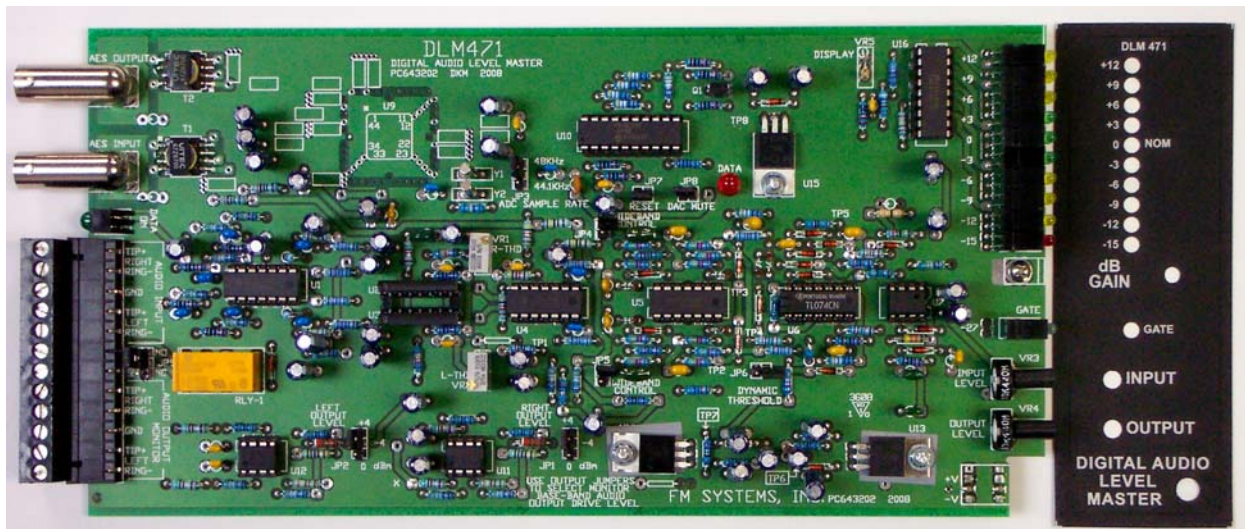


DLM471



DIGITAL STEREO AUDIO LEVEL MASTER

OPERATION MANUAL

IB6432-02

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1.0 GENERAL DESCRIPTION

The DLM471 Digital Audio Level Master stabilizes AES-3id digital or analog audio levels so that the level remains constant when the input varies wildly. This product has both digital and stereo analog inputs and outputs and will correct audio level variations over a range of more than 30dB. The unit will accept any AES-3id or S/PDIF compatible input signals.

It locks to the incoming AES-3id digital audio sample rate when using a digital source, or if used with its analog input as an A/D converter, can internally generate crystal-stable 48 kHz or 44.1 kHz digital output. In A/D mode, the unit can be configured to lock to an incoming digital input reference.

The DLM471 card's digital input and output uses 75-Ohm BNC connectors (AES3-id) and they are transformer-isolated for trouble-free interconnection. It can also accept S/PDIF digital inputs, and feed compatible consumer equipment with S/PDIF inputs that can accept 1V digital levels, by using low-cost RCA-to-BNC adapters.

The unit also has balanced analog stereo audio input and output connections. It can serve as a D/A converter, since the analog outputs are active along with the digital output, and these stereo analog outputs can be used as additional outputs for metering, monitoring or the main program feed. The DLM471 can also serve as an A/D converter, since the analog inputs can be used to encode analog audio into digital AES-3id signals.

The control system is program-dependent and is designed to minimize audible artifacts such as pumping, ducking on loud transients, or noise rush-up in pauses. This allows the digital audio Level Master to control the audio level without adding a sound of its own. The noise gate freezes the audio gain when the audio level subsides to prevent an increase of noise when the program is quiet. The unit controls the audio level without audible compression artifacts, so you get program audio that sounds natural without annoying level variations. Recommended dialog normalization settings for downstream AC3 encoders are suggested for trouble-free audio level set-up.

A ten-LED display indicates the degree of gain control being exerted on the digital audio and the "Gate" LED lights when the gain control is frozen. This system will control your digital audio variations over a 32 dB range. An LED on the rear panel indicates the presence of digital input.

The monitor/line analog audio output level is field-programmable by jumpers on the PC Card. The analog output level can be set for a balanced level of -4, 0, +4 dBu and also -10 dBu unbalanced.

The Digital Audio Level Master is a broadcast quality, automatic digital audio level control system, built for performance and reliability with the price and quality-conscious audio professional in mind. Each DLM471 card contains one digital stereo control system, and nine of these cards will fit into one RMS-400 mainframe (5.25" x 19"). The RMS-400 mainframe will hold audio level control for up to 9 stereo channels in just 3 "RU" rack unit spaces.

2.0 INSTALLATION

MODULE CARD INSTALLATION

1. Select one of the unused 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 thumbscrew 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 the 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 thumbscrew that was removed in step 4 while rotating it in a clock-wise direction. When it begins to thread into the card, continue until it is finger tight. ***CAUTION - TIGHTEN BY HAND ONLY, DO NOT USE TOOLS TO TIGHTEN THE THUMBSCREW. OVER-TIGHTENING WILL DAMAGE THE CIRCUIT CARD.
8. Attach any cables or wires necessary for operation.

NOTE:

Most circuit board modules have several adjustments that are carefully factory-set with precision instruments for optimum performance. Change only those that must be adjusted. Some controls, when misadjusted, produce little change under normal operating conditions, but can seriously reduce the ability of the unit to function correctly under other conditions that 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 analog output levels are factory set for +4 dBu average level, unless otherwise specified. If a 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 dBu, 0 dBu, +4 dBu, can be selected.

Additionally an unbalanced level -6 dB lower than each of the jumper selections can be used if the output is wired for unbalanced audio. This allows for -10 dBu, -6 dBu, and -2 dBu unbalanced output levels. The output drive is low impedance so more than one high-impedance audio load may be connected. Driving more than one 600-Ohm load is not recommended.

3.0 DIGITAL CONNECTION AND SETUP

Connect a cable carrying AES3-id from the source equipment to the "AES INPUT" BNC connector of the DLM471. The green LED next to the digital input connector will light indicating lock to the incoming digital signal. The unit will also accept S/PDIF digital audio signals with an RCA-to-BNC adapter, and can drive compatible S/PDIF equipment inputs that can accept a 1Vp-p AES3-id digital level.

A relay is energized (and the green LED is lit) when the unit is locked to a digital input signal. Relay contacts are available for the user. Jumper JP9 selects normally closed ("NC") or normally open ("NO") contacts.

Connect to the destination equipment via the "AES OUTPUT" BNC. The output sample rate will be the same as the input sample rate.

Input normal program level and adjust the INPUT LEVEL control for nominal gain (middle green LED) as indicated on the LED display. When gain is increased above nominal, the display moves upward, indicating higher relative gain. It moves downward with lower gain. If a more dynamic sound is desired, drive the unit more lightly (display indicating higher gain), as desired.

The OUTPUT LEVEL control adjusts the AGC threshold, so it affects output level only when the input is high enough to cause gain control action (which is the normal mode of operation). The range is +/- 3dB. Use this control to trim the output level as desired.

There is interaction between the output level trim and system gain. When the output level (threshold) is increased with the front-panel Output Level control, the amount of gain is also increased, so the display will move upward. The display will move downward, indicating lower gain, with decreased threshold. For example, a 3 dB increase in output level caused by adjusting this control will cause a 3 dB increase in gain, as indicated by the LED display. Readjust the Input Level control to return the gain to the desired range. (The analog output level jumpers have no affect on AGC threshold).

Nominal digital output level is -20 dBFS. (The output level jumpers JP1 and JP2 only affect the analog monitor/line outputs.)

To assist you with setting AC-3 encoder dialog normalization, we have measured an average of -21 dBFS LAeq (Loudness A-Weighted Equivalent) at maximum output level setting, and -28 dBFS LAeq at minimum, using program material that consisted of dialog. As a starting point, we suggest an encoder setting of -24 with the DLM471 output level control at the center of its range.

4.0 ANALOG CONNECTION AND SETUP

Audio connections to the unit are made with a removable screw terminal connector block at the rear of the unit, for ease of connection, unplug the connector block, connect the wiring, and plug the block back into the unit. Connect the wiring by inserting stripped wires into the appropriate holes in the connector block, and secure them 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 DLM471 analog input:

Source TIP, (+) or HI to input "TIP"
Source RING, (-) or LO to input "RING"

Source SHIELD:

Connect the shield to "GND" at one end of the cable 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, preventing ground loop-induced hum. The DLM471 input amplifiers are active balanced, bridging (high-impedance).

From an UNBALANCED output source to DLM471 analog input:

Center (SIGNAL) conductor TO "TIP"
Shield to "RING"

From DLM471 output to a BALANCED input:

Output "TIP" to TIP, (+) or HI
Output "RING" to RING, (-) or LO
"GND" - Connect the shield at DLM471 only.

From DLM471 output to an UNBALANCED input:

Output "TIP" to center conductor
"GND" to shield

The outputs are active balanced, and are capable of driving loads of 600 Ohms and higher with low distortion.

5.0 STEREO CONNECTION:

Refer to the connector block graphics on the PC board 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. Connect outputs of the Level Master to the equipment to be fed, in the same manner as above. Observe correct polarity.

The following adjustments affect both Left and Right channels equally. The gain control action is matched for both channels to preserve stereo image. No balance adjustments are necessary.

Input normal program level and adjust the INPUT LEVEL control for nominal gain (middle green LED) as indicated on the LED display. When gain is increased above nominal, the display moves upward, indicating higher relative gain. It moves downward with lower gain. If a more dynamic sound is desired, drive the unit more lightly (display indicating higher gain), as desired. The actual input drive is not critical, since the unit is, of course, an automatic gain controller. But to make the best use of its control range, try to have normal audio levels cause the display to be near the middle of its control range (green LED's).

The OUTPUT LEVEL control adjusts the AGC threshold, so it affects output level only when the input is high enough to cause gain control action (above threshold, which is the normal mode of operation). Its range is +/- 3dB. Configure the Left and Right output level jumpers JP1 and JP2 for the desired analog nominal output level. The jumpers are set for +4 dBu output as shipped. The output level jumpers only affect the analog monitor/line outputs. The analog outputs are high quality and are always active even when the unit is connected digital in and digital out, so they can be used for monitoring or feeding additional equipment.

CAUTION: The analog inputs are also always active, so when using a digital input be sure to have no signal present on the analog inputs. With no connection, this way the analog input contributes negligible noise to the output signal.

6.0 MIXED ANALOG/DIGITAL CONNECTION:

ADC MODE

If used as an A/D converter, connect left and right analog inputs and the AES digital output. Select the SAMPLE RATE crystal jumper JP3 for the desired rate of 44.1 kHz or 48 kHz.

The unit will also lock to an external AES signal at its digital input. If used in this mode, mute the incoming digital audio by selecting the "DAC MUTE" jumper JP8 "ON". The red "DATA" LED will light. This jumper mutes the incoming digital audio, allowing only the desired analog input audio to be encoded and the digital output is locked to the incoming reference digital signal.

Adjust the input and output controls as described previously.

DAC MODE

Connect the digital input and connect the analog Left and Right outputs as described previously. The unit will lock to the incoming AES digital signal, so the sample rate crystal selection jumpers should be OFF.

Adjust the input and output controls as described previously.

Analog output nominal level can be selected with the Left and Right output level jumpers JP1, JP2 and trimmed with the output level control.

7.0 CONFIGURATION JUMPER OPTIONS

Wideband Control, JP4, JP5

With wideband control (JP4, JP5 jumpers ON), the unit responds to all frequencies equally, but Bass can cause pumping. With jumpers JP4 and JP5 "OFF", there is less response to low frequencies that could cause pumping with heavy Bass.

JP4 and JP5 "OFF" is recommended for best sound quality.

Dynamic Threshold Defeat, JP6

With Dynamic Threshold Defeat jumper JP6 "OFF", the leveled output will increase 1 dB over the entire control range, with the increase flattening out near 0 dB gain. This very slight increase makes the gain control more natural-sounding.

Jumper JP6 "ON" creates an infinite compression ratio. Steady-state audio is output at the same level thru the entire control range.

JP6 "OFF" is recommended for more natural sound.

DAC MUTE, JP8

The DAC MUTE jumper JP8 "ON" mutes the audio decoded from the digital input. This jumper is normally OFF.

For ADC mode operation, select JP8 ON.

RELAY (ALARM) CONTACTS, JP9

Select "NC" or "NO" contacts.

These contacts are used for remote control applications. They indicate the presence of a digital signal at the input. You can select N.O. or N.C. contacts and use the contacts to operate other equipment when the digital signal is lost.

8.0 MAINTENANCE

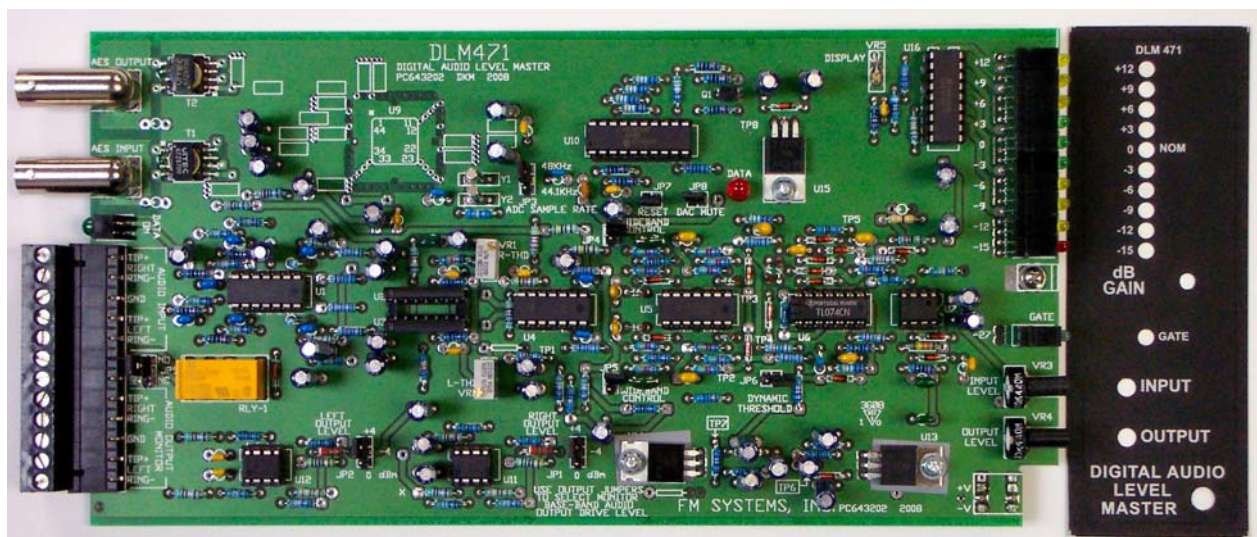
No routine maintenance or adjustment is required. If a problem develops, contact the factory. It is strongly recommended that if servicing is necessary, that the unit be sent to the factory for any adjustment or repair. Most circuit board modules have several adjustments that are carefully factory set with precision instruments for optimum performance. Some controls when misadjusted produce little change under "normal" operating conditions, but can seriously reduce the ability of the unit to function correctly under other conditions that may be encountered.

9.0 ADDITIONAL APPLICATIONS

The DLM471 can be used to insert audio over the top of your existing digital audio. The applications include adding Q-tones, sub-audible tones, or ultra-high frequency control tones to the AES-3 digital output signal. When you have AES-3 program material being processed through the unit you can use the audio input to directly overlay or mix other audio signals with the program material.

Since the audio input can be mixed with the digital input of the AGC gain control system the added tones will be gain controlled to the same level as the original program material. If the insertion level of the audio tone is higher than the original program material then the program material will "duck" (reduce in level) below the tone level. So when a tone is applied to the audio input the background audio programming will reduce in level by the amount of the level difference. The amount of "ducking" the program material does is controlled by the setting of the insertion level of the audio tone.

If an audio control system is being used up stream of the DLM471 then the monitor audio output can be used to recover the audio tones from the digital signal for decoding.



10.0 SPECIFICATIONS

INPUT

| | |
|---------------------|-----------------------------------|
| Digital Format | AES-3id or S/PDIF |
| Sample Rate | 44.1KHz or 48KHz (Auto Detect) |
| Impedance (Digital) | 75 Ohm (Unbalanced) |
| Digital Connector | BNC (Female) Transformer-isolated |
| Analog Audio Level | Left/Right Balanced Line Level |
| Analog Connector | Removable Screw Terminal |

CONTROL SYSTEM

| | |
|---------------------|-----------------------------|
| Audio Control Range | >32 dB |
| Gate | Program Dependent Gain Hold |
| Distortion | < 0.015 %THD |
| Signal-To-Noise | -95 dB, A-weighted, Typical |
| Input Level | Front Panel Adjustable |

OUTPUT

| | |
|-----------------------------|-----------------------------------|
| Digital Format | AES-3id (1V P-P) |
| Sample Rate | 44.1KHz or 48KHz (Auto or Select) |
| Impedance (Digital) | 75 Ohm (Unbalanced) |
| Digital Connector | BNC (Female) Transformer-isolated |
| Digital/Analog Output Trim | Adjustable Front Panel +/- 3dB |
| Analog Level (Field Select) | -4, 0, +4dBm (-10dBm Unbalanced) |
| Analog Connector | Removable Screw Terminal |

METERING

| | |
|---------------------|-----------------------------------|
| Level Control | Ten-segment Front Panel LED Meter |
| Gate | Front-Panel LED Indicator |
| Digital Signal Lock | Rear-Panel LED Indicator |

MECHANICAL

| | |
|-----------------------|--------------------------------|
| Card Size | 10.50"L x 5.00"H x 1.20"D |
| Racking Configuration | 1 of 9 Spaces in RMS400 (3 RU) |
| Power Requirement | +/-12 VDC, 150mA (RMS-400) |