OPTICOM XLA-3

Owners Manual

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I. OVERVIEW

OPTICOM XLA-3 from Acme Audio Manufacturing Co. is an optical audio limiter built to exacting military-style specifications, designed to produce a full range of non-linear, dynamic audio effects. The heart of the XLA-3 is a unique triple optoelectronic circuit that combines the best characteristics of 3 separate compression curves into a single unit. The result: a high-speed optical limiter with tones that range from ‘clean’ to ‘harmonically rich’ to ‘dirty’.

The Opticom uses high-speed cadmium-selenide (CdSe) photocells, all-tube circuitry, and military style point-to-point wiring. From the 16 gauge, cold-rolled steel chassis to the high quality components, the XLA-3 is built to provide years of reliable, solid performance that will meet, if not exceed, the exacting demands of the audio professional. Just a few of the standard features: custom-ordered Bakelite analog control knobs, full-sized backlit panel meters, Neutrik/Cliff connectors, heat resistant Micalex tube sockets.

Features:

1. Made in the US
2. Authentic, military style point-to-point circuitry
3. Unique Sonic Character
4. Versatility
5. Serviceability
6. Ease of Use
7. Competitive Pricing

Web Site: www.acmeaudiogear.com

Contact: info@acmeaudiogear.com

Technical Support: support@acmeaudiogear.com

II. LAYOUT

A. Front panel:

1. Controls:
   Controls on the front panel of the XLA-3 are simple and straightforward. They are:
   a. "Range" selector switch.
   b. "Input Gain" control.
   c. "Response" selector switch.
   d. "Output Gain" control.
   e. "Power" switch / Indicator lamp.

   a. "Range" selector switch:
   The "Range" selector switch allows the "Threshold Drive" meter to be scaled according to the amount of limiting used. The "x1" position is suitable for moderate amounts of limiting, whereas the "x2" position is preferred when greater than average (>12dB) amounts of limiting are used.

   b. "Input Gain" control:
   The "Input Gain" control allows for adjustment of the input signal strength applied across the fixed limiter threshold of the XLA-3. Higher settings of this control will allow the input signal to drive the limiter harder, yielding a stronger compression effect (indicated by the "Threshold Drive" meter).

   Owing to the functional block-placement of this control at the head of the circuit and before any amplifier stages, it functions effectively as an input pad allowing the user to compensate for possibly excessively high (+20 dBm) signal levels fed to the XLA-3.

   c. "Response" selector switch:
   The "Response" selector switch has three positions: "Slow", "Normal", and "Fast". This allows the user to engage the specific set of opto devices having the appropriate response time for the task at hand. This provides a means of altering the limiting characteristics of the XLA-3 in a way that enhances its versatility and flexibility.

   Appropriate opto selection is primarily dependent upon the frequency of the signal (or blend of frequencies) to be limited, the total amount of limiting to be employed, and the final sound texture desired. Selection of the appropriate opto devices is a judgment and ultimately determined by the user through use and listening.

   d. "Output Gain" Control:
   The "Output Gain" control allows for adjustment of the final signal level (makeup gain) after limiting. Higher settings on this control will provide a stronger signal (+10 dBm maximum) at the XLA-3's output jacks (indicated by the "Output Level" meter).

   e. Power Switch / Indicator Lamp:
   The power switch controls the main power to the XLA-3 and must be in the "On" position during use. It is best to return the power switch to the "Off" position when the unit will not be in use for more than several hours, as leaving the unit on for inordinate amounts of idle time will hasten tube wear. When lit, the indicator lamp indicates that the power switch is on and that the unit is receiving power.

2. Meters:
   a. "Threshold Drive" meter:
   The "Threshold Drive" meter indicates the relative amount of instantaneous signal being applied to the XLA-3 which is in excess of the fixed limiting threshold. The meter begins to move at the point which limiting begins to occur, and is provided as a general visual guide with regard to the overall amount of "effect" being imposed on

the signal. While this novel arrangement does not indicate the actual or current state of reduction in dB, it does allow the user to take advantage of meter ballistics to gain a "visual feel" for pre and post dynamic conditions. This allows for better monitoring of audio events whether they occur just at the beginning edge of limiting or well in excess of the threshold.

With the "Range" selector switch in the "x1" position, the meter will indicate 100% when the XLA-3 is providing 9dB of limiting. This setting will allow the meter to register in its mid-swing region when moderate amounts of limiting are used. In the "x2" position, the meter will indicate 100% when the XLA-3 is providing 18dB of limiting. This setting will allow the meter to register in its mid-swing region when greater than average amounts of limiting are used.

b. "Output Level" meter:
The "Output Level" meter indicates the strength of output signal present at the XLA-3's output jacks (as adjusted by the "Output Gain" control). This meter is calibrated to a standard +4 dBm.

B. Rear panel:

1. Inputs:
Balanced XLR and balanced 1/4 inch.

2. Outputs:
Balanced XLR and balanced 1/4 inch

3. Tubes / sockets / shields:
V1 = 12AX7 w/shield
V2 = 12AT7 w/shield
V3 = 12AT7 w/shield
V4 = 12AX7 w/shield
V5 = 12BH7 (no shield)

4. "Ground lift" switch:
The "Ground lift" switch is provided as a means of eliminating ground-loop based hum by allowing the internal signal ground of the XLA-3 to be isolated (lifted) from its chassis/AC-line earthing. The proper setting for the "Ground lift" switch can be determined by listening to which one of the two settings yields the lowest audible hum level. In certain instances, such as when grounds are clean and uniform throughout the audio chain, no audible difference will be heard between the two settings.

5. Power cable.
18/3, type SVT

6. Fuseholder:
Use only 1A, Slo-Blo / 3AG

III. INTERFACE

A. Balanced input:

1. Connector type:
   Balanced XLR and balanced 1/4 inch.

2. Impedance:
   8k ohms.

3. Level:
   Nominal: +4 dBm.
   Maximum: +20 dBm.

B. Balanced output:

1. Connector type:
   Balanced XLR and balanced 1/4 inch.

2. Impedance:
   600 ohms minimum.

3. Level:
   Nominal: +4 dBm.

   Maximum: +10 dBm into 600 ohms.
   +14 dBm into 10k ohms

IV. SOUND

A. Opto cells:
   Speed of response:
   1. Material type:
      The specific type of material employed in a photocell's construction has a profound impact on the cell's response time, and therefore its audio characteristics. The XLA-3 uses cadmium-selenide (CdSe) photocells because of faster response times than cadmium-sulfide (CdS) photocells which are more commonly used in opto limiters. It is this faster response time (the decay time in particular) which contributes to the XLA-3's unique sound.

   2. Attack:
      A general characteristic of photocells is that they exhibit extremely fast "on" (attack) times relative to their respective "off" (decay) times. Despite this rapid turn-on characteristic, they simultaneously offer a secondary audible trademark by delivering a smooth, yet clearly pronounced, attack at the beginning of sharp transient signals. While the overshoot of the CdSe type cell is relatively slight, and will not cause any signal overload down the line, it does impart a realism and openness to the final sound regardless of the total amount of limiting employed.

   3. Decay:
      The release characteristic of an audio limiter that employs a photocell as its primary dynamic element is unique in its complexity because the actual speed of release is not

constant, nor is it linear. The speed of release is fastest at the initial point of the signal being removed, then gradually slows as the photocell element approaches full recovery. Also the speed of initial release becomes faster with increasing amounts of prior limiting, yet the total time to full recovery becomes greater because of the larger swing from which it recovers from. It is this initial fast speed of recovery coming off the backside of large transients that accounts for the aggressive sonic character that accompanies increasing amounts of limiting.

4. Ambient temperature:
   The response time of photocells increases at reduced temperatures. From a practical standpoint this is of no concern, as the temperature which the effect will become noticeable in the XLA-3 is -13 F (-25 C). This slowing of response at low temperatures is only temporary and the response time will recover alongside a return to normal ambient temperature.

5. "Light history" effect:
   A final interesting anomaly regarding photocells is light history, or light memory. As it applies to the sonic characteristics of CdSe type, the effect is such that after a period of non-limiting (several seconds) which is followed by a sharp transient, the cell will be lazy in "waking-up". Not unlike a stage-par in the absence of pre-heat. This applies primarily to the attack time, and in the context of a musical phrase will result in the first percussive transient residing at the head of a subsequent group of transients exhibiting a greater audible attack than those that follow.

   An idling ("cold") optocell that is struck hard with a surprise transient, will always have a slower initial response than a cell that is held active ("warm"). Additionally, a slight secondary lengthening of the "average program level" release time will result during periods of sustained limiting at a given average level without affecting the release time of any simultaneous program transients. Thus, opto-cells offer a natural compound-release characteristic.

B. Tubes:
   The primary benefit of using tubes as pre-amplifier devices is because of the high headroom that they afford to any musical passage that may contain unpredictable signal levels and/or unexpected transients. This high headroom is a function of the correspondingly high supply voltage that the tubes operate from.

   The second benefit of using tubes in any preamp chain is for the sonic elasticity they lend to any signal(s) which may exceed the linear range of the tubes' operation. This is because tubes have a gradual, progressive way of reaching their limit, and as a result are less unpleasing to the ear when lightly overloaded with signal than would be a corresponding silicon equivalent.

   Lastly, tubes do not suffer from a slew-rate limit that plagues op-amps by way of producing harsh-sounding high-frequency transients (cymbals). In the final analysis, tubes would be the preferred choice over op-amps or discreet transistors because of the sonic transparency they offer.

C. Power Supply:
   The heart of the XLA-3 is a 250 volt, highly filtered, low impedance, power supply which works hand-in-hand with the unique and cleverly-crafted circuitry to provide the fuel for optimal tube operating points. The basic requirement for any audio device which employs true active tube circuitry is a plentiful source of voltage and current from which the tubes can freely feed. And no expense was spared in this regard, resulting in the creation of sonic "weight", the type which only a properly designed tube-driven opto-limiter can deliver.

It is this feeling of "impact" and the essence of actual physical inertia which the XLA-3 is capable of imparting to dynamic audio passages that stands out as its most desirable characteristic.

D. Range of OPTICOM XLA-3 sonic effects:
   1. "Slow" setting:
      a. Moderate attack that becomes audibly stronger at increased reduction levels.
      b. Medium recovery speed.
      c. Smooth highs, fat mids, foggy lows.
      d. Clean at all reduction levels.

   2. "Normal" setting:
      a. Flat attack at all reduction levels.
      b. Fast recovery speed.
      c. Leveled highs, pumped mids, blurry lows.
      d. Frequencies below 300Hz become progressively distorted at increased reduction levels. Additional harmonic spectrum is a mix of even and odd-ordered overtones.

   3. "Fast" setting:
      a. Slight attack that becomes audibly stronger at increased reduction levels.
      b. Instantaneous recovery speed.
      c. Hammered highs, leathery mids, distorted lows.
      d. Frequencies below 3kHz are distorted at all reduction levels. Overall sound quality becomes progressively "clobbered" at increased reduction levels. Additional harmonic spectrum consists primarily of even-ordered overtones.

V. CONSTRUCTION

A. External / Mechanical:
   1. Chassis:
      ✓ 16 gauge, cold-rolled steel.
   2. Finish:
      ✓ Durable, attractive, epoxy-powder coat.
   3. Hardware:
      ✓ Large, bakelite pointer-style knobs.
      ✓ Power switch has short, break-resistant, metal ball-end toggle.
      ✓ Response selector switch is military type with short, bend-resistant steel blade-shaft.
      ✓ Full-sized, backlit panel meters, with scratch-resistant glass.
      ✓ Neutrik, balanced XLR and Cliff, balanced 1/4" jacks for input and output.
      ✓ Classic .25" x 1.25" (3AG) fuseholder requires no tools for fuse replacement.

B. Internal / Wiring:
      ✓ Milspec potentiometers rated at 25,000 rotations.
      ✓ Heat resistant Micalex tube sockets provide a solid connection to the tube pins, and resist long-term deterioration from heat and chemical contamination.
      ✓ True point-to-point military style wiring.

VI. SERVICING

A. Tubes:
   1. Lifespan:
      Accurate prediction of tube lifespan is highly dependent on many variables and is, therefore, problematic, at best. However, as with any other piece of tube gear, lifespan is related to cumulative hours of operation, general conditions of operation (mobile or installation), and tube quality.

   2. Diagnosis:
      The primary concern of tube suitability is noise generation. Any tube installed in the XLA-3 which generates background noise greater than what would generally be considered acceptable for the intended use of the XLA-3, should be deemed unsuitable for use in the unit. In this case, noise would be defined as: hum, hiss, growling, crackling, popping, or microphonics.

      Other concerns regarding tube suitability are: weakened amplification (gain), or distorted sound.

      If replacing the suspect tube with a known good tube yields no change in symptoms, the problem probably is not with the tubes and lies elsewhere. At this point, a qualified service person should be consulted.

   3. Replacement:
      Tube replacement is done at the rear of the XLA-3 and does not require opening the chassis.

NOTE: The XLA-3 must be switched OFF when replacing Any Tube.

Attempting to remove or install a tube with the unit turned on, could cause damage to the XLA-3 and /or the tube being replaced.

B. Opto cells:
   The LED activated photocells used in the XLA-3 have an unlimited lifespan, and barring defect, will not require service. The user should not attempt to remove or replace the optos already installed in the unit.

C. Calibration ("Threshold Drive" meter):

NOTE: Calibration requires opening the chassis and because of the high voltage present inside there is a danger of severe electrical shock. Calibration should only be performed by a qualified service person.

Calibration procedure for the "Threshold Drive" meter is as follows:
1. Remove the XLA-3 chassis cover.
2. Turn the unit on and allow it to warm up for 5 minutes.
3. Move the "Ground lift" switch to the DOWN position.
4. Move the "Range" switch to the "x1" position.
5. Rotate the "Input Gain" control to VERTICAL (straight up).position
6. Rotate the "Output Gain" control to FULL OFF (counterclockwise) position.

7. Move the "Calibration" switch to the "ON" position.
8. Apply a 500mV, 1kHz signal to the XLA-3 input.
9. Rotate the “Calibration Trim Pot” until minimum reading is achieved on the "Threshold Drive" meter.
10. Return the Calibration switch to "OFF" position.
11. Calibration is complete.

VII.SPECIFICATIONS

A. DIMENSIONS:
- Width: Standard 19" rack mount.
- Height: Standard 2U, 3.5" rack mount.
- Depth: 8.75" from front panel.

B. WEIGHT:
- 10.5 lbs.
- 4.8 kgs.

C. POWER REQUIREMENTS / CONSUMPTION:
- Voltage requirement: 115 Volts / 60 Hz.
- Current draw: 265 mA.
- Power consumption: 32 W.

D. FREQUENCY RESPONSE:
- 25Hz-17kHz @ -4dB

E. DISTORTION:
- Yes.

F. GAIN REDUCTION:
- 29 dB maximum with 1.228 Volts (+4 dBm) applied at input.
- 36 dB absolute maximum before breakaway.

G. MAKE-UP GAIN:
- 34 dB.

H. LEVELS:

	Nominal	Maximum
Input	+4 dBm	+20 dBm
Output	+4 dBm	+10 dBm into 600 ohms
		+14 dBm into 10k ohms