MASELEC MASTER SERIES

MLA-2 Precision 2-Channel Compressor

Operation Manual
Issue 1.1 January 14, 1998

CONTENTS

Manual Revision History

Issue 1.1 ; January 14, 1998
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Product Revision History

October 1997	This manual is for use with units having serial numbers beginning with ‘1' thus : MLA2-1-xx-xxxx

1. INTRODUCTION

The MLA-2 Precision 2-Channel Compressor is intended for professional audio use in recording, mixing and mastering applications where high performance is required.

The MLA-2 provides a unique set of tools, carefully crafted to provide a compressor whose sonic character was the most important design objective.

The unique character of the device is evident in the technical description of the behaviour of the device.

The MLA-2 employs state-of-the art analogue electronics and provides a perfect solution to analogue mastering needs, especially used in conjunction with Prism Sound A/D and D/A converters.

Also available in the MASELEC MASTER SERIES is the MEA-2 equalizer.

2. SUMMARY OF MLA-2 FEATURES

Operational:

- Easy to operate with input gain controlling compression depth (drive)
- Minimal gain adjustment needed when changing ratio
- Optical gain element for smoothness and freedom from noise
- Dynamically-controlled attack and release to minimize pumping
- Precision stepped controls
- “ImageLink” Intelligent dynamic stereo linking system
- Output gain make-up
- Switchable gain reduction or signal level (VU) metering

Technical:

- Low noise
- Extended headroom with maximum input amplitude of +28dBu
- Extended frequency response
- Low distortion
- Electronically balanced inputs and outputs

3. GETTING STARTED

It is not necessary to read all the manual before being able to use the MLA-2 Precision 2-Channel Compressor. This section contains all the information required for you to get going straight away.

3.1. Unpacking your MLA-2

Check that you have the following items and that they are undamaged:

- MLA-2 Precision 2-Channel Compressor unit
- MLA-2 Precision 2-Channel Compressor operation manual (this book)
- IEC320 type mains lead with appropriate plug for your supply

Check that the slide switch mounted on the rear panel is set to the correct mains voltage range (‘120' setting : 90V-130Vac 50-60Hz; ‘240' setting : 180-260Vac 50-60Hz) and that the plug fitted to the mains lead is of the correct type. If not, DO NOT CONNECT THE MAINS SUPPLY, but contact your distributor.

Please keep the packaging for re-use in the event that the unit should be shipped to another location or in the event that it should ever need to be returned to the manufacturer for repair or upgrade.

3.2. Using the MLA-2 for the first time

Refer to section 21 for wiring details of connecting leads. Connect a source of balanced audio to the input connectors on the MLA-2. Connect the output of the MLA-2 to a monitoring system or to a tape recorder input. Connect the mains supply to the MLA-2 unit. There is a main power switch on the rear of the unit and an auxiliary switch on the front which is more convenient to use if the equipment is rack mounted and the rear panel is inaccessible.

The indicator lamp integral in the rear-mounted mains switch should illuminate when switched on. If it fails to light the power may be absent or the unit may be faulty. Check the mains supply, and try again. If the problem is still evident contact your distributor.

Set the rear-panel Threshold switch to ‘Low’ for recording or ‘High’ for mastering or for working on a stereo mix. Pull the switch lever to overcome the safety lock.
Switch the secondary power switch on the front of the MEA-2 to 'ON'. Set the meter function switch to ‘G.R.’ (Gain Reduction). Set the Compressor In/Out switch to ‘In’. Either by momentarily muting or disconnecting the inputs, check that the meter indication is at or very near to 0dB.

(Note : When the unit is first switched on, this indication may be fractionally below the 0dB reading. This is normal. After a few minutes during which time the unit will stabilise at its normal operating temperature, this will settle at 0dB)

Re-connect or unmute the inputs. Switch the monitor selection to monitor the MLA-2 output. A suggested starting point for control settings is :

- Ratio : 2
- Attack : 0.100
- Release : 0.10
- Input Gain -10dB
- Output Gain +10dB

The unit is now ready to use.

3.3. MLA-2 product concept and capabilities

The MLA-2 Precision 2-Channel Compressor is designed to provide very high quality signal processing for the most demanding professional applications. It has been carefully developed in conjunction with balance engineers, producers and mastering engineers to be easy to use, to provide a natural and warm sound and to offer a greater degree of transparency in the presence of compression. The MLA-2 also offers precision controls which enable exact re-creation of previously-used configurations.

3.3.1. Driving the compressor

Early compressors or limiting amplifiers had few controls and were simple to operate. Many such devices are still popular today, despite (or perhaps even as a result of..) the limitations of their early technology.

Such devices often employed a ‘drive’ control which provided progressively more compression (depth) and input gain when rotated.

Some later devices split this function into two controls, which would have to be operated together to achieve the same progressive effect without marked shifts in signal amplitude.

The MLA-2 uses the ‘drive’ principle and the control is called ‘Input Gain’. The compression threshold is left unchanged while the input gain is adjusted to alter compression depth. This has the advantage that gain and compression depth are adjusted together and so peak level will only vary by a small amount, determined by the ‘ratio’ which sets the severity of compression.

Therefore to increase the depth of compression, or to bring the quieter parts of the mix or instrument dynamics forward, simply rotate the input gain control clockwise until the desired effect is obtained.

Another problem with less sophisticated designs is that as the ‘ratio’ is increased the output level drops dramatically.

The MLA-2 reduces this effect, particularly for moderate amounts of gain reduction, by making small adjustments to the threshold, depending on the ratio setting. This results in less variation on output level, for a given input range, as the ratio is varied.

For larger amounts of gain reduction (much more than about 4-6dB), as ‘ratio’ is increased, it will be necessary to compensate by increasing the ‘output gain’.

In general, for mastering applications use the 'High' threshold setting (switch on the rear of the MLA-2) and for recording applications (such as for an instrument, in an insert point) use the 'Low' threshold setting.

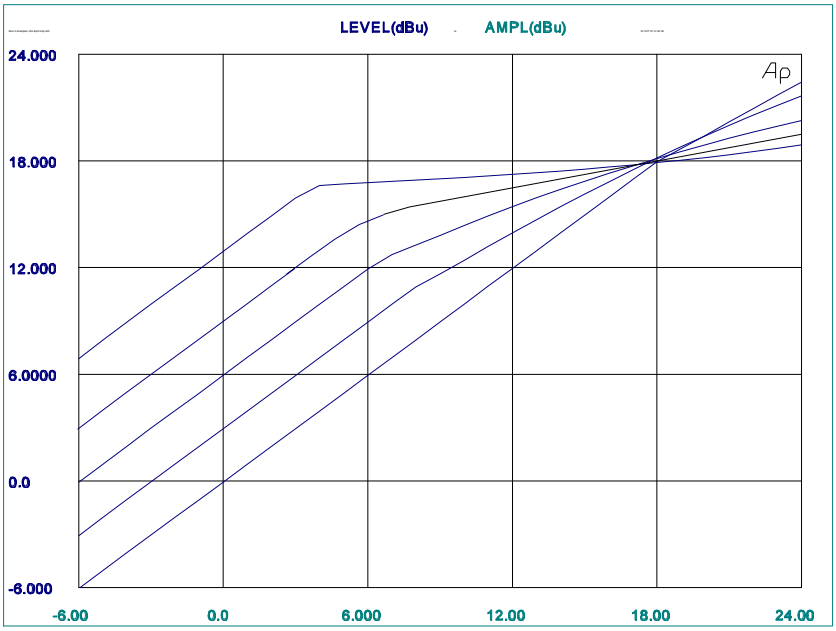
3.3.2. Dynamic behaviour

The gain element of the MLA-2 is an optical device and not the more conventional VCA. This provides a smooth transition between linear and compressed operation with a low level of noise.

One of the main problems for compressors is recovery after loud transients, often called ‘pumping’. To avoid this the attack and release times of the MLA-2 are dynamically controlled - i.e. program dependent. In short, the nominal attack and release times set by the controls are modified according to the program content. This is a key feature of the MLA-2 and one which enables the device to operate effectively and transparently on the most difficult signals without introducing the excessive distortion or pumping so noticeable in less sophisticated designs.

3.4. Example : MLA-2 in a mastering chain

The following are examples of MLA-2 settings for use in a typical mastering chain or in an insertion point in a mixing console. Best results will be obtained with a gain structure where 0VU corresponds to +4dBu and if the chain includes D/A and A/D converters, with 0dBFS (digital full scale) corresponding to +18dBu.



Curve	I/P Gain	O/P Gain	Ratio
Least compression	-20	+20	1.4
	-10	+13	1.4
to	-5	+11	2
	-2	+11	3
Greatest compression	0	+13	8

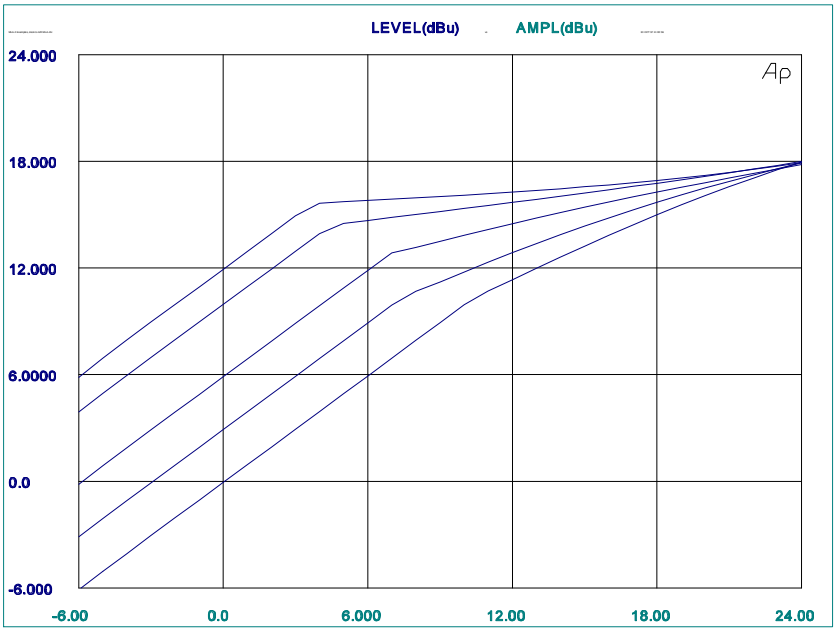
Note : Typ. attack time : 0.02 msec/dB; typ. release time : 0.2 sec/dB; Thres = High.

These transfer curves are shown for a range of settings from gentle to severe compression. Use these as a starting point, if you are unsure of suitable settings. With the suggested gain structure, the compressor will generally prevent clipping, subject to the

attack time setting. If clipping occurs and if it is objectionable or must be avoided for other reasons, try reducing the attack time. If this does not solve the problem, next try reducing the input gain. (This will result in the finest possible gain trim, as the output gain change that results is reduced subject to the ratio setting).

3.5. Example : MLA-2 on a mixer stereo output

This section provides some sample settings that might be selected when using the MLA-2 to control the output of a mixer when driving into a digital recorder or A/D converter. Best results will be obtained with a gain structure where 0VU corresponds to +4dBu and 0dBFS (digital full scale) on the A/D output corresponds to +18dBu.



Curve	I/P Gain	O/P Gain	Ratio
Least compression	-10	+10	1.7
	-6	+9	2
to	-4	+10	3
	-1	+11	5
Greatest Compression	0	+12	8

Note : Typ. attack time : 0.02 msec/dB; typ. release time : 0.2 sec/dB; Thres = High.

The transfer curves are shown for a range of settings from gentle to severe compression. Use these as a starting point, if you are unsure of suitable settings. With the suggested gain structure, the compressor will generally prevent clipping, subject to the attack time setting. If clipping occurs and if it is objectionable or must be avoided for other reasons, try reducing the attack time. If this does not solve the problem, next try reducing the input gain. (This will result in the finest possible gain trim, as the output gain change that results is reduced subject to the ratio setting).

Comparing these settings with those of section 9, it can be seen that in general more gain is used in the former case of the (digital) mastering chain. In the latter case, the MLA-2 input, driven by a console stereo output might reach +24dBu or more.

In each case, the MLA-2 input level is represented on the horizontal axis with the compressed MLA-2 output level on the vertical axis.

For exceptionally hot levels and when using A/D converters set with the gain structure recommended above (such as Prism Sound AD-124 or AD-2) use the Prism Sound 'Overkiller' passive soft clipper in series with the MLA-2 output.

4. OPERATION

The unit is designed for either stereo or 2-channel operation and each channel is controlled independently by an identical set of controls. A linking facility is provided that enables tracking of the two channels for stereo operation. When selected, stereo linking is intelligently controlled by the “ImageLink” system described below.

Each channel has controls for :

- Compressor in/out
- Input gain
- Output gain
- Ratio
- Attack
- Release

Some of these parameters are dynamically controlled. More detailed descriptions are provided below.

Metering is provided for each channel and meter function may be signal amplitude (VU dynamic characteristic) or gain reduction (GR) according to the ‘meter’ function switch. The meter scale is in dB units.

There is a global threshold selection, provided by a locking toggle switch on the rear of the unit. This is designed to be set at installation and should not require changing afterwards. See section 20 for details of the threshold range switch.

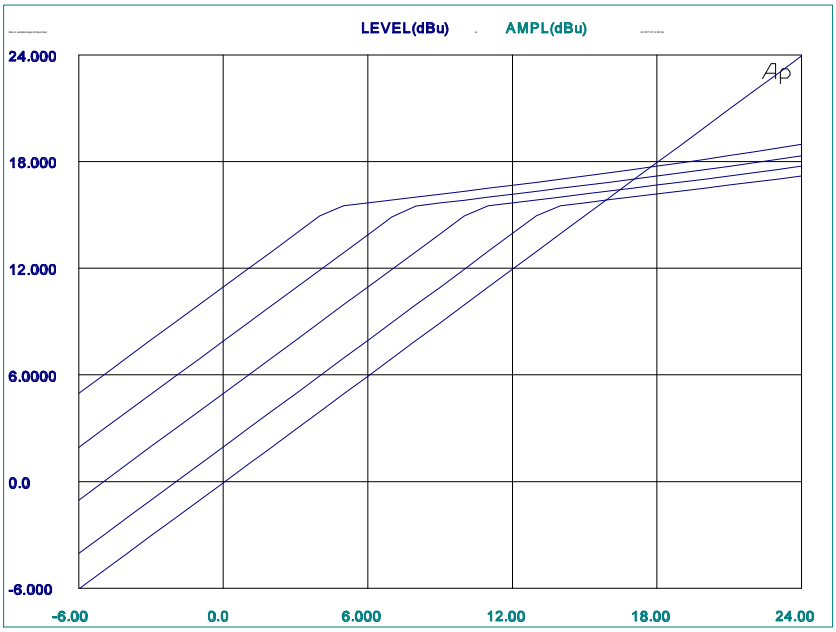
4.1. Input gain

This control attenuates the input audio signal *before* the gain-reduction (compressor) circuit, over the range 0dB to -20dB in 1dB steps.

Increasing the input gain (or reducing attenuation) will drive the compressor harder. The depth of compression will be increased. Output level will also increase, subject to other settings including the compression ratio and attack and release times and the audio signal amplitude and dynamics.

Increasing the input gain can not cause overload.

The following plot illustrates the operation of the input gain control. Threshold range is 'High' in this example :



[NOTE: Refer to section 3.3 for an overview of MLA-2 operation and see section 4.10 regarding threshold]

4.2. Output gain

This control increases the output audio amplitude *after* the gain-reduction circuit, over the range 0dB to +20dB in 1dB steps.

The Output gain control does not affect the amount of gain-reduction (compression).

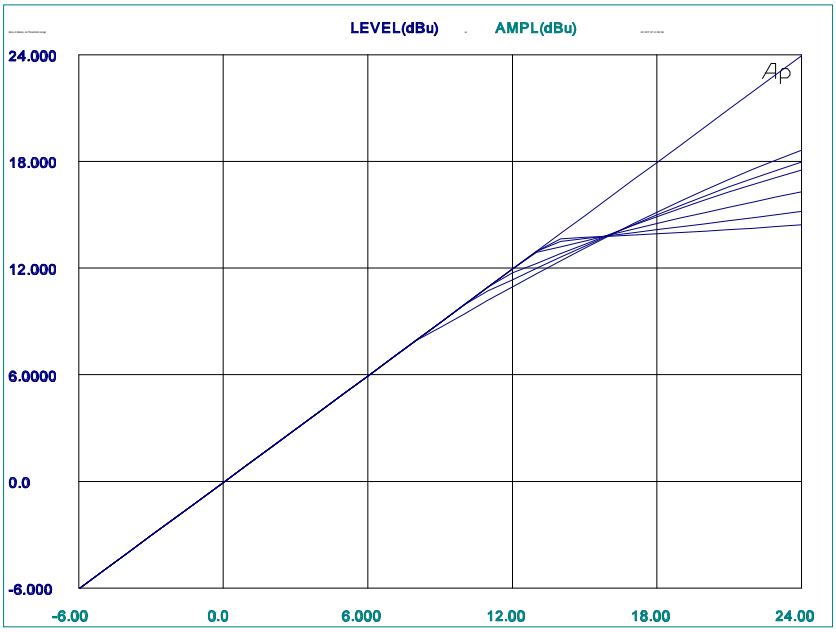
[NOTE : Refer to section 3.3 for a brief overview of MLA-2 operation]

4.3. Ratio

This control adjusts the severity of the compression applied to loud signals (i.e. those which exceed the compression threshold).

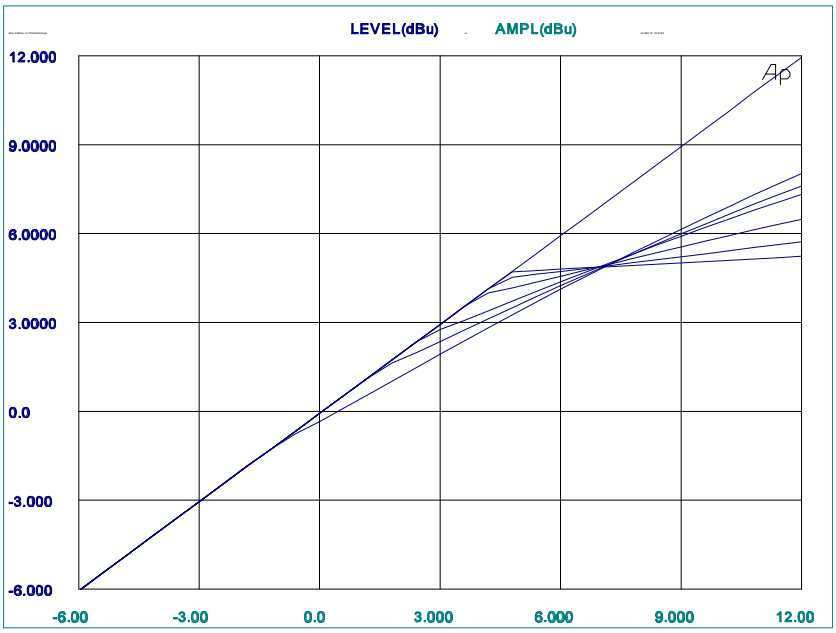
The MLA-2 automatically adjusts the threshold to maintain output level for small amounts of gain-reduction (< 6dB GR). This is best understood by looking at the transfer curves plotted for a range of ratio settings. For completeness, plots are provided for both 'High' and 'Low' threshold settings. [NOTE : Refer to section 3.3 for a brief overview of MLA-2 operation]

Ratios available : 1.4:1 , 1.7:1 , 2:1 , 3:1 , 5:1 , 8:1



Range of ratios at high threshold setting

The rotation point of the compressor characteristic curves at about +16dBu is the key to maintaining nearly constant output amplitude and the threshold variation is also clearly visible.



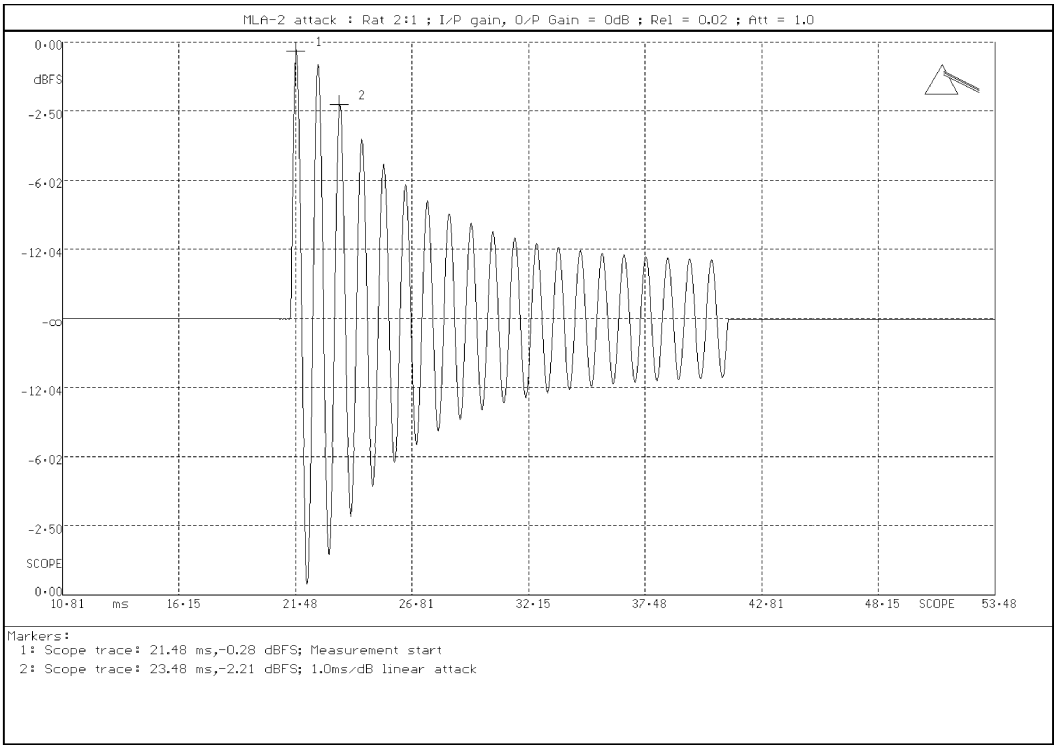
Range of ratios at low threshold setting

Note that the threshold range and the rotation point are now 9dB lower than in the high threshold case.

4.4. Attack time

Setting of this control will determine the attack-time. For real audio programme with complex waveforms the setting will indicate the *average* attack-time. [NOTE : Refer to section 3.3 for a brief overview of MLA-2 operation]

Nominal attack times (ms/dB) are: 0.005 , 0.020 , 0.100 , 0.500 , 1.0 , 1.5



This graph indicates the attack characteristic. MLA-2 settings were:

Input Gain : 0dB Output Gain : 0dB Threshold : Low
Ratio : 2:1 Attack time : 1.0msec/dB Release time : 0.02sec/dB

The attack time setting can be calculated from the plot by calculating the ratio of ms/dB of the time interval and gain change between markers 1 & 2 namely:

Attack time = 2ms/1.93dB = 1.04msec/dB (Setting was 1.0msec/dB.)

4.5. Release time

Setting of this control will determine the release-time. For real audio programme with complex waveforms the setting indicates the *maximum* release-time caused. Short duration peaks will not cause long release times.

[NOTE : Refer to section 3.3 for a brief overview of MLA-2 operation]

Nominal release rates (sec/dB) are: 0.02 , 0.05 , 0.10 , 0.20 , 0.40 , 1.0

The following illustrations were captured using a Prism Sound Dscope test system and AD-124 & DA-1 A/D and D/A converters. The test method was to select the ImageLink feature to link the gain reduction on both channels and to drive the measured channel with a low (below threshold) sinewave, while driving a higher level into the other (controlling) channel. The controlling channel input was muted and the Dscope set to trigger on an increase in level on the measured channel.

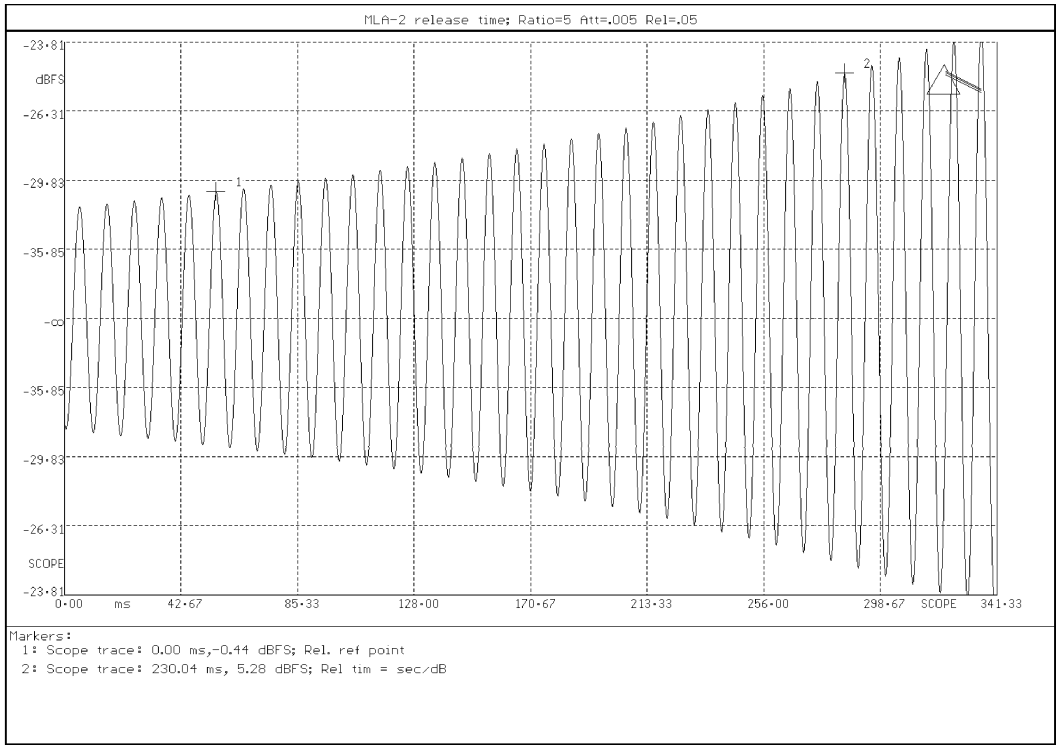
The release time measured is that set on the controlling channel. Settings for this test were as follows:

Threshold range : High

Controlling Channel:
Input Gain : 0dB , Output Gain : 0dB
Ratio : 5:1 Attack Time 0.005 ms/dB Release time : 0.05 sec/dB

Measured Channel:
Input Gain : -20dB (This forces level below threshold), Output Gain : 0dB
Ratio : 5:1 Attack Time .005 ms/dB Release time 0.05 sec/dB

The test signal was applied at +17dBu on both channels prior to trigger and then the controlling channel was muted.



The actual time can be measured from the plot by dividing the time interval measured between the markers in the plot above by the gain change between the markers. The calculated release time is 0.23s/4.84dB = 0.048sec/dB. (Setting was 0.05sec/dB.)

4.6. VU/GR

This control switches the meter reading between:

vu Meter displays the output level. 0VU = +4dBu.

g.r. Meter displays the average gain-reduction (dB).

4.7. Compressor in/out

This control switches the compressor, including input gain and output gain controls, in and out of circuit.

out Compressor by-passed. Meter displays input amplitude in VU mode. In G.R. mode the meter will stay at 0dB.

in Gain-reduction (compressor) circuit is active.

4.8. Compressor indicator lamp

This bi-colour indicator indicates if the compressor's gain reduction circuit is active.

Green Indicates that the compressor is in circuit (on).

Red The colour changes to red when the input signal causes gain reduction. This is particularly useful when the two channels are stereo linked, as the VU meters will not show which channel is causing the gain reduction. The light will also assist when the unit is located at a greater distance from the user.

4.9. Stereo linking

This switch enables the intelligent "Image-Link" system that matches the gain reduction applied to both channels. The linking is *programme dependant*. Momentary gain-reduction due to short duration peaks will not be linked.

This technique maintains the integrity of the stereo image, while avoiding obvious pumping effects resulting from momentary transients on one channel.

The ImageLink system is independent of all other controls. Different ratio, attack and release can be set to either channel.

4.10. Threshold range

This control is located on the rear panel and is designed to be pre-set at the time of installation. It selects between two ranges, 'Normal' for studio use and 'High' for Mastering use. In the 'High' setting, for a given audio programme the depth of compression will be less.

The compression threshold is modified dynamically within these ranges by the MLA-2 control circuitry, according to programme content.

Normal Threshold :	Threshold range -10.5 dBu to +14.5dBu
High Threshold :	Threshold range -1.5dBu to +23.5dBu

Application Note:
Adjustment of threshold might be desired in order to adjust compression depth. However, the MLA-2 provides a more convenient adjustment in the form of Input Gain which has the benefit of increasing compression depth with a clock-wise rotation. In addition, the audio level does not fall as depth is increased.

5. CONNECTORS

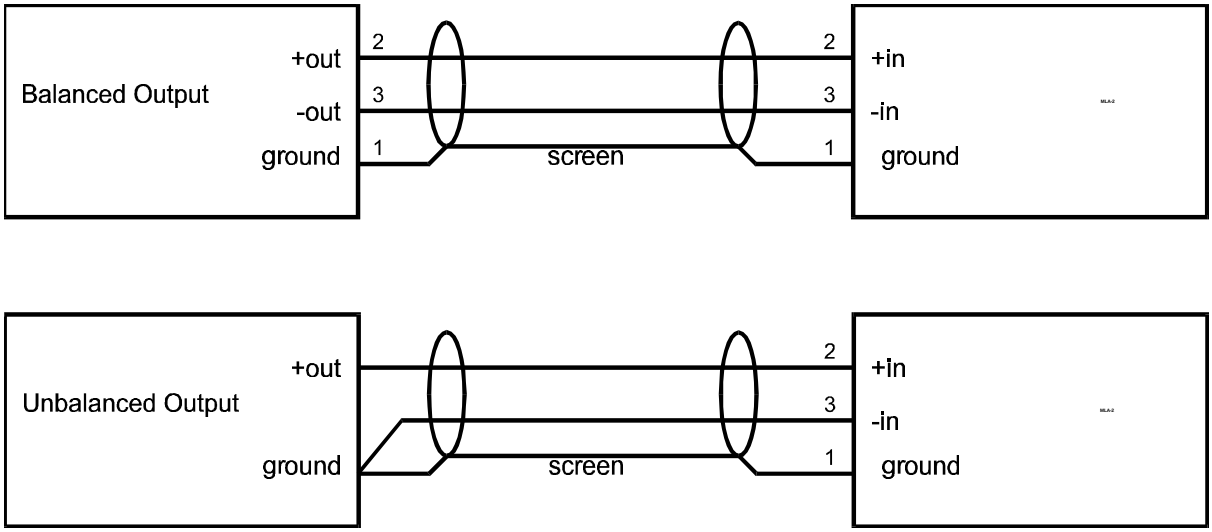
For this equipment, the convention for balanced XLR connections pin 2 is 'hot' or '+' and pin 3 'cold' or '-'. Some users and equipment implement the opposite. This should not be problematic providing a consistent implementation is used throughout.

Note: When interfacing to other devices such as A/D and D/A converters it may be necessary to check the manufacturers polarity convention if the correct absolute phase is to be maintained. However, this does not affect use of the MLA-2 with either polarity convention.

Balanced analogue audio connections should use a good-quality screened twisted-pair lead. Unbalanced connections must also be screened.

5.1. Input connections

This diagram illustrates correct connection for balanced and unbalanced sources:

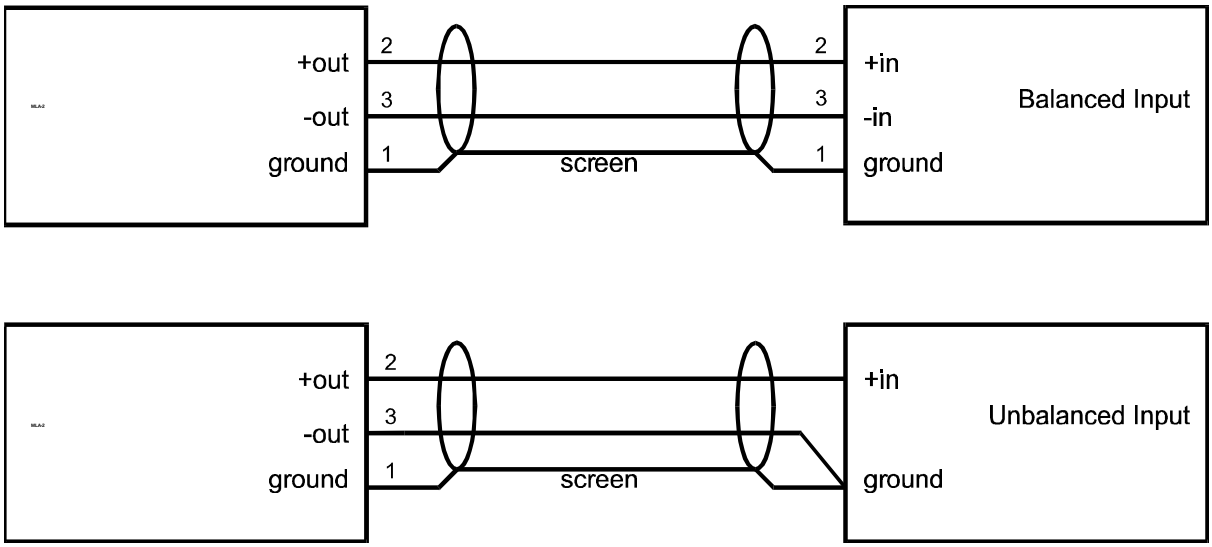


Using the above method when driving the MLA-2 with unbalanced sources should provide best results.

Note: The maximum input amplitude is reduced by approximately 6dB from the nominal +28dBu when driving the MLA-2 from an unbalanced source.

5.2. Output connections

This diagram illustrates correct connection for balanced and unbalanced loads:



Using the above method for driving unbalanced loads should provide best results. It employs 'Ground Loop Compensation' and the signal level remains unchanged compared to balanced operation.

Note: When driving unbalanced loads with the MLA-2 the maximum output level is reduced by approximately 6dB from the nominal +28dBu.

5.3. Rear panel connectors

A. Audio I/O
- Left Channel Input
- Left Channel Output
- Right Channel Input
- Right Channel Output

B. Earthing Stud - Link to a good-quality ground connection by the most direct route.

C. IEC Mains Inlet (Switched).

6. SPECIFICATION

6.1. Analogue inputs

The analogue inputs are on a three pin XLR connector with positive and negative signal polarities on pins 2 and 3 respectively, and screen on pin 1. Pins 2 & 3 have a high impedance path to the chassis earth.

Differential input impedance:	27 kS	(pin 2 to pin 3)
Single-ended input impedance:	27 kS	(pin 1 to 2 or 3)
Coupling impedance to chassis:	1.0 MS	(chassis/pin 1 to 2 or 3)
Common-mode range:	10 Vrms	(note: I/P is not floating)

* Note : Some earlier units are 38.4 kS or 28.2 kS

6.2. Analogue outputs

The analogue outputs are on a three pin XLR connector with positive and negative signal polarities on pins 2 and 3 respectively, and the mid-point on pin 1.

Differential output impedance:	62 S	(pin 2 to pin 3, balanced)
Single-ended output impedance:	31 S	(pin 1 to 2 or 3, unbalanced)

6.3. Performance specification

Specifications quoted in this section are to AES17-1991 (ANSI S4.51-1991) [Ref. 1], with input level set to +22dBu except where stated. For 'Compressor in' measurements, the in/out switches are illuminated and other settings are :

Input Gain : -10dB
Output Gain :+10dB
Threshold : High
Ratio : 2:1
Attack : 0.100ms/dB
Release : 0.10sec/dB

Maximum input amplitude :	+28dBu
Output noise :	Compressor out < -100dBu Compressor in < -90dBu
Frequency response :	+ 0.1, -0.4dB, <1Hz to > 50 kHz -3dB points: 0.03Hz to >350kHz
Crosstalk :	less than -100 dB, 20 Hz to 20 kHz Un-driven input terminated 150R
Dynamic range : (Measured at -32dBu)	Compressor out > 125dB Compressor in > 107dB

6.4. Servicing and repair

There are no user serviceable parts inside this unit. Repairs should only be undertaken by qualified electronics technicians or engineers.

6.5. Mains transformer voltage selection

The mains transformer has a tapped primary to allow operation at nominal voltages of 115V or 230V. A rear-panel slide switch selects the mains voltage range as 120V/240V. Ensure that the correct voltage range is selected before using the MLA-2.

6.5.1.	Mains voltage range :	90-130V (nominally 120V) or 180-260V (nominally 240V) operation. The selected supply voltage range is indicated on the rear panel slide switch.
6.5.2.	Power Consumption :	15W max.

6.6. Fuse

There is one mains fuse, accessible externally in the IEC320 mains inlet. If this fuse is blown it should be replaced by a similar value and type. (20x5mm 250V 315mAT (anti-surge, slow)).

6.7. Earthing

The unit has an internal link connecting the audio ground to the chassis. A chassis earth stud is provided on the rear of the unit.

6.8. Physical dimensions

Weight :	9 lb (4 Kg)
Width :	19 inch (483mm) (rack-mountable)
Height :	2U (90mm)
Depth :	10.25 inches (260mm) (add clearance for connectors)

7. ELECTROMAGNETIC COMPATIBILITY

This equipment is intended for use in an electromagnetically controlled environment. To maintain the performance specification it should not be subject to strong magnetic fields (such as in the immediate vicinity of a power amplifier or cathode ray tube) and all connections should be terminated as described below. This equipment does not include digital circuitry or generate high-frequencies that could be radiated or conducted from the unit.

All XLR connections should use a screened twisted pair cable with the screen connected to pin 1 of the XLR connector at both ends.

8. REFERENCES

[1] AES17-1991 - `AES Standard Method for Digital Audio Engineering - Measurement of Digital Audio Equipment' *J. Audio Eng. Soc.*, Vol. 39 No. 12, pp 961-975 (December 1991)

FURTHER INFORMATION

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