 2-LA-2 Operating Instructions
- IEC Power Cable
- Registration Card

Thank you for purchasing the Universal Audio 2-LA-2 Twin T4 Leveling Amplifier. The 2-LA-2 takes our LA-2A reproduction and updates it with modern features, modern components, and a space-saving design. The LA-2A was originally produced in the early 1960s by Teletronix, which was later acquired

by Babcock Electronics Corporation. My father, Bill Putnam, Sr., purchased the product rights and the name Teletronix from Babcock Engineering in 1967, folding it into his Studio Electronics Corporation shortly before he changed the name to UREI.

The 2-LA-2 retains the same key gain reduction components and simple controls found in the LA-2A, but adds the convenience of a stereo-matched tool made more versatile for today's studio. It uses only the finest audiophile quality parts, from metal film resistors and WIMA capacitors to custom input and output transformers for an extremely low noise floor. While not an exact component clone of the classic LA-2A, the 2-LA-2 utilizes a similar tube-amplified, all discrete design, and, like its ancestor, the 2-LA-2 compression comes from applying audio signal to an electro-luminescent light panel which shines on a photo-electric cell, which in turn controls gain. This customized element, called the T4, provides a dual-stage, program-dependent release time which results in extremely transparent and natural-sounding compression.

Designed by original UREI® engineer Dennis Fink, the 2-LA-2 provides matched T4s for stereo operation while retaining the core “sonic signature” components in order to deliver the same trademark sound of the LA-2A long treasured by engineers worldwide. From drum bus to master bus, vocals to vibraphones, the 2-LA-2 delivers the same authentic, smooth as silk gain reduction you've come to know and trust with the LA-2A, conveniently reconfigured into a two-channel package.

Most of us at Universal Audio are musicians and/or recording engineers. We love the recording process, and we really get inspired when tracks are beautifully recorded. Our design goal for the 2-LA-2 was to build a dual/stereo compressor that we would be delighted to use ourselves—one that would capture the character of the original LA-2A to create a device that induces that “*a-ha*” feeling you get when hearing music recorded in its most natural, inspired form.

Developing the 2-LA-2—as well as Universal Audio's entire line of quality audio products designed to meet the needs of the modern recording studio while retaining the character of classic vintage equipment—has been a very special experience for me and for all who have been involved. While, on the surface, the rebuilding of UA has been a business endeavor, it's really been so much more than that: in equal parts a sentimental and technical adventure.

We thank you, and we thank my father, Bill Putnam.

Sincerely,

Bill Putnam, Jr.

Important Safety Instructions

Before using this unit, be sure to carefully read the applicable items of these operating instructions and the safety suggestions. Afterwards, keep them handy for future reference. Take special care to follow the warnings indicated on the unit, as well as in the operating instructions.

1. **Water and Moisture** - Do not use the unit near any source of water or in excessively moist environments.
2. **Object and Liquid Entry** - Care should be taken so that objects do not fall, and liquids are not spilled, into the enclosure through openings.
3. **Ventilation** - When installing the unit in a rack or any other location, be sure there is adequate ventilation. Improper ventilation will cause overheating, and can damage the unit.
4. **Heat** - The unit should be situated away from heat sources, or other equipment that produce heat.
5. **Power Sources** - The unit should be connected to a power supply only of the type described in the operating instructions, or as marked on the unit.
6. **Power Cord Protection** - AC power supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them. Pay particular attention to cords at plugs, convenience receptacles, and the point where they exit from the unit. Never take hold of the plug or cord if your hand is wet. Always grasp the plug body when connecting or disconnecting it.
7. **Grounding of the Plug** - This unit is equipped with a 3-wire grounding type plug, a plug having a third (grounding) pin. This plug will only fit into a grounding-type power outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact your electrician to replace your obsolete outlet. Do not defeat the purpose of the grounding-type plug.
8. **Cleaning** - Follow these general rules when cleaning the outside of your 2-LA-2:
 - a. Turn the power Off and unplug the unit
 - b. Gently wipe with a clean lint-free cloth
 - c. If necessary, moisten the cloth using lukewarm or distilled water, making sure not to oversaturate it as liquid could drip inside the case and cause damage to your 2-LA-2
 - d. Use a dry lint-free cloth to remove any remaining moisture
 - e. Do not use aerosol sprays, solvents, or abrasives
9. **Nonuse Periods** - The AC power supply cord of the unit should be unplugged from the AC outlet when left unused for a long period of time.
10. **Damage Requiring Service** - The unit should be serviced by a qualified service personnel when:
 - a. The AC power supply cord or the plug has been damaged; or
 - b. Objects have fallen or liquid has been spilled into the unit; or
 - c. The unit has been exposed to rain; or
 - d. The unit does not operate normally or exhibits a marked change in performance; or
 - e. The unit has been dropped, or the enclosure damaged.
11. **Servicing** - The user should not attempt to service the unit beyond that described in the operating instructions. All other servicing should be referred to qualified service personnel.

Table of Contents

A Letter From Bill Putnam, Jr.	i
Important Safety Instructions	ii
Two Page, Two Minute Guide To Getting Started	2
Front Panel	4
Rear Panel	6
Interconnections	7
Insider's Secrets	9
The Technical Stuff	12
History of the 2-LA-2	12
Compressor Basics	14
Electro-Optical Compression/Limiting	18
Operating The 2-LA-2 In Link Mode	20
Making A Custom Insert Cable	21
Maintenance Information.....	23
Meter Calibration	23
Changing the Internal Voltage Selector	23
Changing Fuses	24
Block Diagram	25
Glossary of Terms	26
Recall Sheet	29
Specifications	30
Additional Resources / Product Registration / Warranty / Service & Support	Inside back

The Two Page, Two Minute Guide To Getting Started

No one likes to read owner's manuals. We know that.

We also know that you know what you're doing—why else would you have bought our product?

So we're going to try to make this as easy on you as possible. Hence this two-page spread, which we estimate will take you approximately two minutes to read. It will tell you everything you need to know to get your Universal Audio 2-LA-2 up and running, without bogging you down with details.

Of course, even the most expert of us has to crack a manual every once in awhile. As the saying goes, "as a last resort, read the instructions." You'll find those details you're craving—a full description of all front and rear panel controls, interconnection diagrams, insider's secrets, history, theory, maintenance information, specifications, even a glossary of terms—in the pages that follow.

Manual conventions:



Means that this is an especially useful tip



Means that this is an especially important bit of information

And when we need to direct you to a page or section elsewhere in the manual, we'll use the universal signs for rewind (◀◀) or fast forward (▶▶).

Getting Started With Your 2-LA-2:

Step 1: Decide where the 2-LA-2 is to be physically placed and place it there. The 2-LA-2 is housed in a standard two-rackspace 19" chassis, and so we recommend that it be securely mounted in a rack if possible.

Step 2: Make sure the Power switch in the center of the front panel is off (down) and then connect the supplied IEC power cable to the rear panel AC power connector.

Step 3: Set the LINK/DUAL switch in the center of the front panel to its down (DUAL) position. Set the LIMIT/COMPRESS switches in both channels to their down (COMPRESS) position, and set the Meter switch for both channels to their down (OUTPUT) positions. Then turn the Gain knob to approximately 6 (unity gain) and the Peak Reduction knob to 0 (fully counterclockwise).

Step 4: Mute your monitors and then, using the appropriate cables, make connections to the 2-LA-2's rear panel XLR line inputs and outputs. Most often, these connections will be to a patch bay or to and from a channel or bus insert on a mixer. (▶▶ *see page 7 for an interconnection diagram*)

The Two Page, Two Minute Guide To Getting Started

Step 5: Power on the 2-LA-2. The purple LED above the power switch will light up.

i Because the 2-LA-2 is a tube device, it needs several minutes to achieve stable operating temperature. During warm-up, audio quality may vary slightly.

i Because it can run quite hot, we recommend you power off the 2-LA-2 when it is not being used for extended periods of time.

Step 6: Unmute your monitors and apply signal to the left channel only. Slowly raise the level of the signal being input until sufficient signal strength is achieved on the left channel meter.

Step 7: Now it's time to hear the effect of compression on your signal. Set the Meter switch for the left channel to its up (GR) position and, while continuing to apply input signal to the left channel, slowly turn the Peak Reduction knob clockwise; as you do so, the left channel meter will reflect the amount of gain reduction. You can compare the original, uncompressed signal with the compressed signal with the use of the BYPASS/COMP switch in the center of the front panel. (NOTE: When in BYPASS mode, the 2-LA-2 does not restore signal to its original non-compressed level, so you may hear significant level differences between the BYPASS and COMP settings if a great deal of Peak Reduction is being applied.) As you increase the amount of compression (by raising the level of the Peak Reduction control), the overall signal will be attenuated; turn the Gain knob clockwise to make up the difference. Set the Meter switch back to its down (OUTPUT) position in order to view the final output level of the left channel of the 2-LA-2 and ensure that you are applying the correct amount of makeup gain.

Step 8: Set the left channel LIMIT/COMPRESS switch to its up (LIMIT) position in order to hear the effect of the 2-LA-2 in limiting mode, where a higher compression ratio is applied and only peak signals are reduced in level.

Step 9: Repeat steps 6 - 8 above, this time routing signal to the right channel only and adjusting the 2-LA-2's right channel controls as desired. Note that, in Dual mode, the two channels operate completely independently of one another, giving you two discrete compressor/limiters.

Step 10: To hear the effect of the two compressors stereo linked, set the LINK/DUAL switch in the center of the front panel to its up (LINK) position, and set the Peak Reduction and Gain knobs in both channels identically. (►► see page 20 for more information about operating the 2-LA-2 in Link mode)

►► For more information, refer to the "Front Panel" and "Rear Panel" sections on pages 4 - 6 of this manual.

Front Panel

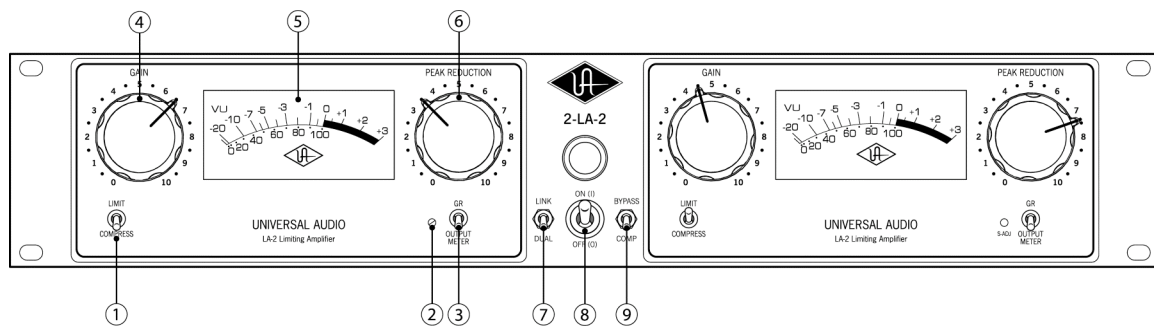


Figure 1: 2-LA-2 Front Panel

NOTE: The 2-LA-2 provides two channels, each of which have identical front panel controls.

(1) COMPRESS / LIMIT switch - Determines whether the 2-LA-2 channel is acting as a compressor or a limiter. When set to the down (COMPRESS) position, the degree of compression is gentler and at a low ratio (approximately 4:1, program-dependent). When the switch is set to its up (LIMIT) position, more severe compression is applied, and at a higher ratio (up to Infinity:1, again, program-dependent). (►► see pages 13 - 16 for more information)

(2) GR Zero Set pot - Used to calibrate the channel's meter. (►► see #3 below and page 23 for instructions for calibrating the 2-LA-2 meter)

(3) Meter Function - This switch determines whether the channel's VU meter displays the final output level or the amount of gain reduction. When OUTPUT is selected (the down position), a meter reading of 0 corresponds to a level of +4 dBm at the rear panel line output. When GR (Gain Reduction) is selected (the up position), the channel's meter will read 0 dB when there is no incoming signal or when no compression is being applied.

(4) Gain - Determines the final output level of the 2-LA-2 channel. A setting of approximately "6" is unity gain. Once the desired amount of compression or limiting is set by adjusting the Peak Reduction knob (►► see #6 on the following page), the Gain knob can then be used to make up for any signal attenuation (up to 35 dB of gain can be added). In order to have the meter display the effect of turning the Gain knob, set the Meter Function switch (◄◄ see #3 above) to the down (OUTPUT) position.

(5) Meter - A standard VU meter that displays either the channel's final output level or the amount of gain reduction, depending upon the setting of the Meter Function switch. (◄◄ see #3 above) Occasionally, the meter may require calibration. (►► see page 23 for instructions for calibrating the 2-LA-2 meter)

(6) Peak Reduction - Determines the amount of gain reduction provided by the 2-LA-2 channel. This control essentially combines the Threshold, Ratio, and Input controls found on other compressors. Higher settings will increase the relative amount of compression, while lower settings reduce the amount of compression (a setting of 0, with the knob at its fully counterclockwise position, results in no compression). Note, however, that all compression performed by the 2-LA-2 is program-dependent—that is, the degree of gain reduction changes as the signal varies.
(▶▶ see pages 13 - 16 for more information)

i The numeric values for the Gain and Peak Reduction knobs are relative scale markings and do not represent specific dB values.

(7) LINK / DUAL switch - Sets the 2-LA-2 to either dual mono or stereo linked operation. When set to the down (DUAL) position, the 2-LA-2 operates as two separate compressors, with the two channels operating completely independent of one another. When set to the up (LINK) position, the two channels of the 2-LA-2 act as a single stereo compressor, with equal gain reduction on both sides, even when there is transient activity only on one channel. (▶▶ see page 20 for more information)

i When operating the 2-LA-2 in LINK mode, the Peak Reduction knobs should normally be set to the same position in both channels. (▶▶ For more information, see page 20.)

i Because it can run quite hot, we recommend you power off the 2-LA-2 when it is not being used for extended periods of time.

(8) Power - Turns the 2-LA-2 power on or off. When powered on, the purple LED immediately above the switch lights up.

(9) BYPASS / COMP switch - Allows the gain reduction circuit to be placed in or out of the audio path. This is useful in comparing the compressed signal to the non-compressed signal with the flip of a switch. This is also useful if the user wishes to use the 2-LA-2 as an amplifier only, for extra gain or tube coloration, without the compression circuit in the signal path.

i When in BYPASS mode, the 2-LA-2 does not restore signal to its original non-compressed level, so you may hear significant level differences between the BYPASS and COMP settings if a great deal of Peak Reduction is being applied.

i The BYPASS / COMP switch setting always affects both channels of the 2-LA-2, regardless of the LINK / DUAL switch setting.

Rear Panel

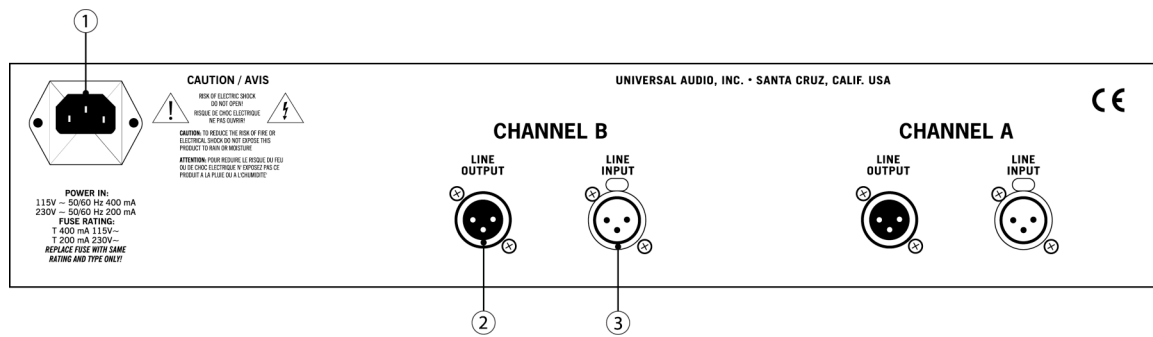


Figure 2: 2-LA-2 Rear Panel

(1) AC Power Connector - Connect a standard, detachable IEC power cable (supplied) here. If fuse replacement is required, use only a 1.6 A time delay (slow blow) fuse for operation at 100 or 120 volts, or an 800 mA time delay (slow blow) fuse for operation at 240 volts.

ⓘ Never substitute different fuses other than those specified here!

(2) LINE OUTPUT - A balanced XLR connector carrying the line-level output signal of the 2-LA-2 channel. This signal will normally be routed via a patchbay to a channel or bus insert return.

(3) LINE INPUT - Connect line-level input signal for each channel to this balanced XLR connector. Pin 2 is wired positive (hot). This signal will normally be arriving via a patchbay from a channel or bus insert send.

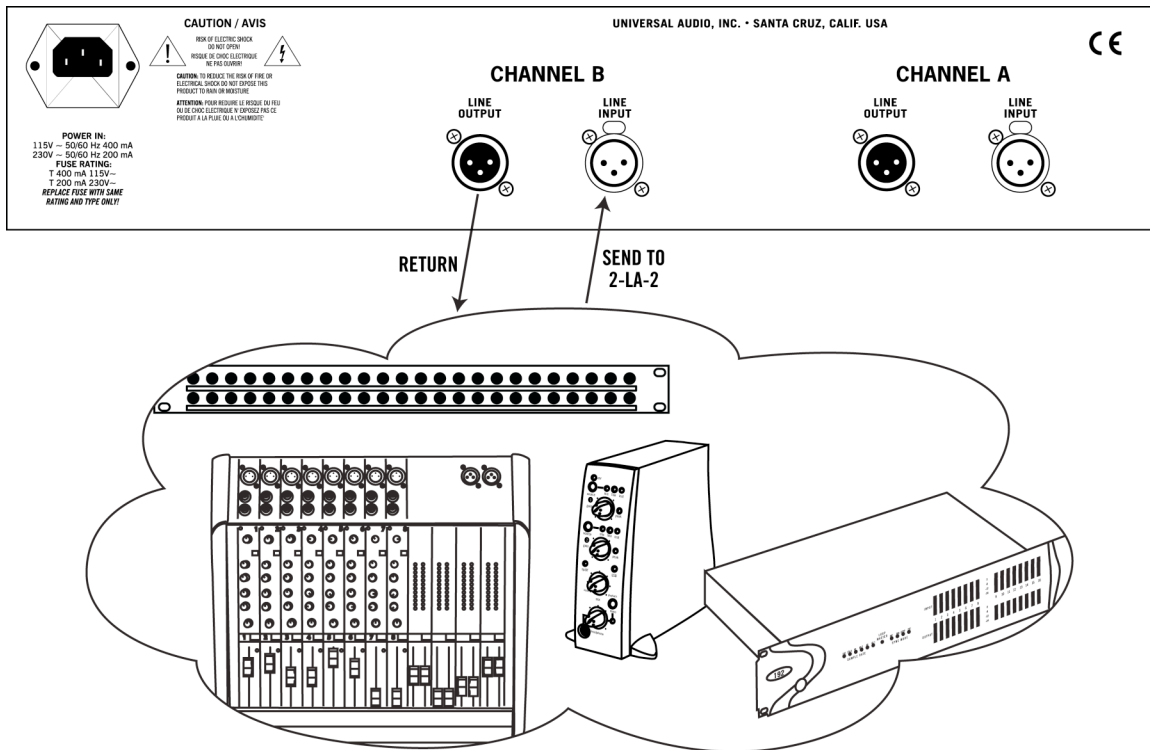


Figure 3: Using the 2-LA-2 as a send-return processor

In the above illustration, one side of the 2-LA-2 is used as a send-return processor. Typically a specialized send-return cable is used for this purpose (► see page 21 for more information)

Interconnections

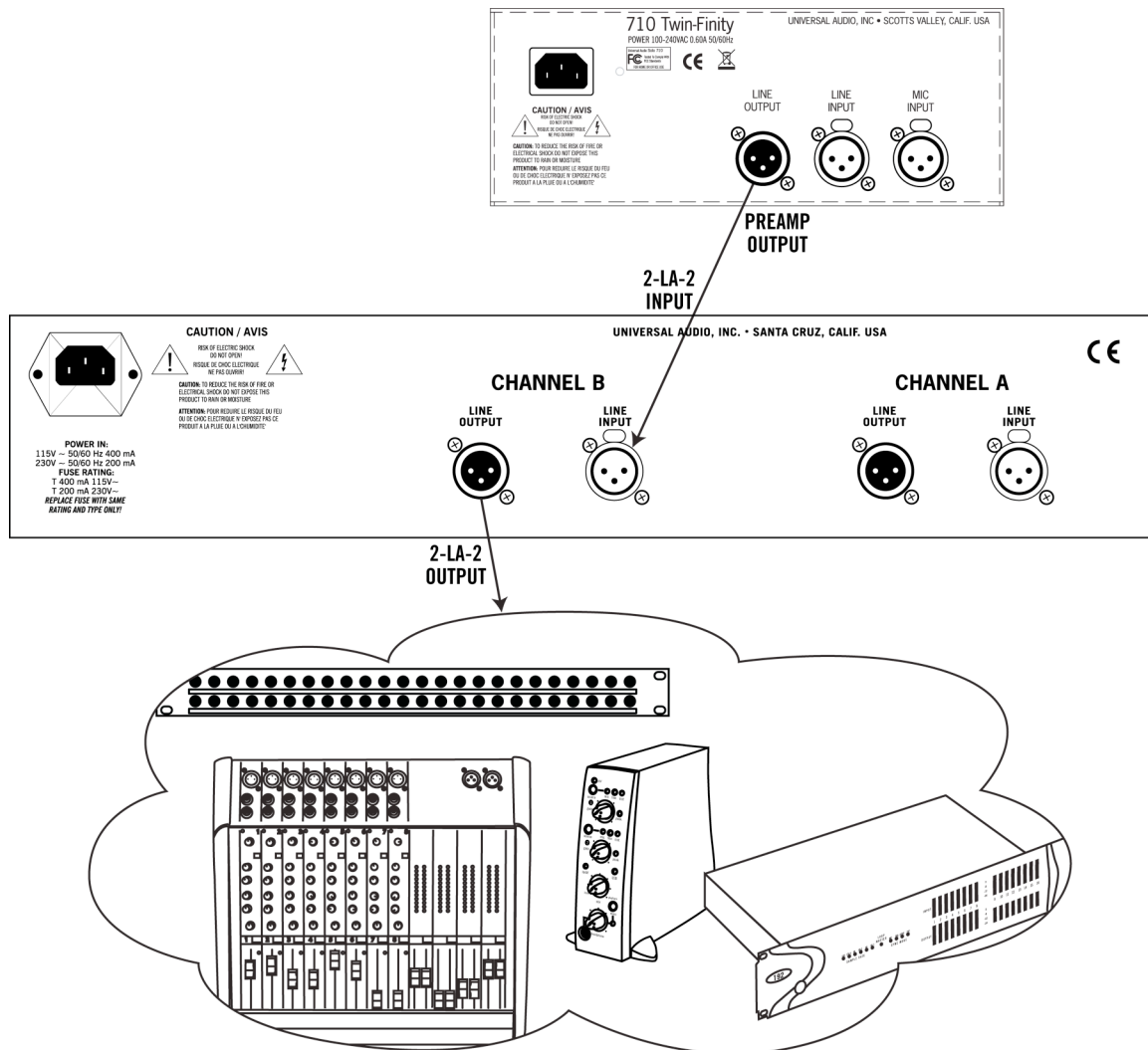



Figure 4: using the 2-LA-2 inline with a mic preamp

In the above illustration, one side of the 2-LA-2 is used inline with a mic preamp. This is typically done to prevent peaks in the input signal from overdriving the recording device or mixer.

Whatever you can do with an LA-2A, you can do with a 2-LA-2... two times over. In addition, Link mode allows the 2-LA-2 to process not just monophonic signals, but stereo signals such as drum or backing vocal submixes. You can even strap the 2-LA-2 across the master bus, using it as a premastering tool.

Vocals, Vocals, Vocals

 **Dialing in judicious amounts of Peak Reduction can help get every syllable of a lead vocal intelligible, even in a track with dense instrumentation, and can also help backing vocals to “sit” correctly.**

The original LA-2A was often thought of primarily as a vocal compressor. This comes as no surprise, considering its well-deserved reputation for reining in even the most untamable performances. Dialing in judicious amounts of Peak Reduction can help get every syllable of a lead vocal intelligible, even in a track with dense instrumentation, and can also

help backing vocals to “sit” correctly. Acclaimed engineer Mike Shipley (Def Leppard, Shania Twain, Blondie) says of the LA-2A, “On certain voices you can crank it heavily, to where you almost want to put a piece of tape over the meter because there’s so much gain reduction that you don’t want anyone else to see it! I’m not particularly into over-compression, but when you use it that way there’s something about it that just sounds really great... if you have a singer with an intensely piercing voice I find [the LA-2A]... incredibly useful. It makes things warmer, especially when you crank it, and for thinner voices that can be just the ticket.”

In reviewing the LA-2A for the November, 2000 issue of *MIX* magazine, Michael Cooper began with what he described as “every engineer’s nightmare: compressing a very undisciplined female vocalist who had a cutting attack, glaring tone and wildly fluctuating dynamics.” But, according to Cooper, “the LA-2A made it

“ When you need to warm up a piercing or thin vocal and smooth its uneven dynamics, the LA-2A can work miracles.”
— Michael Cooper, *MIX* magazine

easy, providing completely transparent gain reduction and a velvety tone. The result was a vocal track that sounded dramatically smoother and warmer.” And, he notes, “it took well under a minute to dial in the sound.” His conclusion? “The LA-2A’s uniquely transparent processing makes it incredibly effective for treating vocals. When you need to warm up a piercing or thin vocal and smooth its uneven dynamics, the LA-2A can work miracles.”

Similarly, Nick Batzdorf of *Recording* magazine reported in his October, 2001 review that he successfully used the LA-2A on a male singer who had “a nice but small and dynamically uneven voice. Even when it was providing as much as 10 dB of gain reduction (that’s a lot), all [the LA-2A] did was smooth him out and make his voice thicker.”

In the August, 2002 issue of *Pro Audio Review*, Ted Spencer concluded that “where [the LA-2A] works best on vocals is when a certain blending or warming of the sound is desired... this is especially true for particular voices (often female) that are a bit “edgy” or harsh. The LA- 2A is like honey in your tea in these cases—smoothing, softening and, yes, warming the sound. The nice thing is that it accomplishes this coloring effect without sounding like anything heavy-handed has been “done” to the sound; it effortlessly does its magic without taking away any of the apparent fidelity. On the contrary, the euphonic coloration adds a sort of depth and dimension that can actually make voices sound *more* hi-fi.”

Kick Drum

The LA-2A is also used by many engineers on kick drum. Often, a kick drum does not need a lot of compression, but a compressor can nonetheless tame the big peaks, and add some character and tone to boot. The LA-2A has just the right attack time to let the beater hit come through, then the program-dependent nature of the release time gracefully pulls the volume back as the low-end thump occurs.

Michael Cooper noted in his review that “Limiting a kick drum track with the LA-2A, the dynamics were... reined in tightly, yet so smoothly. Instead of providing a warmer, rounder tone, however, the LA-2A gave the kick a snappier sound—somewhat like the old trick of taping a quarter to the drum head where the beater strikes. The rigorously consistent output levels the LA-2A provides, along with the extra “point” on the sound, was just the ticket... I could crank the kick drum track to where it rocked hard without any need for rolling off excess bottom end or adding top.”

Electric Guitar and Bass

There's something very special about the mix of tube compression and electric guitar and bass, and this is an area where the LA-2A positively shines. Ted Spencer described a session involving a bass overdub as follows: “The LA-2A sounded just sensational... providing a certain “blended” quality to the sound but not at the expense of clarity or dynamic impact.” He went on to enthuse, “For a mix of a pop rock track in Pro Tools, using the LA-2A inserted on electric guitar was even more of a no-brainer... if you often compress electric guitars, buy an LA-2A and you can thank me later.”

**“ If you often compress electric guitars, buy an LA-2A and you can thank me later.” — Ted Spencer,
*Pro Audio Review***

Ace engineer Jim Scott (Tom Petty, Red Hot Chili Peppers, Wilco) says, “I use LA-2As all the time. I use them on bass, and it's one of the compressors I use for reverb. Often I'll send a bunch of things to one LA-2A and bring it back into the console like a return—it's great for drums, great for kick drum especially.”

“LA-2As warm things up,” he adds. “They EQ all the warmth and low mids and bass. When you put bass and drums in them they get fatter and bigger. And unless you hit them way hard and make the tubes sizzle they don't really distort. Of course, you can get them to sound like an AC-30 if you want to; just turn them all the way up.”

Cooper also used the LA-2A to limit a DI'd electric bass guitar, reporting, “As always, the dynamics processing was completely transparent. And the LA-2A put some much-needed “hair” on the relatively lean-sounding track, making it beautifully round and lush.”

Acoustic Guitar and Bass

Due to its unique attack and release time characteristics, you'll find that compressing acoustic guitar or bass with the LA-2A yields equally excellent results. The pick or slap of the string will sneak through cleanly, and then a little mild compression will really bring the tone forward: just slowly raise the Peak Reduction knob until the channel's meter is almost always showing gain reduction in the -1 to -3 dB range.

Versatility

You'll undoubtedly find lots of other uses for your 2-LA-2. In his review, Batzdorf commented on the versatility of the LA-2A, saying, "The thing about [it] that makes it so good in the right application is

"The LA-2A can control the most unruly signals incredibly tightly and still sound completely natural." — Nick Batzdorf, *Recording magazine*

the way it can control the most unruly signals incredibly tightly and still sound completely natural. No pumping, no compression nasties. Just a smooth, dense sound... the LA-2A sounds astoundingly good on lots of sources: acoustic guitar, pizz cello (simulating acoustic bass for review purposes), alto recorder, and spoken voice."

Mixing and Premastering

Any recording can potentially benefit from line-level tube-stage processing. The matched T4s in the 2-LA-2 mean that it is capable of processing even an entire mix without altering the stereo imaging. A little gentle compression or limiting can add polish to a final mix and help "glue" the many components together (similar to the way that the limiters that are used in radio and television transmission sometimes improve the sound of mixes). Also, by reducing the overall dynamic range, the apparent loudness of the overall track is increased—something that is becoming increasingly important in today's loudness wars.



Try processing entire stereo mixes through the 2-LA-2.

Even if you don't opt to compress or limit the final mix, it's often worth passing the signal through the 2-LA-2 in Bypass mode. Even though the gain reduction circuitry is disconnected in that mode, the signal continues to pass through the 2-LA-2's transformers and tubes, picking up their signature warmth, giving your mix a creamier finish with a broad but gentle low-end boost.

Ducking Applications

When the 2-LA-2 is placed in stereo Link mode, the Peak Reduction knobs in each channel serve to mix the two incoming signals to the side-chain circuit of both channels. In most musical applications, you will want the left and right signals to affect the compressor equally, so that a transient occurring in one channel will serve to increase compression or limiting in both channels the same way. Thus, for normal operation in most musical and recording applications, it is important that the Peak Reduction knobs for both channels be set to the same value.

However, one byproduct of this circuit design is that it allows you to make the gain reduction circuitry more sensitive to one channel than the other. If you therefore increase the amount of Peak Reduction in one channel relative to the other, the compressor will be more sensitive to transients occurring in the that channel. This can sometimes be useful in broadcast applications, where you might want to "duck" a musical bed, for example, whenever an announcer is speaking. It can also serve as a creative tool in musical applications: for example, you might want to have one instrument automatically lowered in level whenever another instrument comes in, and then return to its original level when the second instrument stops playing. Or you can create dramatic ambience effects by using a transient (say, a snare or kick drum hit) fed into one channel of the 2-LA-2 to raise and lower the level of a room mic track fed into the other channel. Your only limit (pardon the pun) is your imagination!

The Technical Stuff

History of the 2-LA-2

The original LA-2A design was the brainchild of James F. Lawrence Jr., who had been a radar operator in World War II. Following his tour of duty, Lawrence began studying electrical engineering at the University of Southern California, while also quietly designing sub-miniature telemetry devices and optical sensors for the military. But his passion was always radio, and he eventually landed a job as a broadcast engineer at KMGH in Los Angeles, where he soon became frustrated with having to constantly ride gain to ensure a proper signal. This led to Lawrence's conception of a device he called a "leveling amplifier."

Shortly afterwards, Lawrence started a company called Teletronix, setting up shop in his hometown of Pasadena, California in 1958. Among the line of broadcast products manufactured by Teletronix were conversion and transmitter tubes, emergency tone generators, multiplex generators, even full-scale radio transmitters. Lawrence's first attempt at building a leveling amplifier resulted in the Teletronix LA-1, of which around one hundred units were made.



Teletronix LA-1

At the heart of the LA-1 was an electro-optical sensor. This was a small light-proof metal canister which housed two components: a photoelectric cell (a light sensitive device whose electrical resistance changes depending upon the intensity of light to which it is subjected, typically used in the home to sense when darkness falls and then switch on lights) and a light source positioned to shine directly on the photo-cell. Early attempts employed either neon or incandescent light sources. Both of these took time to light up, and this delay resulted in slow attacks.

The LA-1 was not a big commercial success, but it did find its way into the hands of singing cowboy Gene Autry, who used it extensively for his own radio and recording dates, thus helping give it a degree of exposure and encouraging Lawrence to continue refining the design. Soon after, the LA-2 was released, with a sensor that had evolved to use an electro-luminescent panel as its light source—a component which lit up more quickly and thus resulted in a faster attack, yielding a gentler form of compression suitable for recording as well as broadcast applications. This sensor was named the T4, and its development serendipitously created one of the most musically sensitive devices to ever ride gain.



Teletronix LA-2

Engineer Sid Feldman purchased an LA-2 early on, and soon became involved in its distribution, selling units to numerous broadcast and recording facilities in New York and Nashville. In 1962 Lawrence began to reconfigure the LA-2 into the LA-2A, at which time the device gained a Limit/Compress switch in response to the newfound interest from the recording industry. With its 0 to 40 dB of gain limiting, a balanced stereo interconnection, flat frequency response of 0.1 dB from 30-15,000 Hz and a low noise level (better than 70 dB), the LA-2A quickly became one of two industry standard compressors (the other being Bill Putnam Sr.'s 1176)—both devices that continue to be used extensively on recording sessions to this very day.

Teletronix became a division of Babcock Electronics Corp. in 1965. In 1967 Babcock's broadcast division was acquired by Bill Putnam's company, Studio Electronics Corp., shortly before he changed the company's name to UREI®. Three different versions of the LA-2A were produced under the auspices of these different companies before production was discontinued around 1969. However, Putnam continued using the T4 optical detector for new designs, such as the solid-state LA-3A, followed by the LA-4 and LA-5.

The companies that Putnam started—Universal Audio, Studio Electronics, and UREI—built products that are still in regular use decades after their development. In 2000, Bill Putnam Sr. was awarded a Technical Grammy for his multiple contributions to the recording industry. Highly regarded as a recording engineer, studio designer/operator and inventor, Putnam was considered a favorite of musical icons Frank Sinatra, Nat King Cole, Ray Charles, Duke Ellington, Ella Fitzgerald and many, many more. The studios he designed and operated were known for their sound and his innovations were a reflection of his desire to continually push the envelope. Universal Recording in Chicago, as well as Ocean Way and Cello Studios (now EASTWEST) in Los Angeles all preserve elements of his room designs.

In 1999, Putnam's sons Bill Jr. and James Putnam re-launched Universal Audio. One of the company's first new products was a reissue of the LA-2A, designed to deliver complete authenticity, from its handwired components to its carefully selected tubes and original spec componentry. In 2007, Universal Audio released the 2-LA-2, designed by original UREI® engineer Dennis Fink. The 2-LA-2 retains the same key gain reduction components and simple controls found in the LA-2A, but adds the modern convenience of a stereo-matched tool made more versatile for today's studio. In addition, the 2-LA-2 has a much lower noise floor than its ancestor, allowing it to be used on low-output sources with less risk of introducing undesirable hiss.

Traditionally, the LA-2A was used as a monophonic compressor. Although a stereo link connection was provided on its rear panel terminal strip, it was nonetheless uncommon to gang two units together for

The Technical Stuff

stereo operation, largely because T4 modules often vary slightly between units in their release times. While they are similar enough from unit to unit to independently achieve the famous LA-2A sound, ganging them together can be less than ideal, as these subtle differences in release times can negatively affect the stereo image. With the 2-LA-2, the T4 modules are stereo matched to tight tolerances, guaranteeing a smooth and stable stereo image.

The 2-LA-2 also addresses the other limitation to ganging two LA-2As: the sheer hassle of interconnecting, calibrating and gain-matching two independent units. To do so, the user has to connect the units with a wire on their barrier-strip screw terminals, then has to send a test tone to both units while adjusting the sensitivity switch on the rear of the master unit to balance the gain reduction elements and metering. Furthermore, the wire must be disconnected to return the units to monophonic use. With the 2-LA-2, alternating between stereo and dual mono operation is completely simplified, accomplished with a flip of a switch.

We here at Universal Audio, have two goals in mind: to reproduce classic analog recording equipment designed by Bill Putnam Sr. and his colleagues, and to design new recording tools in the spirit of vintage analog technology. Today we are realizing those goals, bridging the worlds of vintage analog and DSP technology in a creative atmosphere where musicians, audio engineers, analog designers and DSP engineers intermingle and exchange ideas. Every project taken on by the UA team is driven by its historical roots and a desire to wed classic analog technology with the demands of the modern digital studio.

Compressor Basics

The function of a compressor is to automatically reduce the level of peaks in an audio signal so that the overall dynamic range—that is, the difference between the loudest sections and the softest ones—is reduced, or compressed, thus making it easier to hear every nuance of the music. Compression is sometimes referred to as *peak reduction* or *gain reduction*, because a compressor (or “limiter,” when acting more severely) “rides gain” on a signal much like a recording engineer does by hand when he manually raises and lowers the faders of a mixing console. Its circuitry automatically adjusts level in response to changes in the input signal: in other words, it keeps the volume up during softer sections and brings it down when the signal gets louder. The amount of gain reduction is typically given in dB and is defined as the amount by which the signal level is reduced by the compressor.

Compression or limiting enables even the quietest sections to be made significantly louder while the overall peak level of the material is increased only minimally. The dynamic range of human hearing (that is, the difference between the very softest passages we can discern and the very loudest ones we can tolerate) is considered to be approximately 120 dB. Early recording media such as analog tape and vinyl offered much less dynamic range, so compression was a virtual necessity, raising the overall level of the material (making it “hotter”) without peak levels causing distortion. While many of today's digital recording media approach or even exceed 120 dB of available dynamic range, quiet passages of recorded music can still be lost in the ambient noise floor of the listening area, which, in an average home, is 35 to 45 dB.

Despite the increased dynamic range, compression is especially important when recording digitally, for two reasons: One, it helps ensure that the signal is encoded at the highest possible level, where more bits are being used so that better signal definition is achieved. Secondly, it helps prevent a particularly harsh type of distortion known as *clipping*—something that, ironically, is especially egregious in digital recording, due to the inherent limitations of digital technology.

During recording, compression is customarily used to minimize the volume fluctuations that occur when a singer or instrumentalist performs with too great a dynamic range for the accompanying music. It can also help to tame acoustic imbalances within an instrument itself—for example, when certain notes of a bass guitar resonate more loudly than others, or when a trumpet plays louder in some registers than in others. Properly applied compression will make a performance sound more consistent throughout. It can tighten up mixes by melding dense backing tracks into a cohesive whole, can make vocals more intelligible, and can add punch and snap to percussion instruments like kick drum and snare drum, making them more “present” without necessarily being louder. It can also impart tonal coloration, making a signal warmer and fatter. Compression can even serve as a musical tool, enhancing the sustain of held guitar notes or keyboard pads, or providing a snappier attack to horn stabs or string pizzicato.

Input Signal and Threshold

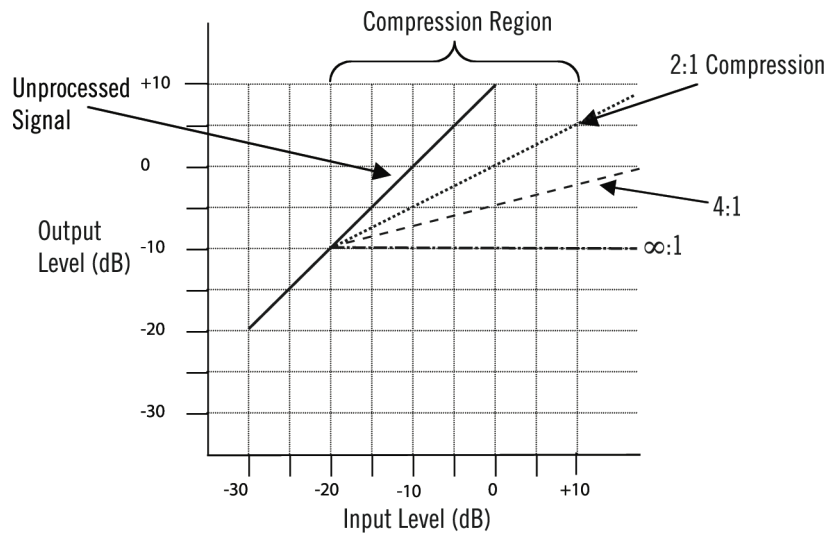
The first and perhaps most significant factor in compression is the level of the input signal. Large (loud) input signals result in more gain reduction, while smaller (softer) input signals result in less gain reduction. *Threshold* is another important factor. It is a term used to describe the level at which a compressor starts to work. Below the threshold point, the volume of a signal is unchanged; above it, the volume is reduced. For example, if a compressor’s threshold is 0 dB, incoming signals at or above 0 dB will have their gain reduced, while those below 0 dB will be unaffected.

In the 2-LA-2, the Peak Reduction knob in each channel controls both the threshold and the amount of input signal being routed to the compressor circuit. As it is turned up (clockwise), the overall degree of compression increases; as it is turned down (counterclockwise), the overall degree of compression decreases. At the 0 (fully counterclockwise) setting, no signal enters the compression circuit, hence no gain reduction.

Ratio

Another important term is compression *ratio*, which describes the amount of increase required in the incoming signal in order to cause a 1 dB increase in output. A ratio of 1:1 therefore means that for every 1 dB of increase in input level, there is a corresponding 1 dB increase in output level; in other words, there is no compression being applied. A ratio of 2:1, however, means that any time there is an increase of 2 decibels in the loudness of the input signal, there will only be a 1 dB increase in output signal. A ratio of 4:1 means that even when there is a full 4 decibels of increase in loudness, there will still only be a 1 decibel increase in output signal. (Bear in mind that decibel is a logarithmic form of measurement, so a 2 dB signal is not twice as loud as a 1 dB signal; in fact, it requires approximately 10 dB of increased gain for a signal to sound twice as loud.)

The Technical Stuff



As you can see from the illustration above, at a low ratio, a compressor has relatively less effect on the incoming signal; at higher ratios, it has more effect. When a channel is operating in compression mode (that is, when its front-panel switch is set to COMPRESS), the 2-LA-2 uses a compression ratio of approximately 4:1; however, as we will see shortly, this is program dependent, so that the actual ratio changes according to the frequency content of the incoming signal.

While the terms “compression” and “limiting” are often used interchangeably, the general definition of compression is gain reduction at ratios below 10:1; when higher ratios (of 10:1 or greater) are used, the process is instead called *limiting*. Limiters abruptly prevent signals above the threshold level from exceeding a certain maximum value. At very high ratios of 20:1 or greater (some limiters even offer a theoretical infinite ratio of Infinity:1), “brick wall” limiting kicks in—that is, any change in input, no matter how great, results in virtually no increase in output level. Infinity:1 is the ratio used by the 2-LA-2 when a channel is operating in limiting mode (that is, when its front-panel switch is set to LIMIT); however, the 2-LA-2 is designed so that the same warm sonic characteristics are retained, even though more severe gain reduction is applied.

As an aside, an *expander* is the opposite of a compressor: a device which *increases* the dynamic range of a signal. For example, a 10 dB change in the input signal might result in a 20 dB change in the output signal, thus “expanding” the dynamic range.

Knee

A compressor's *knee* determines whether the device will reach maximum gain reduction quickly or slowly. A gradual transition (“soft knee”) from no response to full gain reduction will provide a gentler, smoother sound, while a more rapid transition (“hard knee”) will give an abrupt “slam” to the signal. The 2-LA-2 utilizes soft knee compression and limiting, which is generally preferred for most musical applications; hard knee compression or limiting is more often used in applications where instrumentation (such as broadcast transmitter towers) must be protected from transient signal overloads.

Attack and Release

The main key to the sonic imprint of any compressor lies in its *attack* and *release* times; these are the parameters which most affect how “tight” or how “open” the sound will be after compression. The attack time describes the amount of time it takes the compressor circuitry to react to and reduce the gain of the incoming signal, usually given in thousandths of a second (milliseconds). The 2-LA-2 attack time is approximately 10 milliseconds (though, like ratio, this is somewhat program dependent). A fast attack such as this kicks in almost immediately and catches transient signals of very brief duration (such as the beater hit of a kick drum or the pluck of a string), reducing their level and thus “softening” the sound. A slow attack time allows transients to pass through unscathed before compression begins on the rest of the signal.

The release time is the time it takes for the signal to then return to its initial (pre-compressed) level. If the release time is too short, “pumping” and “breathing” artifacts can occur, due to the rapid rise of background noise as the gain is restored. If the release time is too long, however, a loud section of the program may cause gain reduction that persists through a soft section, making the soft section inaudible. The 2-LA-2 is unique in that it provides a dual stage release time: in the first 60 milliseconds, approximately half the signal is released, with the remainder taking anywhere from 1 second to 15 seconds to die away, depending upon its frequency content.

Makeup Gain

Finally, an output control is employed to make up for the gain reduction applied by the gain reduction circuitry; on the 2-LA-2, this is the function of each channel’s Gain knob. Makeup gain is generally set so that the compressed signal is raised to the point at which it matches the level of the unprocessed input signal (for example, if a signal is being reduced in level by approximately -6 dB, the output makeup gain should be set to +6 dB).

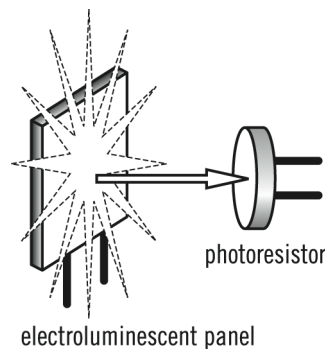
As you are adjusting a compressor, a switchable meter such as the one provided by each channel of the 2-LA-2 can be helpful in order to view the strength of the outgoing signal (displayed when the meter is set to OUTPUT) or the difference in levels between the uncompressed input signal and the compressed output signal (displayed when the meter is set to GR). When in GR mode, the 2-LA-2 meter will read 0 dB when there is no incoming signal or when no compression is being applied.

The Technical Stuff

Electro-Optical Compression/Limiting

In order to operate, a compressor must first have some method of determining the level of the incoming signal, and must then be able to use the fluctuations in that signal to control the gain. There are many different circuit designs which have been developed to accomplish these tasks. In each channel of the 2-LA-2, both of these functions are performed by an electro-optical element called a T4.

A T4 is at the very heart of each of the dual compressors in the 2-LA-2. It is comprised of a small light-proof metal canister that contains two components: an electro-luminescent (EL) panel (a device that lights up when electrical signal is applied) and a cadmium-sulfide photoelectric cell (a light sensitive device whose electrical resistance changes depending upon the intensity of light to which it is subjected). It is the unique gain reduction characteristics that result from the interaction between these two components that predominantly gives an electro-optical compressor its signature sound. (Note: While the “el-op” circuit design was one of the first of its kind, and is still used to this day in other compressor products, Universal Audio has its photo-cells uniquely manufactured to exacting specs that were originally found on the LA-2A. No other manufacturers have access to these cells.)



The genius of the el-op circuit lies in its simplicity: the larger the signal that is applied to the EL panel, the brighter the light that is generated; the brighter the light, the less resistance the photo-cell (which controls the gain of the electrical circuit) exhibits. Thus, the louder the incoming signal, the brighter the light and the more gain reduction is applied... and with virtually no harmonic distortion or audible artifacts. (In the most extreme case, if the resistance of the photo-cell becomes zero [a dead short], then the signal would be grounded and there would be no output. In reality, photo-cell resistance cannot go completely to zero and hence there will always be some signal present.)

Conversely, when there is a small input signal (resulting in a dim light), the photo-cell will have a great deal of resistance and will therefore not affect the circuit at all, so there will be no gain reduction.

Perhaps the most important thing about electro-optical compression and limiting is that it is 100% program-dependent; in other words, both the degree of gain reduction and the compression ratio vary continuously with the incoming signal, making for a very natural sound. What's more, unlike other compressors which allow the user to adjust the attack and release times, both of these parameters are automatic and are completely determined by the response of the EL panel and photo-cell in the T4.

The electroluminescent panel utilized in the T4 discharges most of its light very quickly, resulting in an extremely fast attack time (which can be as low as 10 milliseconds, depending on the frequency of the incoming signal). Even more critical to the sound of the 2-LA-2 compressor is its signal-dependent release time. Short transients are released quickly, while longer, more sustained parts of the sound are given a much slower release. Like the original T4, the T4 in the 2-LA-2 actually releases in two stages: the initial release generally takes place in about 40- 80 milliseconds (which is relatively fast), followed by a gradual release that can take as much as several seconds. This kind of program-dependent dual stage quick-then-gradual release results in a warm and natural sound without the “pumping” which plagues so many other compressor designs.

The amount of time it takes for the photo-cell to recover after the light is removed depends on how long light had been shining on it and how bright the light was. This causes something called “memory effect.” As a result, you can actually “train” the T4’s response characteristics by pre-rolling material for a minute or two, essentially saturating the photo-cell. Similarly, because the amount of time it takes the luminescent panel to light up determines the attack, you can “prime” the T4 to light up faster so that the first note's transient doesn't sneak by too aggressively. To do so, simply have the musician trigger the compressor by playing a note just before recording begins.

Another interesting phenomenon which affects the threshold (and, to a lesser degree, attack time and release time) of an electro-optical compressor is “panel aging,” something which is more related to the amount of actual use rather than age in years. The more “aged” the EL panel, the greater the amount of gain reduction will need to be applied. Panel aging is probably a major reason why the same model of electro-optical compressor can sound subtly different between units.

The Technical Stuff

Operating The 2-LA-2 In Link Mode

The two T4 gain reduction cells in the 2-LA-2 have been carefully matched to allow smooth and musical operation when stereo linked, with equivalent attack and release times in both channels. When operating the 2-LA-2 in Link mode (◀ see #7 on page 5), the Peak Reduction knobs in each channel serve to mix the two incoming signals to the side-chain circuit of both channels. In most musical applications, you will want the compressor to equally affect the left and right signals, so that a transient occurring in one channel will serve to increase compression or limiting in both channels the same way. Thus, for normal operation in most musical and recording applications, it is important that the Peak Reduction knobs for both channels be set to the same value. However, because there can be minor variations in the tolerance of any potentiometer, we recommend that you calibrate the two Peak Reduction controls as follows:

1. While in Link mode, send stereo signal to the 2-LA-2 but monitor the left channel only.
2. In the left channel of the 2-LA-2 only, set the Limit/Compress switch as desired and adjust the Peak Reduction and Gain knobs until the desired amount of compression or limiting is heard.
3. In the right channel of the 2-LA-2, set the Limit/Compress switch and the Peak Reduction and Gain knobs of the right channel to the identical setting as the left channel, and then begin monitoring both channels, in stereo.
4. Set the 2-LA-2 to Dual mode and mute the stereo source. Instead run a steady-state test signal through both channels, like a 1khz test tone.
5. Set the meter for both channels to OUTPUT, then adjust the lower of the two Peak Reduction knobs so that the output on both meters is identical.
6. Finally, disconnect the test signal and restore the original stereo signal.

One byproduct of this circuit design is that it allows you to make the gain reduction circuitry more sensitive to one channel than the other. Thus, for example, if you set the Peak Reduction knob for the left channel considerably higher (turned more clockwise) than the right channel, the compressor will be more sensitive to transients occurring in the left channel. This can sometimes be useful in broadcast applications, where you might want to “duck” a musical bed, for example, whenever an announcer is speaking. (◀ see page 10 for more information.)

Making A Custom Insert Cable

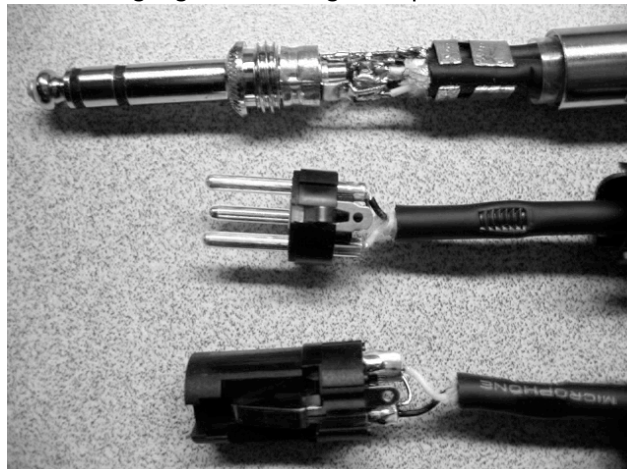
In order to ensure unity gain, the input and output to a compressor are normally derived from a channel or bus insert send and return. Although the inputs and outputs to the 2-LA-2 use standard XLR connectors, most mixing consoles provide such inserts on unbalanced TRS (Tip/Ring/Sleeve) connectors, with the tip carrying the send and the ring carrying the return, with the sleeve serving as common ground. Pre-made “insert” Y-cables that provide a single TRS plug on one end and two XLR connectors on the other end are commercially available for this purpose. However, it can be considerably more cost-effective to make your own custom insert cable—something which requires only basic soldering skills and a few inexpensive parts.

To make such a cable, first acquire the following components:

- (1) Female XLR cable connector
- (1) Male XLR cable connector
- (1) 1/4" TRS cable connector
- A suitable length of light gauge unbalanced microphone cable
- A short piece of 22 gauge bus wire

Then follow these steps to assemble the cable:

1. Cut two lengths of audio cable suitable to reach from the 2-LA-2 to the insert point on your mixer. Light gauge cable should be used in order to allow the two cables to comfortably fit inside a TRS jack.
2. Use a short piece of bus wire to tie pins 1 (cold) and 3 (ground) together on each XLR connector. Only solder pin 3, as you will also need to solder an audio lead into pin 1.
3. On both XLR connectors, solder the hot (red) lead into pin 2, and solder the cold (black) lead into pin 1, as well as the other end of the bus wire (as described in the previous step).
4. Solder the hot (white) lead from the cable connected to the male XLR to the tip connection point of the TRS jack. Solder the hot (white) lead from the cable connected to the female XLR to the ring connection point of the TRS jack. As shown in the photograph below, combine the cold lead and the shielding together at the ground point.



The Technical Stuff

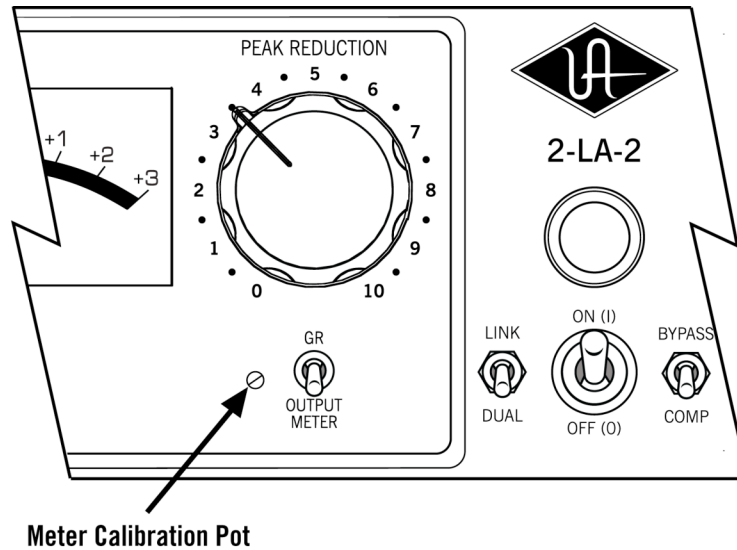
5. Your finished cable should look like the photograph below. Be sure to check continuity with a voltmeter or test light before use, to ensure proper grounding and signal flow.



Maintenance Information

Meter Calibration

The 2-LA-2 meters may occasionally need to be calibrated. This is accomplished by adjusting the GR Zero Set potentiometer, located to the left of each channel's Meter switch.



The procedure for adjusting the meter is as follows:

1. Power on the 2-LA-2 and allow it to warm up for five minutes.
2. Set the Meter switch for the channel being calibrated to its up (GR) position.
3. Set the Peak Reduction control fully off (turn the knob fully counterclockwise) and make sure there is no signal present.
4. Use a small screwdriver to slowly adjust the GR Zero Set potentiometer so that the meter reads 0 dB. Watch how the meter settles before completing the calibration.

Changing the Internal Voltage Selector

The 2-LA-2 can operate at 100V (for use in Japan), 120V, or 240V. To change the internal voltage selector, wait 5 minutes after power down, then **unplug the AC power cord from the rear chassis**. Remove the top cover. As shown in the photograph below, there is a connector that can be plugged into one location or another to configure the unit for different voltage operation. This connector is part of the wiring that comes from the power transformer located at the rear center of the 2-LA-2. (NOTE: This photograph shows the unit configured for 120V operation.)



NOTE: When changing operating voltage, the fuse value must be changed as well. *Make sure the 2-LA-2 is properly set for the voltage in your area before applying AC power to the unit!* Failure to do so may damage the unit.

Changing Fuses

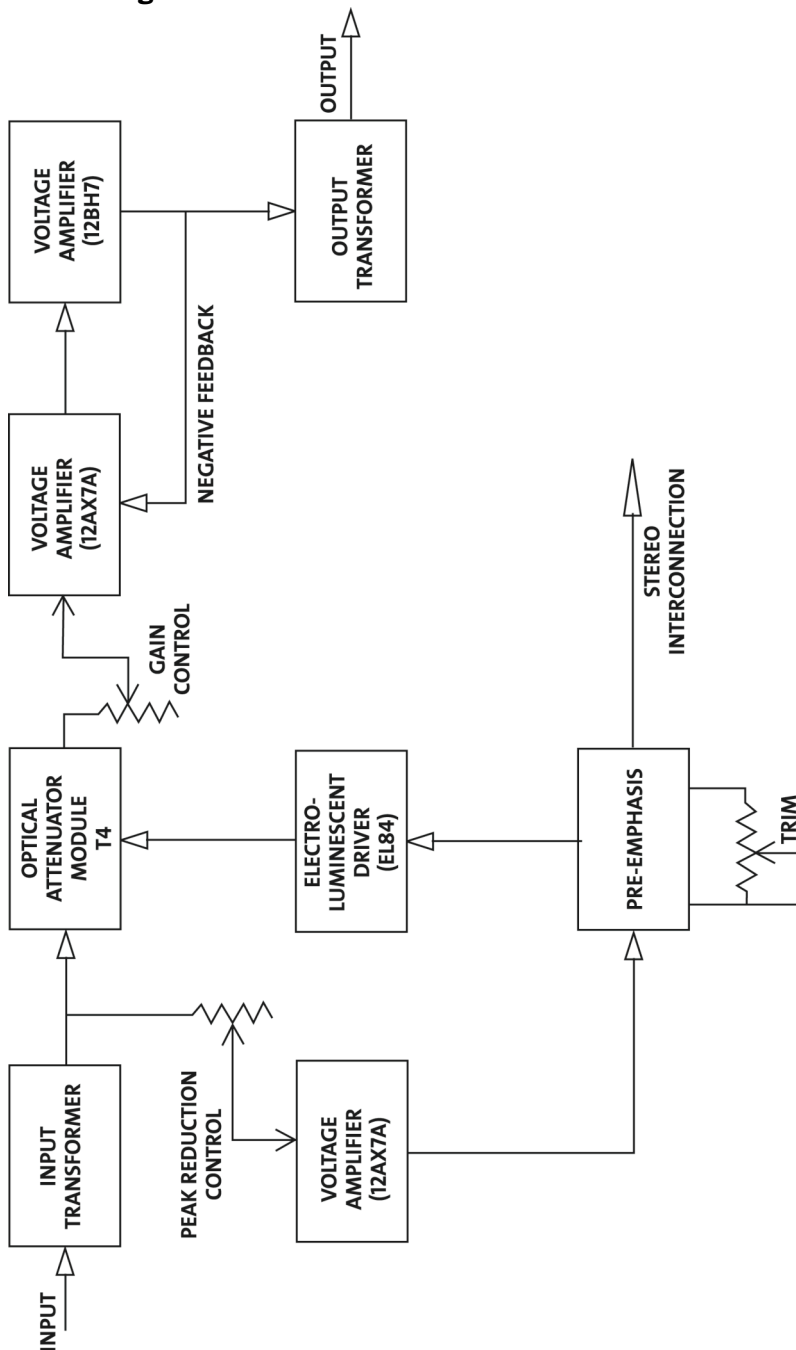
The AC power fuse is located in the AC power connector block. Remove the power cord before checking or changing the fuse.

A 1.6 A time delay (slow blow) fuse is required for operation at 100 or 120 V.

A 800 mA time delay (slow blow) fuse is required for operation at 240 V.

ⓘ Never substitute different fuses other than those specified here!

Block Diagram



As shown in the illustration above, each channel's input transformer provides isolation and impedance matching. After this, the signal is fed into both the side-chain circuit and the gain reduction circuit. The side-chain is comprised of a voltage amplifier, a pre-emphasis filter, and a driver stage which provides the voltage necessary to drive the electro-luminescent panel. This signal controls the gain of the compressor. After the gain reduction circuit, the signal is sent through an output Gain control and a two-stage output amplifier, followed by the output transformer.

Glossary Of Terms

Ambient noise floor - Low-level noise created by environmental factors such as fans, air conditioners, heaters, wind noise, etc.

Attack time - Describes the amount of time it takes compressor circuitry to react to and reduce the gain of incoming signal. A compressor set to a fast attack time kicks in almost immediately and catches transient signals of very brief duration, reducing their level and thus "softening" the sound. A slow attack time allows transients to pass through unscathed before compression begins on the rest of the signal. The 2-LA-2 attack time is approximately 10 milliseconds, program dependent.

Auxiliary (Aux) send - A mixer bus output designed to combine and send multiple signals to an external processor or monitor system.

Balanced - Audio cabling that uses two twisted conductors enclosed in a single shield, thus allowing relatively long cable runs with minimal signal loss and reduced induced noise such as hum.

Bus - The point in an audio mixer where various signals are blended together.

Bus insert - An insert across a mixer bus.

Channel - A functional path in an audio circuit. A mixer provides multiple channels, each with its own dedicated input(s) and several outputs, such as buses, auxiliary sends, etc.

Channel insert - An insert across a mixer channel.

Clipping - A particularly harsh form of audio distortion, caused when the loudness of an incoming signal exceeds an audio recording device's capability to represent its amplitude. When that happens, the peaks of the signal simply get "clipped" off, thus drastically changing the waveform. When clipping occurs in a digital recording device, the result is an especially unpleasant sound.

Compression - The process of automatically reducing the level of peaks in an audio signal so that the overall dynamic range—that is, the difference between the loudest sections and the softest ones—is reduced, or compressed. "Compression" is sometimes described as "gain reduction" or "peak reduction."

Compression ratio - A term that describes the amount of increase required in the incoming signal in order to cause a 1 dB increase in output. A ratio of 2:1, for example, means that any time there is an increase of 2 decibels in the loudness of the input signal, there will only be a 1 dB increase in output signal. When compression ratios of 10:1 or higher are being used, the device is instead said to be limiting.

DAW - An acronym for "Digital Audio Workstation"—that is, any device that can record, play back, edit, and process digital audio.

dB - Short for "decibel," a logarithmic unit of measure used to determine, among other things, power ratios, voltage gain, and sound pressure levels.

dBm - Short for "decibels as referenced to milliwatt," dissipated in a standard load of 600 ohms. 1 dBm into 600 ohms results in 0.775 volts RMS.

dBV - Short for "decibels as referenced to voltage," without regard for impedance; thus, one volt equals one dBV.

Ducking - No, nothing to do with Donald. Describes the technique of using the level of one signal to control the level of another. In broadcast applications, a music bed is often automatically “ducked” whenever the announcer’s voice is heard; it then returns to its original level when the announcer stops speaking.

Dynamic range - The difference between the loudest sections of a piece of music and the softest ones. The dynamic range of human hearing (that is, the difference between the very softest passages we can discern and the very loudest ones we can tolerate) is considered to be approximately 120 dB. Modern digital recording devices are able to match (or even exceed) that range.

Electro-luminescent panel (EL) - A component (commonly used in night lights) which lights up quickly when electrical signal is applied: the stronger the signal, the brighter the light.

Electro-optical compression (“el-op compression”) - A circuit design whereby a light source and a photoelectric cell are used for gain reduction.

Flat frequency response - No boost or attenuation in any frequency range.

Gain reduction - A synonym for compression or limiting.

Insert - A place where a signal path can be broken so that a processing device can be placed in line with the signal at unity gain (no cut or boost). An insert is most commonly a TRS jack with one conductor being an output (send) and the other being an input (return). The jack is wired with a *normalled* connection so that with nothing plugged in, the send and return are connected together.

Knee - A term used to describe whether a compressor will reach maximum gain reduction quickly or slowly. A gradual transition is called “soft knee,” while a more rapid transition is called “hard knee.” The 2-LA-2 utilizes soft knee compression and limiting, which is generally more desirable for musical applications.

Limitter - A compressor that operates at high compression ratios of 10:1 or higher.

Limiting - A more severe form of compression, where a high compression ratio (of 10:1 or higher) is being used.

Line level - Refers to the voltages used by audio devices such as mixers, signal processors, tape recorders, and DAWs. Professional audio systems typically utilize line level signals of +4 dBm (which translates to 1.23 volts), while consumer and semiprofessional audio equipment typically utilize line level signals of -10 dBV (which translates to 0.316 volts).

Makeup gain - A control that allows the overall output signal to be increased in order to compensate (“make up”) for the gain reduction applied by the compressor.

Memory effect - In an electro-optical compressor, refers to the fact that it takes a certain amount of time for the photo-cell to recover after light is removed, depending on how long light had been shining on it and how bright the light was. Because of this, you can actually “train” the compressor’s response characteristics by pre-rolling material for a minute or two, essentially saturating the photo-cell.

Mic level - Refers to the very low level signal output from microphones, typically around 2 millivolts (2 thousandths of a volt).

Glossary Of Terms

Millisecond (ms) - A thousandth of a second.

Patch bay - A passive, central routing station for audio signals. In most recording studios, the line-level inputs and outputs of all devices are connected to a patch bay, making it an easy matter to re-route signal with the use of patch cords.

Patch cord - A short audio cable with connectors on each end, typically used to interconnect components wired to a patch bay.

Panel aging - More related to the amount of actual use rather than age in years, this is a phenomenon which affects the threshold (and, to a lesser degree, attack time and release time) of an electro-optical compressor. The more "aged" the EL panel, the greater the amount of gain reduction will need to be applied. Panel aging is probably a major reason why the same model of electro-optical compressor can sound subtly different between units.

Peak reduction - A synonym for compression or limiting.

Photo-electric cell ("photo-cell") - A light sensitive device whose electrical resistance changes depending upon the intensity of light to which it is subjected.

Program dependent - Refers to a parameter that varies according to the characteristics of the incoming signal. The 2-LA-2 compressor and limiter ratio, as well as the attack time and release time, are all program dependent.

Release time - The time it takes for a signal to return to its initial (pre-compressed) level. If the release time is too short, "pumping" and "breathing" artifacts can occur, due to the rapid rise of background noise as the gain is restored. If the release time is too long, however, a loud section of the program may cause gain reduction that persists through a soft section, making the soft section inaudible. The 2-LA-2 features a dual-stage release, where it takes approximately 60 milliseconds for the first 50% of release, then from 1 to 15 seconds for the final release.

Terminal Strip - An insulated stamped strip of tin-plated loops of copper, used for multiple electrical or audio interconnections. Sometimes called a "barrier strip."

Threshold - A term used to describe the level at which a compressor starts to work. Below the threshold point, the volume of a signal is unchanged; above it, the volume is reduced.

Transient - A relatively high volume pitchless sound impulse of extremely brief duration, such as a pop. Consonants in singing and speech, and the attacks of musical instruments (particularly percussive instruments), are examples of transients.

TRS - Short for "Tip/Ring/Sleeve," a standard quarter-inch jack connector, with the tip and ring carrying audio signal and the sleeve attached to the shield of the cabling, thus providing ground. When used for mixer channel or bus inserts, the tip and ring will typically carry send and return signals, respectively. When used for balanced connections, the tip and ring will carry the same audio signal, with one signal out of phase with the other.

XLR - A standard three-pin connector used by many audio devices, with pin 1 typically connected to the shield of the cabling, thus providing ground. Pins 2 and 3 are used to carry audio signal, normally in a balanced (out of phase) configuration.

UNIVERSAL AUDIO

The image shows the front panel of a Universal Audio LA-2 Limiting Amplifier. The panel is divided into two identical horizontal sections, each containing a VU meter, a gain reduction meter, and various control knobs and switches. The top section is labeled "2-LA-2" and features a large "U" logo. The bottom section is labeled "LA-2 Limiting Amplifier". Both sections include a "GAIN" knob, a "LIMIT" switch, a "COMPRESS" switch, a "VU" meter, a "PEAK REDUCTION" meter, a "GR" switch, a "SLO" switch, a "METER" switch, a "LINK" switch, an "ON (I)" switch, a "BYPASS" switch, and a "DUAL" switch. The panel is black with white markings and text.

The image displays two identical panels of the LA-2 Limiting Amplifier, a classic piece of audio equipment. Each panel features a central VU meter with a scale from -20 to +3, and a diamond-shaped logo with the letters 'LA' inside. The top section of each panel is labeled 'GAIN' and includes a circular scale from 0 to 10. The bottom section is labeled 'PEAK REDUCTION' and also includes a circular scale from 0 to 10. Between these sections, there are two large circular knobs labeled '2-LA-2'. The left knob has a 'LINK' switch and a 'DUAL' switch. The right knob has an 'ON (0)' switch, a 'BYPASS' switch, and a 'COMP' switch. Below the knobs, there are two smaller circular knobs labeled 'LIMIT' and 'COMPRESS'. At the bottom of each panel, there are two more circular knobs labeled 'GR' and 'METER', and a switch labeled 'SLO OUTPUT'. The text 'UNIVERSAL AUDIO' and 'LA-2 Limiting Amplifier' are printed on each panel.

Universal Audio, Inc. • 1700 Green Hills Rd. • Scotts Valley, CA • 95066-4926 • www.uaudio.com • 877-MY-UAUDIO • voice: 831-440-1176 • fax: 831-461-1550

Specifications

Output Level	+20 dBu nominal, @ 1%
Input Level	+24 dBu maximum
Output Impedance	600 Ω balanced
Input Impedance	600 Ω balanced
Maximum Gain	35 dB +/- 1 dB
Frequency Response	30 Hz to 15 kHz +0.1 dB
Compressor Ratio	~4:1, soft knee, program dependent
Limiter Ratio	~Infinity:1, soft knee, program dependent
Attack Time	~10 ms, program dependent
Release Time	Dual stage: ~60 ms for 50% release, then 1 - 15 seconds, program dependent
Signal-To-Noise	-70 dBu
Distortion	< 0.35% at +10 dBm, < 0.75% at +16 dBm
Meter	Gain Reduction (dB) and Output (dB)
Input/Output Connections	XLR
Tube Complement	(2) 12AX7, (1) 12BH7, (1) EL84 per channel
Power Connector	Detachable IEC power cable
Power Requirements	100 V / 120 V / 240 V
Fuse	1.6 A time delay (slow blow) / 100 or 120 V 800 mA time delay (slow blow) / 240 V
Power Consumption	80 watts
Dimensions	19" W x 3.5" H x 12.25" D (two rack space)
Weight	14.5 lb.

Additional Resources

We've got a pretty cool website, if we may say so ourselves. Check us out at <http://www.uaudio.com>.

There, you'll find tons of information about our full line of products, as well as e-news, videos, software downloads, FAQs, an online store, and a way cool webzine that features hot tips, techniques, and interviews with your favorite artists, engineers and producers each month. The webzine even offers something we call "Playback"—a monthly contest where the winners get their music posted on our site, exposing their songs to thousands of visitors per day!

Product Registration

Please take a moment to register your new Universal Audio product by visiting our website at <http://www.uaudio.com/support/register.html>

Registration allows us to contact you regarding important product updates and also makes you eligible for online promotions.

Warranty

The warranty for all Universal Audio hardware is one year from date of purchase, parts and labor.

Service & Support

Even gear as well designed and tested as ours will sometimes fail. In those rare instances, our goal here at UA is to get you up and running again as soon as possible.

The first thing to do if you're having trouble with your device is to check for any loose or faulty external cables, bad patchbay connections, grounding trouble from a power strip and all inputs/outputs (mic/line/Hi-Z, etc.). If your problem persists, call tech support at 877-MY-UAUDIO, or send an email to hardwaresupport@uaudio.com, and we will help you troubleshoot your system. (Canadian and overseas customers should contact their local distributor.) When calling for help, please have the product serial number available and have your unit set up in front of you, turned on and exhibiting the problem.

If it is determined your product requires repair, you will be told where to ship it and issued a Return Merchandise Authorization number (RMA). This number must be displayed on the outside of your shipping box (use the original packing materials if at all possible). Most repairs take approximately 2 - 4 days, and we will match the shipping method you used to get it to us. (In other words, if you shipped it to us UPS ground, we will ship it back to you UPS ground; if you overnight it to us, we will ship it back to you overnight). You pay the shipping costs to us; we ship it back to you free of charge. Qualified service under warranty is, of course, also free of charge. For gear no longer under warranty, tech bench costs are \$75 per hour plus parts.