

ALM473

DUAL MONO \ STEREO AUDIO LEVEL MASTER



OPERATION MANUAL

IB6408-01

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1.0 GENERAL DESCRIPTION

The ALM473 Audio Level Master is a dual mono / stereo audio level controller designed to maintain consistent audio program output levels over a wide range of input levels. The unit is designed to be used at cable television head-ends, and FM or TV Broadcasting installations, connected between the audio output of a satellite receiver and insert switch and the inputs of TV and FM channel modulators. It can also be used in any application where there is a need for high quality automatic audio level control.

The ALM473 is two fully independent level controllers that can handle two different audio programs. If stereo operation is desired, programming jumpers on the PC Board lock the left and right channel voltage controlled amplifiers to a common control voltage to ensure accurate stereo image.

DB-linear control characteristics allow smooth gain control over a 30 dB range. Program input levels can vary plus or minus 15 dB while the output level remains relatively constant. An elegant VCA design provides very low noise and distortion. Program-dependent release time assures that gain is controlled without the usual compressor artifacts common to less sophisticated designs, such as "ducking", a sudden drop in average overall level after a loud transient, like the sound of gunfire in a movie. Noise rush-up during pauses in program audio is eliminated by gate circuits that prevent gain increase when the input audio drops below a preset threshold level. When recovery is frozen in either channel, that channel's "GATE" LED will light.

A 5-LED display for each channel indicates the amount of gain reduction, in 3 and 6 dB steps, relative to the center of the range. There is an HF LIMIT (high frequency limit) LED for each channel of audio. This LED illuminates when high level high frequency audio is being controlled.

The ALM473 is a high performance audio controller that is transparent in its operation. It has no "sound" of its own, but automatically produces an output that sounds as if the input level had been correctly set manually, even with widely varying input levels.

2.0 INSTALLATION

Up to nine (9) ALM473s can fit into a single RMS-400 mainframe power supply, which occupies three (3) standard "RU" 19 inch Rack Units (5-1/4 inches) high.

MODULE CARD INSTALLATION

1. Select one of the un-used nine positions to be occupied by the new circuit board module.
2. Remove the blank label in that position by peeling it off of the front panel. Peel the label slowly to remove all of the label and adhesive. Any remaining adhesive may be removed by rubbing the surface with your thumb. **WARNING DO NOT USE SOLVENTS TO REMOVE THE LABEL ADHESIVE.** The solvent could damage the equipment cards or cause a fire.

3. Peel the backing off of the new label and apply it to the front panel of the RMS-400 rack in the position of the new card. Align the new label with the screw head in the hole in the lower right hand corner of the label, then align the center thumbscrew with the clearance hole in the front panel. This should cause the label to be straight and vertical. When the label is in place press firmly to secure the label.
4. Then remove the thumb-screw retainer from the product card, it is located at the front of the card and is removed by rotating the knob counter-clock-wise.
5. Select any and all product options on the specific card, (See Instructions for individual product).
6. Next slide the card into the card guides at the rear of the RMS-400. Be sure that the notch in the circuit card is facing forward and down. Push the card all the way to the front of the rack until it stops. DO NOT APPLY EXCESSIVE FORCE TO THE CARD.
7. Insert the thumb-screw that was removed in step 5 while rotating it in a clock-wise direction. When it begins to thread into the card, continue until it is finger tight. CAUTION TIGHT BY HAND ONLY, DO NOT USE TOOLS TO TIGHTEN THE THUMB-SCREW. OVER TIGHTENING WILL DAMAGE THE CIRCUIT CARD.
8. Attach any cables or wires necessary for operation.

Most circuit board modules have several adjustments which are carefully factory set with precision instruments for optimum performance. Change only those which must be adjusted, some controls when mis-adjusted produce little change under normal operating conditions, but can seriously reduce the ability of the unit to function correctly under other conditions which may be encountered. Therefore, if you must adjust a control, place a mark on it before moving it, so that it may be returned to its original setting with reasonable accuracy.

If you have any questions regarding FM SYSTEMS, INC. products, please contact our engineering department at 800-235-6960 or fax your questions to 714-979-0913, we will call you back immediately.

Before mounting in rack, check the input level requirements of the equipment to be fed by the Level Master. Left and right output levels are factory set for 0 dBm average level, unless otherwise specified. If higher or lower level is required, refer to the Graphics on the PC BOARD for programming of the output level select jumpers. Average output levels of -4 dBm, 0 dBm, +4 dBm, can be selected.

Additionally an unbalanced level -6 dBm down from each of the jumper selections can be used if the output is wired for unbalanced audio. This allows for -10 dBm, -6 dBm, and -2 dBm unbalanced output levels. The output drive is low impedance so more than one audio load may be connected without loading down the output level.

3.0 CONNECTION AND SETUP

Audio connections to the unit are made to a removable connector block at the rear of the unit, For ease of connection, unplug the connector block, connect wiring, and plug block back into unit. Connect wiring by inserting stripped wires into the appropriate holes in the connector block, and secure by tightening the screws on top. PUSH FIRMLY ON THE CONNECTOR BLOCK TO "SNAP" IT INTO PLACE on the PC Board. Refer to the connector graphics on the PC CARD.

From a BALANCED output source to ALM473 input:

SOURCE TIP or HI - to input T
SOURCE RING or LO - to input R

Connect shield to G at one end only, grounding at the signal source end is preferable. Connecting shield at only one end prevents current flow in the shield due to differences in AC ground potential between equipment, this preventing ground loop-induced hum. The ALM473 input amplifiers are active balanced, bridging.

From an UNBALANCED output source to ALM473 input:

CENTER (SIGNAL) CONDUCTOR - TO T
SHIELD - to R

From ALM473 output to a BALANCED input:

OUTPUT T - to TIP or HI
OUTPUT R - to RING or LO
G - Connect shield at ALM473 only.

From ALM473 output to an UNBALANCED input:

OUTPUT T - to center conductor
OUTPUT R - to shield

The outputs are active balanced, and are capable of driving loads of 600 Ohms and higher with low distortion. Connection to multiple loads per output is discussed under STEREO CONNECTION on page 6.

MONO CONNECTION:

In the dual mono mode, left and right channels of the ALM473 will control two separate programs. Connect any program audio feed, at a point after any satellite receiver or ad insert switching, to the Left output and it will feed that program channel's modulator. Connect another program audio feed to the Right channel in the same manner. DO NOT USE the STEREO COUPLE when operating in the dual mono mode.

MONO SETUP:

Remove the ON-BOARD Stereo Jumpers and hang them on one pin. If the jumpers are left in the stereo coupled position, the channel with the highest level will control the gain of both channels. THE ON BOARD JUMPERS MUST BE IN THE DUAL MONO POSITION.

MONO SETUP (cont.)

Adjust the INPUT SET control of the appropriate channel until the "SET" green LED, (0 dB) is lit with normal level program audio. This sets the input level to the center of the gain control range. The display will move down during lower level passages, indicating higher relative gain (less gain reduction), and it will move up with higher levels, indicating lower relative gain (more gain reduction). At this point, the unit can either increase or decrease gain by 15 dB relative to normal level.

This operating range is recommended where large level variations are expected, but there is clear program audio with a good signal-to-noise ratio.

NOTE: With noisy program material, or if quiet passages in program are desired to remain quieter, adjust the INPUT SET control to place normal program level at a lower point in the gain reduction range, such as the "-6" LED normally lit, with the "-3" LED flashing occasionally. The unit will then bring up lower levels by a maximum of about 10 dB, which will reduce the maximum amount of noise increase, but still control excessively high levels. Also, the gate will freeze recovery (gain increases) more frequently, allowing a more dynamic sound. This is a good starting point for critical services, such as pay-per-view channels.

STEREO CONNECTION:

Refer to the connector block drawing and connect the program source to the Left and Right inputs. Make sure that Hi or (+) connects to TIP, and LO or (-) connects to RING at both inputs. A reversal of polarity will cause cancellation of any center or monaural signal. Connect shields to G at one end only. (See first part of Section 3). Connect outputs of Level Master to equipment to be fed, in same manner as above. Observe correct polarity.

CONNECTION TO 2 STEREO MODULATORS:

There may be a need to feed two stereo modulators from the ALM473. A program service such as MTV, for example, may have originally fed a stereo FM modulator and a mono TV modulator. Later, a BTSC television stereo modulator may have been added, and now a need would exist for feeding two stereo modulators. In this case, be sure that the ALM473 is loaded by 600 Ohms or higher. If one or both modulators have high impedance (bridging) inputs, no problem. However, if they both have 600 Ohm terminations, wither internal or external, remove the termination from one of the unites, whichever is most convenient.

STEREO SET: READ THIS ENTIRE SECTION BEFORE MAKING ANY ADJUSTMENTS.

Turn both Left and Right INPUT SET controls fully counterclockwise. Temporarily move the stereo coupling jumpers to the DUAL MONO position. The most accurate stereo setup is done with KNOWN equal level applied to both input channels of the unit. This can be done by connecting both left and right inputs in parallel with jumper wires at the connector block (forcing equal levels to both inputs), feeding one program channel at normal level into both inputs.

STEREO SET: (cont.)

Turn up Left channel INPUT SET control until desired gain reduction is indicated on the left channel LED display. (See discussion of gain reduction range under MONO SETUP on page 3). Turn up Right channel INPUT SET control until the two LED displays are equal. This calibrates the ALM473 to precisely equal gain in both input channels.

Now, separate the left and right program lines to their respective inputs. Do not re-adjust INPUT SET controls. Set the channel balance of the program sources in your system. The ALM473 can be used as an indicator of channel balance.

NOTE: A pitfall to avoid is a situation where the ALM was set using a source that was not balanced. For example, the source may have a higher output on the left channel and the ALM left input level was set low to compensate.

If any program switching is being done, such as for local ad inserts, the next source may itself be supplying a properly balanced signal. Then the left channel ALM output would be too low in level. This, of course, is not a problem if only one source is feeding the unit, and, if desired, setup can be done as follows:

ALTERNATIVE STEREO SETUP METHOD:

Temporarily connect the stereo coupling jumper for DUAL MONO mode. With program material at normal level feeding the unit, turn up the Left INPUT SET control until the gain reduction LED display is indicating 0 dB, (set green LED), most of the time. Now, slowly turn up Right INPUT SET control so that both left and right LED gain displays are matched.

With normal stereo program material, this adjustment is best done during a mono portion, such a center-stage speech in a movie, or a single announcer speaking. In music, the lead vocal is usually centered. If you get a stable balanced display, the unit is probably being fed a mono signal. If a mono portion of program is not available, try to get the best average balance. If the opportunity exists to set up you entire audio chain with test tones, balance can be easily set with equal level tones in both channels of your system.

A very precise setting can be made by adjusting the INPUT SET controls to a point where the LED's just transition from one LED to the other LED with normal program level. This places the control voltage for each display at the threshold, which is a very well defined point. (Full illumination of any one given LED occurs over a range of 3 and 6 dB).

After the inputs have been matched, re-connect the stereo coupling jumpers in the STEREO position to lock both channels to the same control voltage. In the stereo position, both gates receive a sum of left and right, and the gain control voltage is determined by whichever channel is producing the highest gain reduction. Control is coupled by a diode "OR" circuit. If one channel is just a little higher than the other, that one channel is active. This is why the input levels are set while in the dual mono mode.

ALTERNATIVE STEREO SETUP METHOD: (cont.)

In the STEREO coupled mode, the gain reduction LED displays will track together. Channel separation and dynamics are unaffected by this display technique.

If in doubt, temporarily connect the stereo coupling to DUAL MONO and then check to see that both displays match. In this mode, what you see is what you get, with the true differences displayed in 3 and 6 dB steps.

4.0 FUNCTIONAL DESCRIPTION

The ALM473 is made up of the following subsections:

- 4.1 LEFT AND RIGHT INPUT AMPLIFIER
- 4.2 VOLTAGE CONTROLLED AMPLIFIER
- 4.4 OUTPUT AMPLIFIER
- 4.5 CONTROL
- 4.6 GAIN REDUCTION DISPLAY
- 4.7 POWER SUPPLY

4.1 LEFT AND RIGHT INPUT AMPLIFIER

The input amplifier is a differential amplifier. It responds to signals applied between the tip and ring inputs, while rejecting common-mode hum and noise. A low-pass filter follows the input amplifier. It is flat to 15 KHz, designed to prevent out-of-band noises from influencing the gain control action. Left channel input amplifier and low-pass filter are comprised of one-half of U1L and associated circuitry, right channel is one-half of U1R.

4.2 VOLTAGE CONTROLLED AMPLIFIER

The VCA is realized using a gain cell in the feedback loop of an op-amp. Maximum control voltage forces maximum gain through the gain cell which produces more negative feedback through the op-amp, producing minimum overall gain. U5L is the active circuitry for the left channel VCA, right channel is U5R.

4.4 OUTPUT AMPLIFIER

Left channel output amplifier is U7L. Right channel output amplifier is U7R. Each output driver is an active balanced, configuration. These are low output impedance amplifiers, designed to feed loads of 600 Ohms or higher.

4.5 CONTROL

Output from each VCA is applied to rectifier circuits. Each circuit is a full-wave precision rectifier with a preset threshold. When the peak value of the signal exceeds the threshold in either polarity, the rectifier produces an output pulse. The rectifier output pulses are applied to timing and converter circuits. The timing circuits can be thought of as RC filters that smooth the rectifier pulses to produce a DC control voltage. These filters have a fast attack and slow decay characteristic.

The converter produces DC from the filters, which becomes the VCA control voltage. The stereo coupling jumpers ORs the left and right control voltage before it is applied to the converters. Timing and converters are U4L for the left channel, and U4R for the right channel. The left and right channel gates are made up of U4 and associated circuitry. Signal from the input amplifier is applied to an amplifier that has a band-pass response centered at 1 KHz, to prevent the gate from responding to program noise. This signal is rectified and applied to a voltage comparator. When the rectified program audio signal is above the comparator threshold, the output goes positive, enabling gain recovery.

4.6 GAIN REDUCTION DISPLAY

Gain control voltage from U4L is fed to the input of U8,9, and 10L left channel LED display driver. Gain control voltage from U4R is fed to U8, 9, and 10R the right channel LED driver. The degree of gain reduction taking place is indicated by five LED's per channel. Gain reduction is indicated in 3 and 6 dB steps, with the SET LED indicating the 0 reference point. At this point, a linear voltage change causes a dB-linear gain change in the VCA's.

4.7 POWER SUPPLY

The power supply is part of the RMS-400 mainframe. It is a conventional series-regulated supply, the output voltage is +/- 12 VDC.

5.0 MAINTENANCE

No routine maintenance or adjustment is required. If a problem develops, contact the factory. It is strongly recommended that if servicing is necessary, the unit be sent to the factory for any adjustment or repair.

SPECIFICATIONS

INPUT

Average Input Level	-20 to +10 dBm (adj. range)
Peak Program Level	10 dB above Average
Input Level Control	Adjustable Front Panel Control
Impedance	Balanced Hi-Z (600 Ohm)
Common Mode Suppression	40 dB or better
Mode	Dual Mono or Stereo
Connectors	Wire Screw Terminal

SPECIFICATIONS

CONTROL SYSTEM

Frequency Response	20 Hz to 20 KHz, 0.5 dB
Control Range	+/- 15 dB (30 dB range)
Noise Gate	Gain freeze on drop-out
Distortion	0.03 %THD maximum
Signal-To-Noise	80 dB
Compression Artifacts	None Perceptible

OUTPUT

Level (Programmable)	-10, -4, 0, and +4 dBm
Impedance	Low-Z (600 Ohm)
Connectors	Wire Screw Terminal

METERING

Level Control	Dual 5 Position L.E.D.
Noise Gates	Separate L.E.D. Indicators

MECHANICAL

Card	Fits in one nine spaces in the RMS-400 Mainframe
Power Requirement	+/-12 VDC (RMS-400)

CAUTION

Most circuit board modules have several adjustments which are carefully factory set with precision instruments for optimum performance. Change only those which must be adjusted. Some controls when mis-adjusted produce little change under "normal" operating conditions, but can seriously reduce the ability of the unit to function correctly under other conditions which may be encountered. Therefore, if you must adjust a control, place a mark on it before moving it, so that it may be returned to its original setting with reasonable accuracy.