

DUAL LIMITER

CLASSIC PWM LIMITER



USER'S MANUAL



IMPORTANT SAFETY INSTRUCTIONS – READ FIRST



This symbol, wherever it appears, alerts you to the presence of uninsulated dangerous voltage inside the enclosure. Voltage that may be sufficient to constitute a risk of shock.



This symbol, wherever it appears, alerts you to important operating and maintenance instructions in the accompanying literature. Please read manual.

Read instructions:

Retain these safety and operating instructions for future reference. Heed all warnings printed here and on the equipment. Follow the operating instructions printed in this user guide.

Do not open:

There are no user serviceable parts inside. Refer any service work to qualified technical personnel only.

Power sources:

Only connect the unit to mains power of the type marked on the rear panel. The power source must provide a good ground connection.

Power cord:

Use the power cord with sealed mains plug appropriate for your local mains supply as provided with the equipment. If the provided plug does not fit into your outlet consult your service agent. Route the power cord so that it is not likely to be walked on, stretched or pinched by items placed upon or against.

Grounding:

Do not defeat the grounding and polarization means of the power cord plug. Do not remove or tamper with the ground connection on the power cord.

Ventilation:

Do not obstruct the ventilation slots or position the unit where the air required for ventilation is impeded. If the unit is to be operated in a rack, case or other furniture, ensure that it is constructed to allow adequate ventilation.

Moisture:

To reduce the risk of fire or electrical shock do not expose the unit to rain, moisture or use in damp or wet conditions. Do not place a container of liquid on it, which may spill into any openings.

Heat:

Do not locate the unit in a place close to excessive heat or direct sunlight, as this could be a fire hazard. Locate the unit away from any equipment, which produces heat such as: power supplies, power amplifiers and heaters.

Environment:

Protect from excessive dirt, dust, heat, and vibration when operating and storing. Avoid tobacco ash, drink spillage and smoke, especially that associated with smoke machines.

Handling:

To prevent damage to the controls and cosmetics avoid rough handling and excessive vibration. Protect the controls from damage during transit. Use adequate padding if you need to ship the unit. To avoid injury to yourself or damage to the equipment take care when lifting, moving or carrying the unit.

Servicing:

Switch off the equipment and unplug the power cord immediately if it is exposed to moisture, spilled liquid, objects fallen into opening, or the power cord or plug becomes damaged during a lightning storm or if smoke odor or noise is noted. Refer servicing to qualified technical personnel only.

Installation:

Install the unit in accordance with the instructions printed in the user guide.

DUAL LIMITER

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INTRODUCTION

Thanks for purchasing Applied Research and Technology's DUAL LIMITER offering a superb level of sound quality, DUAL LIMITER has a unique design that will enhance the sonic textures of your audio system for years to come. Developed in partnership with studio and live-sound engineers, the DUAL LIMITER is very musical.

The heart of the Dual Limiter is a unique PWM gain control circuit. Combined with its' intelligent detector, the result is a Classic sounding compressor/ limiter without the traditional nose and distortion artifacts.

The DUAL LIMITER was designed and constructed with high quality components, assuring a lifetime of quiet, reliable performance.

Features:

- Two channels of dynamics processing
- Selectable stereo linking of channels
- XLR balanced inputs and outputs
- 1/4" TRS active balanced inputs and outputs
- Variable Attack and Release controls
- Selectable Slope
- Hardwire bypass
- 5-segment Gain Reduction LED array
- Internal power supply
- 3-year parts and labor warranty

The DUAL LIMITER may be used as either a compressor or a limiter with all of the following:

- Multitrack or analog recording device.
- In a mixer's channel insert points.
- Between a microphone preamp and signal processors.
- Between pre-amplified electronic musical instruments (synthesizers, guitars, bass, samplers, acoustic instruments with pickups) and other line-level equipment.

INSTALLATION

The ART DUAL LIMITER may be used in a wide variety of applications and environments. Housed in a rack-mountable, all-steel enclosure, the unit is designed for continuous professional use. Mounting location is not critical. However for greater performance and reliability, we recommend that users not place the unit on top of power amps, or other sources of heat and/or strong magnetic fields.

Unpacking

The DUAL LIMITER was packed with care at the factory. The shipping carton was designed to protect it during initial shipment. Please retain this carton for use in transporting DUAL LIMITER when it is not installed in a rack, or in the unlikely event that the DUAL LIMITER requires servicing. The shipping carton should contain:

- DUAL LIMITER
- The user's manual
- Power cord

AC Power Hookup

DUAL LIMITER has an internal power supply designed to operate at 105 to 125VAC, 50 to 60Hz. Units manufactured for use outside of the United States have been modified to comply with the required electrical specifications for the country of use. Under no circumstances should the power cable be altered. If the cable becomes cut or damaged, discontinue its use and have it replaced before operating DUAL LIMITER.

The power source must provide a good ground connection, and the ground pin on the mains plug should never be defeated.

Analog Audio Connections

Audio connections to and from DUAL LIMITER are:

- | | | |
|------------------|--------|---|
| Balanced input: | [XLR] | Pin 2 = Hot (+), Pin 3 = Cold (-), Pin 1 = Ground |
| | [1/4"] | Tip = Hot (+), Ring = Cold (-), Sleeve = Ground |
| Balanced output: | [XLR] | Pin 2 = Hot (+), Pin 3 = Cold (-), Pin 1 = Ground |
| | [1/4"] | Tip = Hot (+), Ring = Cold (-), Sleeve = Ground |
| Detector loop: | [1/4"] | Tip = Input, Ring = Output, Sleeve = Ground |

Unbalanced 1/4-inch cables may be used with no damage to DUAL LIMITER, however, we strongly recommend users use a balanced connection whenever possible to reduce noise. We recommend using only high-quality cables equipped with the appropriate connectors.

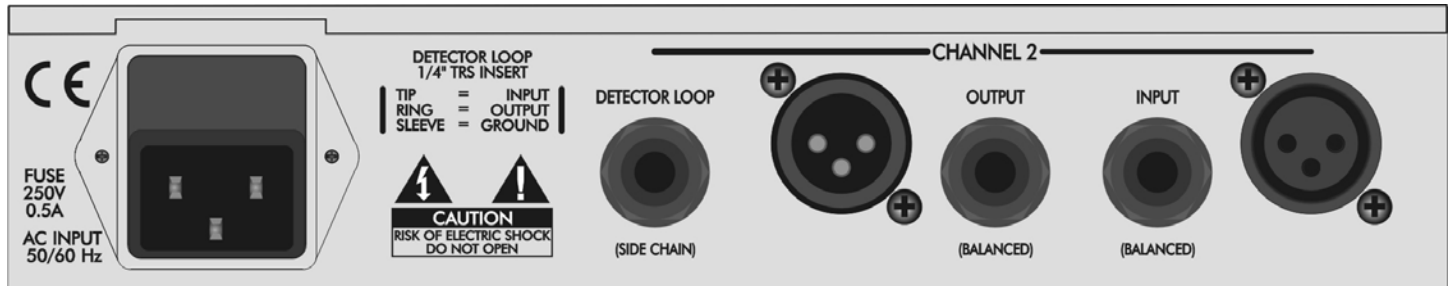


FIGURE 1 – Rear Panel

REAR PANEL I/O

Balanced Inputs

The DUAL LIMITER provides both an XLR and 1/4-inch input jack. These jacks are balanced, but the 1/4-inch jack can be used with unbalanced signals by simply plugging in an unbalanced cable.

The inputs are designed for use with line level signals ranging from -30dBm to $+20\text{dBm}$. While it is possible to plug an instrument directly into the DUAL LIMITER, it is desirable to run the instrument into a preamp ahead of the unit. This will provide a stronger signal and will keep noise to a minimum. Microphones must connect through a microphone preamplifier (like the ART Pro MPA II) before connecting into the DUAL LIMITER.

NOTE: The DUAL LIMITER has a passive (hardwire) bypass. This means that the bypass works even if the power is off.

Balanced Outputs

The analog output of the DUAL LIMITER is available on both a 1/4-inch TRS balanced jack and an XLR jack. The output has a 150-Ohm output impedance with power on/off muting.

Detector Loop

The Detector loop is an insert point between the buffered input signal and the Detector of the compressor.

Connecting an EQ to process this signal can contour the compressor's response to perform de-essing by boosting the frequency from 5kHz to 8kHz.

Connect an audio signal to the Detector Loop Input and have the DUAL LIMITER reduce gain when a signal is present to provide *Ducking* (see the APPLICATIONS section for more information).

NOTE: The Input control will NOT control the gain reduction of the Dual Limiter in this Ducking application.

FRONT PANEL CONTROLS and INDICATORS

Power

The POWER switch turns the power on and off to the unit. The DUAL LIMITER should be turned “ON” with all monitor levels turned down to protect against any thumping caused by power up. Likewise, the DUAL LIMITER should be turned off only after turning all monitor levels down. Power on the DUAL LIMITER before any monitoring outputs or power amps are turned on.

If the DUAL LIMITER fails to power up when the POWER switch is turned on, check to see that its power cord is plugged into an active outlet. If the unit still fails to operate properly, turn it off and unplug it. You can inspect the fuse as long as the unit's AC power cord is unplugged. Consult an ART dealer or the ART Customer Service Department if the fuse continues to blow.

Bypass Switch

The DUAL LIMITER BYPASS switch physically connects the input jack to the output jack on each respective channel (also known as a hardwire bypass). The analog signal still passes from input to output if the Bypass switch is depressed even when power is off.

Input Control

The Input control sets the input gain of the DUAL LIMITER. Turning this control clockwise lowers the threshold by adding more gain to the input signal. To increase the amount of compression (or sustain if processing an instrument), simply rotate the control clockwise. You can get up to 40dB of gain through the unit when both the Input and Output controls are adjusted fully clockwise.

Use the attenuation meter as a visual guide to the amount of compression/limiting applied. After this is set you can adjust the Output level control.

Output Control

The OUTPUT control adjusts the output level of the Dual Limiter after the gain reduction takes place. Use this control after the Input control is adjusted to set the required overall output level.

The markings on the output control indicate the output level (in dBm) when the slope is set to LIMIT with at least 3dB of gain reduction.

Ratio Switch

The RATIO Switch selects the “amount” of compression applied to the input signal once that signal reaches or exceeds the threshold. This compression amount is expressed as a ratio of input to output. For example if a 4:1 compression ratio is chosen, for every 4dB over the threshold the input signal rises, the output level only rises by 1dB. In this case if the input signal increased 12dB over the threshold, the output level would only rise by 3dB.

Setting the Ratio switch to LIMIT will hold the output level constant above the threshold. This setting is useful to prevent excessive peak levels or simply add sustain to an instrument.

If you require slopes less than 4:1, you can connect the output of the unit to the Detector Loop Input. This will produce a slope of 2:1 when the front switch is set to LIMIT and 1.15:1 when set to 4:1. Note: in this configuration, the output control will set the compression threshold.

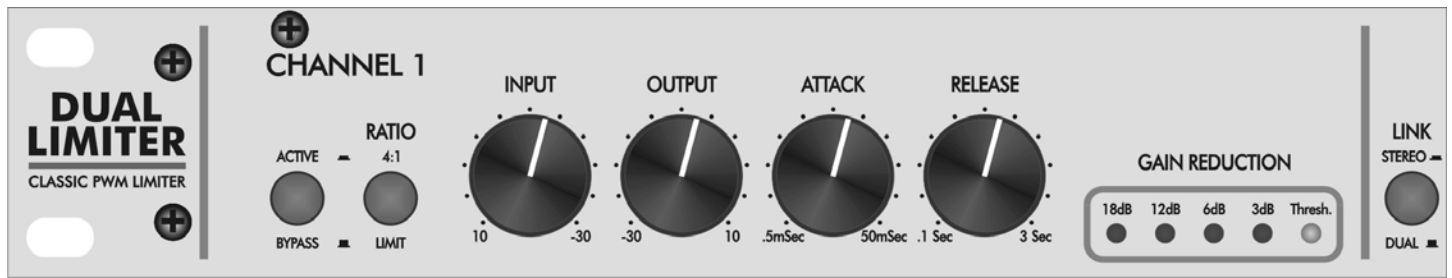


FIGURE 2 – Channel 1 Controls

Attack Control

The ATTACK control sets the time it takes the Compressor/Limiter to respond to increases in signal level (by reducing gain) and shape the *front end* of the dynamics envelope.

One example is to listen to a snare hit and adjust the ATTACK control. A short attack makes the snare sound “thin”. As the attack time goes longer (the knob is turned clockwise) more of the thump in the compressed snare can be heard. The downside is that this creates an overshoot, or “transient”, the length of which is the time set by the ATTACK control.

Overshoots less than 1 mSec. are very hard to hear even when they are clipped. If the ATTACK is set too fast, the gain may be reduced too much and thereby create a *pumping* sound¹.

Release Control

The RELEASE control sets the time the Compressor/Limiter takes to increase the gain after the input level drops.

Longer settings maintain the dynamics of the input signal, while shorter settings reduce the dynamics. Shorter settings will also increase the apparent reverberation, and at extreme gain reduction settings, lead to *breathing* artifacts².

Compressor Attenuation LED Meter

The attenuation meter displays the DUAL LIMITER compressor/limiter action. The meter covers a very large range. The Thresh. LED illuminates when the input signal reaches or exceeds the compressor detector threshold setting (Input control) and results in a reduction of 0.5dB or more.

Subtle compression settings should not require more than 6-12dB of gain reduction.

NOTE: if the display “dims”, that means that more than 25dB of gain reduction is taking place and the unit is close to clipping. Turn the Input control counter-clockwise to prevent this.

¹ “Pumping” in a Compressor/Limiter sounds like the signal is attenuated when it shouldn’t be.

² “Breathing” is the sound of the Compressor/Limiter turning up the gain so quickly breathing noises between words during vocal processing are heard.

The Link Switch

The two channels of the DUAL LIMITER can be configured for stereo operation by depressing the LINK switch. *Link Mode* connects the gain reduction of the two channels together for stereo operation. *Link Mode* ensures that each channel of the stereo input signal is processed identically to prevent any shifting or distortion of the stereo image.

The Detector signals of the two channels are summed so either channel's signal can trigger gain reduction.

Both channels' Input, Output, Attack and Release controls must be set identically to maintain stereo operation.

Bypass switches remain independent in *link* mode.

APPLICATIONS

Compressor/ Limiter

The main application of the DUAL LIMITER is to control the dynamic range of an audio signal. Plug a line level (post preamplifier or other gain stage) source into either input, and set the Input and output controls to provide the desired amount of compression to the input signal.

To keep the compression effects to a minimum, adjust the INPUT and RATIO controls such that the Compressor Attenuation meter reads 6dB or less.

Stereo Mix and Mastering

Because of its low noise and excellent tonal qualities, the DUAL LIMITER is ideal for processing mixes when recording to digital or analog recording devices. Used as a mastering device, the DUAL LIMITER is capable of adding volume and impact to the overall signal level while limiting peak levels. The DUAL LIMITER is ideal for live use as well.

Putting the unit into *link mode* maintains the stereo image of the source material during gain reduction. The knobs and switches on both channels should be set identically.

The DUAL LIMITER really does a good job of controlling the peak content when setting the attack and release short and the ratio to "Limit". Make sure not to set the Input control too high however. Only 6-9 dB indicated on The Compressor Attenuation meter is required to maximize the level for digital recordings.

Vocal and Instrument Leveling

The musical nature of the DUAL LIMITER makes it ideal for use on a wide range of instruments and vocals. Place the DUAL LIMITER into a channel insert, after a preamplifier, or in line with the direct output of a mixer channel. Adjust the controls of the DUAL LIMITER to achieve the desired amount of compression.

A good starting point for speech is a Ratio of 4:1 and gain reduction of 3-9dB.

Adding sustain to instruments requires more aggressive settings for ratio (set to LIMIT) and Input controls. Gain reduction in the 15dB range typical.

Vocal processing may require tailoring of the detector response to prevent excessive sibilance. Connect a graphic EQ to the detector loop and boost the 5-8 kHz bands 6dB or more to reduce vocal sibilance.

Ducking

One application of *ducking* is muting the background music whenever someone talks into a mic. Simply connect the background music to be *ducked* to the audio input of the DUAL LIMITER and connect the line level buffered mic signal to the Detector Loop jack. Set the RATIO control to "Limit". Set the ATTACK control to 1 to 2 mSec to guarantee the music fades off quickly. Adjust the RELEASE control to set the time it takes to fade the music back in after there is no mic signal.

For a stereo music source, depress the LINK switch and make sure that the Channel 2 Detector Loop jack has a shorting plug inserted or the same mic signal applied.

WARRANTY INFORMATION

Limited Warranty (USA only)

Applied Research and Technology will provide warranty and service for this unit in accordance with the following warrants:

Applied Research and Technology, (A R T) warrants to the original purchaser that this product and the components thereof will be free from defects in workmanship and materials for a period of **three** years from the date of purchase. Applied Research and Technology will, without charge, repair or replace, at its option, defective product or component parts upon prepaid delivery to the factory service department or authorized service center, accompanied by proof of purchase date in the form of a valid sales receipt.

Online Registration

We recommend that you register your product online to insure prompt warranty repair servicing on any repair issues. Please go to www.artproaudio.com. Select "*Support*", then "*Product Registration*" input your information here.

Exclusions

This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. This warranty is void if the serial number is altered, defaced, or removed.

A R T reserves the right to make changes in design or make additions to or improvements upon this product without any obligation to install the same on products previously manufactured.

A R T shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitations of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific rights and you may have other rights, which vary from state to state.

For units purchased outside the United States, an authorized distributor of Applied Research and Technology will provide service.

SERVICE

The following information is provided in the unlikely event that your unit requires service.

1. Be sure that the unit is the cause of the problem. Check to make sure the unit has power, all cables are connected correctly, and the cables themselves are in working condition. You may want to consult with your dealer for assistance in troubleshooting or testing your particular configuration.
2. If you believe that the ART unit is at fault, go to www.artproaudio.com.
3. Select “*Support*”, then “*Return Authorization Request*” to request a return authorization number.
4. If you are returning the unit for service, pack the unit in its original carton or a reasonable substitute. The original packaging may not be suitable as a shipping carton, so consider putting the packaged unit in another box for shipping. Print the RA number clearly on the outside of the shipping box. Print your return shipping address on the outside of the box.
5. Include, with your unit, a note with the RA number and your contact information, including a return shipping address (we cannot ship to a P.O. box) and a daytime phone number, and a description of the problem, preferably attached to the top of the unit. Also include a copy of your purchase receipt.

Please fill in the following information for your reference:

Date of purchase: _____

Purchased from: _____

Serial Number: _____

SPECIFICATIONS

Input Impedance	20k Ohms
Output Impedance Balanced/Unbalanced	150 Ohms
Maximum Levels	
Inputs	+20dBu
Output	+20dBu
Overall Gain	+40dB max
Frequency Response	10Hz to 30kHz (+/- 1dB)
Dynamic Range	>105dB (20-20kHz)
THD @ 0dBm Out	0.03% (typical)
Equivalent Input Noise (EIN)	-97dBu (20-20kHz)
Attack Time	0.5mSec. to 50mSec., variable
Release Time	100mSec. to 3 Sec., variable
Slope	4:1 or >20:1, switchable (OR 2:1 or 1.5:1 when patching output to det. loop input)
Dimensions (HWD)	1.75-inch x 19.0-inch x 5.9-inch 44.5 mm x 482.6 mm x 150mm
Weight	4.7 lbs. (2.1 kg.)
Power Requirements	USA – 105 to 125 VAC / 60 Hz, 1/2A fuse, <15W Export units configured for country of destination.

Note: 0 dBu = 0.775 V_{RMS}

ART maintains a policy of constant product improvement. ART reserves the right to make changes in design, or make additions to, or improvements upon, this product without any obligation to install same on products previously manufactured. Therefore, specifications are subject to change without notice.



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