

OWNER'S MANUAL

TCL-2 Twincom

Two Channel Opto Compressor/Limiter
with Twin Topology

Millennia Media and Music Systems

READ THIS FIRST!

Any changes or modifications not expressly approved by MILLENNIA MEDIA, INC. could void your authority to operate this equipment under the CE or FCC rules.

1. Copyright: You acknowledge that no title to the intellectual property in the TCL-2 is transferred to you.

2. Inspection: Inspect packing boxes, TCL-2, and cables for damage, unusual marks, or shortages. It is your responsibility to report damage, shortage, or mis-shipments in a timely manner. Millennia Media and/or its dealers will not be responsible for claims arising from damage in shipping, nor will claims for shortage or mis-shipments be honored, more than 10 days after ship date.

3. Read this manual carefully and completely before attempting to use the TCL-2. Improper operation could result in damage to product. It is the user's responsibility to understand the safe use and operation of this device.

4. The shipping box of the TCL-2 system will include (1) Owner's Manual, (2) TCL-2, (3) a UL approved power cord, (4) Owner's Registration Card. Fill out the Owner's Registration Card and return to Millennia Media at your earliest ability.

The material contained in this manual consists of information that is property of Millennia Media, Inc. and is intended solely for use by the purchasers of the equipment described in this manual. Millennia Media, Inc. expressly prohibits the duplication of any portion of this manual or the use thereof for any purpose other than the operation and/or maintenance of the equipment described in this manual without the express written permission of Millennia Media, Inc. Under copyright laws, this manual may not be duplicated in whole or in part without the written consent of Millennia Media, Inc.

TCL-2 and Twin Topology are trademarks of Millennia Media, Inc. All other trademarks are property of their respective holders. Serial numbers are located on the rear left side of each unit. We suggest that you record the serial numbers in the space provided below. Refer to it whenever you call an authorized Millennia Media repair facility or the manufacturer. Make sure that you return your completed warranty card immediately.

Serial Nos. _____

Purchase Date _____

Where Purchased _____

Features and specifications subject to change without notice.

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SAFETY PRECAUTIONS

For your safety and the safety of others, be sure to read and understand all safety and operational instructions before attempting to use the TCL-2. **WARNING: The TCL-2 internal circuitry carries lethal voltages.** Carefully observe all warnings, precautions, and instructions on the TCL-2 and as described in the instructions supplied with the unit.

1. WATER, MOISTURE, AND SPILLAGE

Do not attempt to use the TCL-2 in, near, or around water or in unusually moist environments, such as near a sink or swimming pool. Prevent liquids or any other materials or objects from spilling or falling into the TCL-2 unit.

2. HEAT AND VENTILATION

Be sure to allow adequate ventilation to TCL-2 and avoid using or installing unit in close proximity to heat sources, such as heaters, stoves, radiators, power amplifiers, spotlights, or other heat producing appliances or equipment.

3. POWER SOURCES AND POWER CORD PROTECTION

The TCL-2 Power Supply should be connected to a power source only of the type described in the operating instructions or as marked on the Power Supply. Route the power cord so that it is not likely to be walked on or pinched by having objects placed on it. Pay particular attention to plugs, receptacles, and the point where the AC power cord exits the TCL-2.

4. GROUNDING

For your safety, it is extremely important that the grounding pin of the 3-wire power cable (included with unit) be inserted into a grounding type 3-pin power outlet. If you are unable to insert the plug into an existing outlet, contact an electrician to install a properly grounded 3-pin power outlet.

5. DAMAGE REQUIRING SERVICE

This unit should be repaired or serviced by qualified personnel whenever:

- The AC power cord has been damaged, or
- Objects have fallen or liquid has spilled into any TCL-2 unit, or
- The unit does not function properly or exhibits a marked change in performance, or
- The unit has been abused, dropped, or damaged, or
- The unit has been exposed to rain or moisture

6. SERVICING

Lethal voltages are found inside the TCL-2 chassis. The user should not attempt to repair or service this unit. All servicing and/or repairs should be referred to Millennia Media.

If, after reading all instructions, precautions, and warnings, you have remaining questions, please contact Millennia Media directly before attempting to use your TCL-2. Retain this owner's manual as a record of your purchase to aid in positive identification in the event of loss.

QUICK START!

READ THIS!! The TCL-2 operates with lethal operating voltages — the voltage inside the TCL-2 can kill you. Never, under any circumstances, remove the top cover. Refer to a qualified electronics technician any and all servicing, tube replacement, and other operations which require the top cover to be removed.

Congratulations on your purchase of the Millennium Media TCL-2 with Twin Topology. The TCL-2 is the result of meticulous listening tests on numerous circuit, topology, and packaging designs. Your TCL-2 is a finely tuned instrument intended for critical professional applications — we feel it offers the world's most sonically pure analog dynamics. With the emergence of 24 + bit digital audio, recording engineers are faced with a new requirement for undistorted control of dynamic range. The TCL-2 meets this challenge exceptionally well.

Before connecting power to the TCL-2, assure that the rear panel voltage selection fuse block switch is set correctly. In the USA, the TCL-2 is shipped with the voltage selection block set to 100-120 VAC. At this voltage setting, pair of 1 amp 5 x 20 mm slow blow fuses have been factory installed. If you change the voltage selection block to 200-240 VAC usage, be sure to change both fuses to 500 milliamp (0.5 amp) slow blow types.

The TCL-2 enclosure measures 19" wide x 3.5" high x 12.5" deep and is designed for mounting into a standard 2U, 19" equipment rack. If the TCL-2 is mounted in a road case or other rack which is prone to strong vibration or shock, it is recommended that the rear of the TCL-2 be supported or otherwise reinforced to withstand such conditions. The TCL-2 requires adequate ventilation. To assure proper air circulation and operation, leave at least one rack screw space open above and below the TCL-2.

The TCL-2 is designed on a common ground topology. For high quality operation, and for your own safety and the safety of others, do not defeat the purpose of the earth grounding pin on the A/C power cord!

A front panel "recall template" is available for downloading (950 kb) from our web site in the Adobe PDF format: <http://www.mil-media.com/tcl2.html>

TCL-2 PHILOSOPHY & DESIGN

The TCL-2 *Twincom* is an entirely balanced topology from input to output, meaning that pin 2 and pin 3 have their own, discrete, mirror-matched amplifiers. Even when the TCL-2 is used with unbalanced signals, the internal circuitry remains balanced. These mirror-matched amplifiers are comprised of both vacuum tubes and discrete J-FETs, each topology selectable via a front panel *Twin Topology* switch.

Dynamics control is achieved via a passive precision-matched resistor network in which a matched LDR array (light dependent resistor) is used as a shunt element between the positive and negative legs of the network. Thus, the audio present at the output of the unit has not passed through an LDR or VCA. Avoiding LDRs and VCAs in the audio path results in improved (more accurate, minimally colored) sonic performance.

Because of TCL-2's unique design qualities, it is best suited for applications offering a balanced high-level (+4) source and a balanced bridging load (3,000 ohms, or greater). Operating the unit in a -10 dBu nominal environment may not provide adequate drive for optimal use. When wired to an unbalanced destination, the output XLR connector pin 3 should remain floating (unconnected). See the suggested unbalanced interface cable wiring configurations shown later in this manual.

All TCL-2 design decisions have been made towards the goal of absolute sonic neutrality and timbre purity:

- 1.) **No audio transformers.** The vast majority of professional vacuum tube audio equipment uses audio transformers. Yet, as someone once said, "there is no transformer that sounds like no transformer." For this reason, Millennia avoids audio path transformers and relies on other, "less colorful," coupling techniques.
- 2.) **Lower, tighter gain and threshold structure.** Because less inherent amplifier gain generally translates into heightened sonic reality, the TCL-2 is designed with a modest 20 dB of overall gain; IOdB available as make-up gain. The threshold range (-20 to +30 dB) is similarly structured for optimal sonic performance. Due to this optimized gain structure, compression or limiting of very-low-level signals (less than -20 dBu at the input) is not possible, whereas compression or limiting of very-high-level signals (+30 dBu at the input) is possible.
- 3.) **No bypass relays or audio path switching.** Input signals are always in-circuit, thus avoiding the need for switched / relay signal bypass (read: audio path switch points degrade over time). When the TCL-2 is "bypassed," only the actual dynamics side-chain control is removed from circuit. The audio signal remains in-circuit (via tube or solid state amplifier).
- 4.) **Single amplifier design.** In keeping with Millennia's minimalist philosophy, the TCL-2 is designed around a single audio path amplifier. This amplifier acts as input buffer, dynamics follower, and output driver. The amplifier is mirror imaged so that single but mirror-matched amplifiers follow both pin 2 and pin 3, respectively.

TCL-2 REAR PANEL

(1) INPUTS "In 1 (Left), In 2 (Right)"

Conventional 3-pin female XLR input jacks for all balanced or unbalanced line-level signals. Pin 1 is chassis ground, pin 2 is positive phase audio signal, pin 3 is negative phase audio signal. Input impedance is greater than 20k ohms.

(2) OUTPUTS "Out 1 (Left), Out 2 (Right)"

Conventional 3-pin balanced male XLR output jacks. Pin 1 is chassis ground, pin 2 is positive phase audio signal, and pin 3 is negative phase audio signal. J-FET topology output impedance is less than 5 ohms. Vacuum tube output impedance is less than 300 ohms.

(3) EARTH/AUDIO GROUND JUMPER

A barrier terminal which ties earth ground to audio ground. If ground "hum" loops are experienced when using the TCL-2, removing this jumper may help. Removing this jumper will not compromise chassis/earth ground integrity.

(4) AC VOLTAGE MAINS SELECTION "100-120" or "200-240"

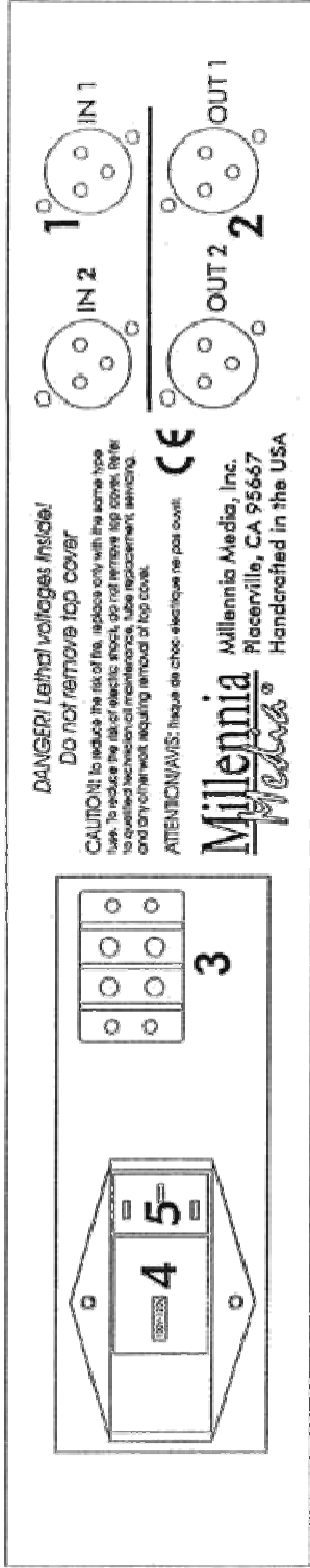
A power entry module with a removable fuse holder block. This fuse holder block is selectable for 100 to 120 Volt or 200 to 240 Volt worldwide mains powering. The fuse block contains two fuses — one fuse is in series with the hot power line while the other fuse is in series with the neutral power line. Both fuses *must* be installed. To change the mains voltage selection, remove IEC power connector and *assure that the TCL-2 is not connected to mains power*. With a non-conductive tool, gently pry the fuse block away from the power entry module. Remove the two fuses and replace both with type as shown below. Slide out the internal PCB, turn it over, and reinsert the PCB so that the desired AC mains voltage appears in the viewing window. Double-check that the fuses installed correspond to the AC mains voltage range which appears in the viewing window. Gently push the fuse block back until flush and snug.

FUSES:

For 100-120 VAC mains, use 5x20mm, 1A, slow blow, 250V Littlefuse 218 or equivalent. For 200-240 VAC mains, use 5x20mm, 500mA, slow blow, 250V, Littlefuse 218 or equivalent.

(5) POWER ENTRY "IEC Power Receptacle"

An IEC-type AC line-power receptacle for use with removable cords. Use only the power cord provided with the TCL-2 unit or equivalent U/L approved type SV SVT, SJ, or SJT AC power supply cord. *Do not defeat the third pin earth ground!* If ground lifting is desired, remove the Earth/Audio Ground Jumper strap (3).



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TCL-2 "Twincom" Rear Panel

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TCL-2 FRONT PANEL

(1) THRESHOLD CONTROL "THRESHOLD"

Conductive plastic rotary potentiometer offering variable compression threshold. When fully CCW, the compression threshold is least sensitive. Threshold range is approximately -20 dB to +20 dB. Threshold is most sensitive when control is turned fully CW.

(2) ATTACK CONTROL "ATTACK"

Conductive plastic rotary potentiometer offering variable attack timing. When fully CCW the fastest attack is achieved (2ms). When fully CW the slowest attack is achieved (100 ms).

(3) RELEASE CONTROL "RELEASE"

Conductive plastic rotary potentiometer offering variable compression release timing. When fully CCW the fastest release is achieved (100 ms). When fully CW the slowest release is achieved (3 seconds).

(4) RATIO CONTROL "RATIO"

Conductive plastic rotary potentiometer offering variable compression ratio. When fully CCW the lowest and most gentle ratio is achieved (1.4:1). When fully CW the highest and most pronounced ratio is achieved (30:1). A compression ratio of approximately 10:1 (or higher) is typically called "limiting." All TCL-2 controls are available optionally with "detented" action, offering loggable resetability for mastering recall. Contact the factory for details.

(5) CHANNEL IN SWITCH "CH IN"

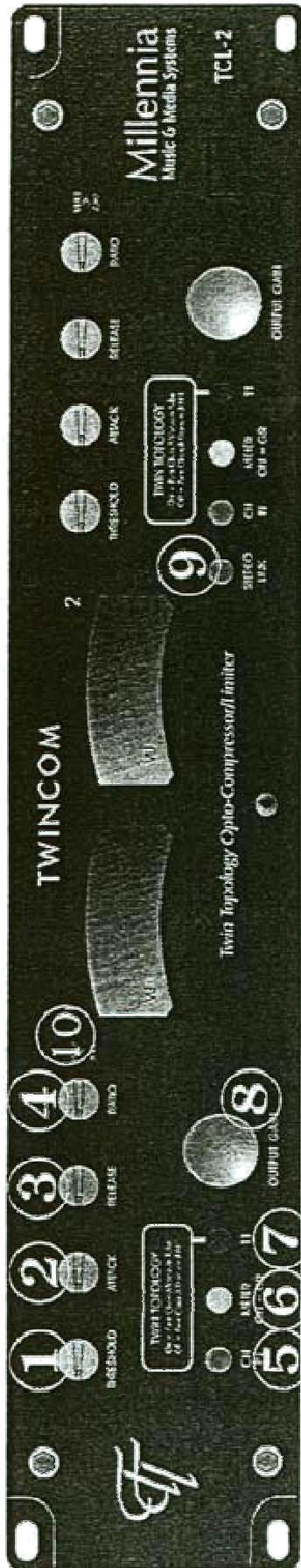
Pushbutton switch which selects channel status. When switch is depressed and corresponding LED is illuminated, audio signal will be processed by dynamics functions. When switch is not depressed and LED is not illuminated, audio signal is not processed by dynamics functions. This is not a "hard-wire" bypass. Audio signal is always in the active circuit path regardless of this switch's status.

(6) METER FUNCTION SELECT SWITCH "METER ON=GR"

Pushbutton switch which selects meter function. When switch is depressed and corresponding LED is illuminated, meter indicates the amount of gain reduction. When switch is not depressed and LED is not illuminated, meter indicates output level (0 VU = +4 dBu).

(7) TWIN TOPOLOGY SELECT SWITCH "TT"

Pushbutton switch which selects the corresponding channel as a complete vacuum tube compressor or a complete solid state compressor. Not a gimmick. Twin Topology is designed around two world-class, musically optimized Class-A amplifiers — one amplifier is based on twin triode vacuum tubes, while the other is based upon all discrete J-FET servo amplifiers. Like having two distinctly different compressors in one chassis. When switch is depressed and LED is illuminated, the channel is operating as a solid state compressor. When the switch is not depressed, the channel is operating as a vacuum tube compressor. Because of the TCL-2's unique shunt design, the dynamic processing chain leaves little or no detectable signal path artifact when in-circuit.



TCL-2 "Twincom" Front Panel

(8) OUTPUT GAIN CONTROL "OUTPUT GAIN"

Conductive plastic rotary potentiometer offering variable output gain level. When fully CCW the output gain is fully attenuated (off). When fully CW, the output gain is at maximum. Up to 10 dB of make-up gain is available when fully CW

(9) STEREO LINK SWITCH "STEREO LINK"

Pushbutton switch which selects the stereo link function. When switch is depressed and LED is illuminated, both channels will respond to the channel with the highest compression activity. When the switch is not depressed, each channel's dynamics operates independently. The side-chain controls (threshold, attack, release, and ratio) remain individually adjustable and are not stereo linked. Stereo tracking can be tightened by reducing the ratio setting of the channel driving hardest. The following set-up procedure will help balance a linked stereo image.

(9A) STEREO LINK BALANCING

- A) Apply a steady 1 KHz tone to channel one of the TCL. (0 VU = +4 dBU is a good level)
- B) Set the attack, release, and ratio controls for identical settings on both channels.
- C) Make sure the stereo link switch is in the "Out/Off" position.
- D) With the meter in GR mode, increase the Threshold control until you reach the desired amount of GR as shown on the meter.
- E) Depress the Stereo Link switch. Note... the amount of GR shown on the meter will probably decrease. Simply increase the threshold until you again achieve the desired amount of GR as shown on the meter.
- F) You should now see the same amount of GR on BOTH meters. If you don't, adjust the ratio control(s) first on channel two or both channels if necessary, until you do.

(10) METER ZERO ADJUST "METER ZERO"

Trimmer potentiometer behind front panel hole which adjusts meter zero set-point. Adjust this trimmer only after TCL-2 has reached a stable, warmed-up condition.

(11) METERS

Large (and very expensive!) Sifam true audio level meters offering superb ballistics and accuracy. A custom back-lit dial face provides oversized numerals for clear readability. Backlighting also provides a pilot light function.

(12) POWER SWITCH "POWER"

Rocker switch for switching AC line power on and off.

NOTE:

The TCL-2 *Twincom* is based on pure Class-A all vacuum tube and pure Class-A discrete all transistor amplifier designs. Both topologies perform best after reaching a stable, warmed-up condition. All TCL-2 factory adjustments have been performed when unit is fully warmed-up; at least one-half hour after turning unit on. During TCL-2 warm-up period, user may find that certain adjustments may drift slightly, including the 0 dB meter reading when in "GR" (Gain Reduction) mode.

TCL-2 GENERAL SPECIFICATIONS

THD + Noise, 20 Hz - 30 kHz	< .01%, typical .002 %
Frequency Response -3 dB (SS)	Sub 2 Hz to beyond 100 kHz
Frequency Response -3 dB (VT)	Sub 2 Hz to beyond 100 kHz
Maximum Input Level	+30 dBu (VT or SS)
Maximum Output Level	> +32 dBu (VT or SS)
Input Impedance	25,000 ohms (VT or SS)
Output Impedance (SS)	< 5 ohms
Output Impedance (VT)	< 300 ohms
Recommended Load (<i>important</i>)	> 300 ohms (SS), > 3,000 ohms (VT)
Noise (20 Hz - 22 kHz)	-87 dBu (SS), -82 dBu (VT)
Common Mode Rejection Ratio	> 50 dB, > 75 dB typical, 100 mV to 20 kHz
XLR Polarity	Pin 2 positive polarity, Pin 1 = ground

DYNAMICS PARAMETERS

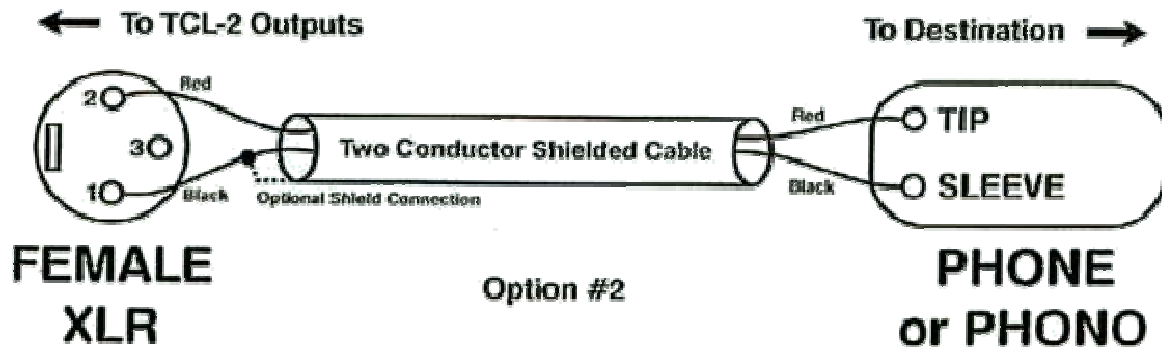
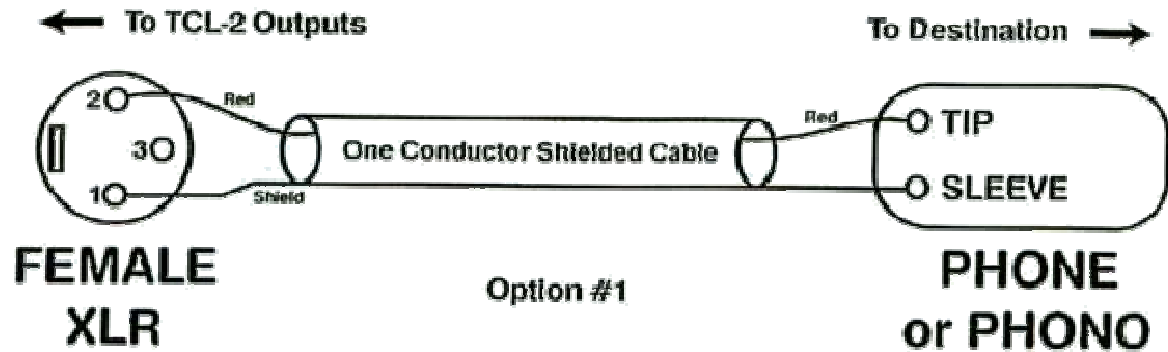
Threshold Range	-20 dBu to +20 dBu, continuously adjustable
Attack Range	2 ms to 100 ms, continuously adjustable
Release Range	100 ms to 3.0 sec, continuously adjustable
Compression Ratio Range	Min: 1.4 to 1, Max: 30 to 1, continuous
Dynamics Bypass on Each Channel?	Yes
Meter Gain Reduction -or- VU Switch?	Yes
Stereo Link Switch?	Yes
Twin Topology Selection Switch	Switch In = FET Amplifiers Switch Out = Vacuum Tube Amplifiers

ELECTRO-MECHANICAL SPECIFICATIONS

Power Consumption	55 Watts, nominal
Power Requirements	100VAC to 240VAC, 50/60Hz, selectable
Fuses (2 required)	2 ea 1A with 100-120VAC mains (5x20mm, slow-blow, 250V) 2 ea 500mA with 200-240V mains (5x20mm, slow-blow, 250V)
Internal DC Power	+350V+28V -28V +12V
Dimensions	19"Wx12.5"Dx3.5"H
Net Weight	25 pounds

Millennia Media reserves the right to change specifications, delivery, and pricing without notice

TCL-2 Unbalanced Interface Cables



Optional cable orientations shown. Build per your specific studio wiring conventions.

TCL-2

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WARRANTY

Millennia Media will repair this product, free of charge, in the USA, in the event of defect of materials or workmanship for one (1) year following date of purchase. This warranty is extended only to the original purchaser. This limited warranty covers failures due only to defects in materials and workmanship which occur during normal, intended use and does not cover damage which occurs in shipment or failures which are caused by products not supplied by Millennia Media. This limited warranty does not cover failures which arise from accident, misuse, abuse, neglect, mishandling, misapplication, faulty installation, improper adjustment, alteration or modification of product, incompatibilities, line-power surges, acts of God, or service performed by anyone other than Millennia Media or its authorized agent. Vacuum tube failures are not covered under warranty.

LIMITS AND EXCLUSIONS

There are no express warranties except as listed above. Millennia Media shall not be liable for special, subsequent, incidental, consequential, or punitive damages, including, but not limited to: damage to recordings, microphones, mixing consoles, or any associated equipment, downtime costs, loss of goodwill, or claims of any party dealing with purchaser for such damages resulting from the use of this product. All warranties, express and implied, including the warranties of merchantability and fitness for a particular purpose are limited to the applicable warranty period set forth above.

Some states do not allow the exclusion or limitation of incidental or consequential damages, or length of time an implied warranty remains in effect. As such, the above exclusions may not apply. This warranty gives you specific legal rights and you may also have other rights which can vary from state to state.

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