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## LM Series

- LM26-24
- LM106-4
- LM53-24

Analog LED Bar Graph Audio Level  
Meters

User Guide

Part Number 821013, Revision C

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# LM Series User Guide

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## Introduction

### Overview

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The LM Series of 1U and 2U analog audio level metering units provide:

- 12 pairs of 26-segment level meters for the LM26-24
- 12 pairs of 53-segment level meters for the LM53-24
- Two pairs of 106-segment level meters for the LM106-4

### Topics

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# Safety Instructions

1. Read, keep, and follow all of these instructions; heed all warnings.
2. Do not use this equipment near water.
3. Use only a dry cloth to clean the equipment.
4. Do not block any ventilation openings. Install only in accordance with the instructions in the section entitled, "[Installation Recommendations](#)" on [page 3](#).
5. Do not install near any heat source such as a radiator, heat register, amplifier, or stove.
6. Do not expose the equipment to rain or moisture.
7. Do not attempt to plug the unit into a two-blade outlet (with only two prongs of equal width).

**IMPORTANT:** By design, these monitors will only plug into a three-prong outlet for your safety. If the plug does not fit into your outlet, contact an electrician to replace the obsolete outlet.

8. Protect the power cord from being walked on or pinched, particularly at plug's source on the equipment and at the socket.
9. Use only the attachments/accessories specified by the manufacturer.
10. Unplug the equipment during lightning storms or when unused for long periods of time.
11. Refer all servicing to qualified service personnel. Servicing will be required under all of the following conditions:
  - The equipment has been damaged in any way, such as when the power-supply cord or plug is damaged.
  - Liquid had been spilled or objects have fallen onto the equipment.
  - The equipment has been exposed to rain or moisture.
  - The equipment does not operate normally.
  - The equipment has been dropped.

# Installation Recommendations

## Mounting

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The unit is designed to install into a standard 19" rack mounted at eye level for best visual observation of the monitor screens.

## Heat Dissipation

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The ambient temperature inside the mounting enclosure should not exceed 40° Celsius (104° Fahrenheit). Adjacent devices can be rack mounted (or stacked) in proximity to the unit if the above temperature is not exceeded. Allow a 1RU (1.75"/44.45mm) space above and below the unit for air circulation.

**Important:** To reduce noise, the meter does not have any fans. As a result, the heat generated by the power supplies, and other components is vented by enclosure surfaces. Therefore, as a safety precaution, we advise you to be sure to allow proper ventilation on both sides of the unit.

## Power

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The unit comes with a standard 24VDC/3.0A internal power supply and connects an A/C mains power source (65W, 100 to 240 VAC, 50/60Hz) to the IEC connector provided on the rear panel of the unit.

## Description

Standard input connectors for the LM Analog Series are "mini" Phoenix type terminal block connectors. Analog input connector impedances are 27 K  $\Omega$  (ohm) balanced, and may be adjusted for Reference Level gain via rear panel DIP switches.

The standard display mode is set as a single segment PPM 'dot' above a VU bar; each segment's color is fixed according to its position on the scale. Each bargraph meter section (pair) may be individually adjusted for a number of parameters, including Display Mode, Peak Hold, PPM

Ballistics, Alternate Scales, and Phase Correlation via rear panel and internal DIP switches. An Auto Line Level Calibrate feature is also available.

## Features

- Twenty-six, 53, or 106-segment tri-color bargraph level meters provide wide dynamic range
- Monitors industry standard analog audio signals
- Front panel power indication LED
- Standard input connectors are "mini" Phoenix
- Selectable input Reference Level (0, +4, +6, or +8 dBu)
- Selectable Display Mode (VU Only, VU/PPM, or PPM Only)
- Selectable Peak Hold (Manual, 3-Second, 10-Second, or Off)
- Selectable PPM Ballistics (Type I, Type II, DIN 45406, or SSRT)
- Selectable alternate Bargraph Scales (Extended VU, VU, BBC, NORDIC, and DIN)
- Front panel bargraph brightness control

# Applications

The LM Analog series of level metering units are an adaptable and effective way to monitor any analog audio application. The following are some of the applications where an LM Series unit would prove valuable.

- Radio Broadcast Station
- TV Control Room
- Mobile Broadcast unit
- Remote Radio Station
- Sound Staging development
- Recording Studio
- Cinema
- Theatrical Staging
- Music Design Application
- Broadcasting Schools
- Home Theater
- Any Aural Media applications

# Specifications

The specifications of the LM Series are listed below.

**Table 1–1 LM Series Specifications**

Specification	LM26-24	LM53-24	LM106-4
Level Meter Type	LED bargraph		
Segment Quantity	26	53	106
Level Gain (DIP switch selectable)	0, +4, +6, +8 dBu		
Bar Graph Length	1.078" (27.85 mm)	2.22" (56.4 mm)	4.44" (113 mm)
LED Segment Size	0.14" x 0.028" (3.57 x 0.7 mm)		
LED Segment Pitch	0.041" (1.05 mm)		
Segment Display Color	Tri-color (red, amber, green)		
Peak Emmission Wavelength	Green: 570 nm, Red: 630 nm		
Segment Brighness, (If = 20 mA)	3.5 mcd		
Segment Brightness, Uniformity:	<10% difference between segments		
Dynamic Range: Extended VU (Standard Analog) Scale	67 dB	66 dB	72 dB
Midscale Resolution: Extended VU (Standard Analog) Scale	2 dB	1 dB	0.5 dB
Analog Full Scale Input	+12, +16, +18, and +20 dBu (ref level dependent)	+16, +20, +22, and +24 dBu (ref level dependent)	
Analog Input Impedance	27k $\Omega$ balanced		
Input Connectors	mini" Phoenix, female (Standard)		
AC Mains Power	100-250 VAC, 50/60 Hz universal input, auto-switch		
Power Consumption	25 W max	40 W max	25 W max
Dimensions	1U = 1.7 x 19 x 8" (44 x 483 x 203 mm)	2U = 3.4 x 19 x 8" (88 x 483 x 203 mm)	1U = 1.7 x 19 x 8" (44 x 483 x 203 mm)
Weight	8 lbs (3.5 kg)	12 lbs (5 kg)	8 lbs (3.5 kg)



**Note:** All of the specifications listed above are subject to change without notice.

## Front Panel Features

### Common Features

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- **Bargraph Brightness Control:** This control is recessed into the front panel and can be accessed using a small flathead screwdriver. Turning it clockwise will increase the relative brightness of the bargraph LED segments. Adjusting this one control will simultaneously affect the brightness of all bargraph displays on the front panel.
- **Power Indication (Green LED):** This Power Indication LED signals the operating condition of the power supply. The LED glows green to indicate the unit is connected to mains power and an operation voltage is present.
- **Level Meters:** Audio levels for the source channels are displayed via pairs of tri-color LED bargraph meters. All bargraph LED segments are of the tri-color type (green, amber, red) and are user adjustable for reference level, display mode, peak hold, PPM ballistics, and alternate bargraph scales via DIP switches on the rear panel and inside the unit. Refer to [DIP Switches on page 12](#) for more information regarding level meter DIP switch settings.

### LM26-24 Features

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Figure 1–1 LM26-24 Front Panel



## LM Series User Guide

### Front Panel Features

The audio levels for the analog input sources of the LM26-24 are displayed via these 26-segment LED bargraph display level meters (Figure 1-1 above).

Each LED bargraph represents a single channel. Above each LED bargraph on the front panel is a channel number which corresponds to one of two numbers found next to the input connector on the rear panel (each 6-pin input connector receives two channels). See page 19 for an interconnect block diagram of the signal paths through the input/display sections.

Bargraph displays are arranged in groups of four on the front panel, four being the number of input channels available in each input section on the rear panel.

## LM53-24 Features

Figure 1-2 LM53-24 Front Panel

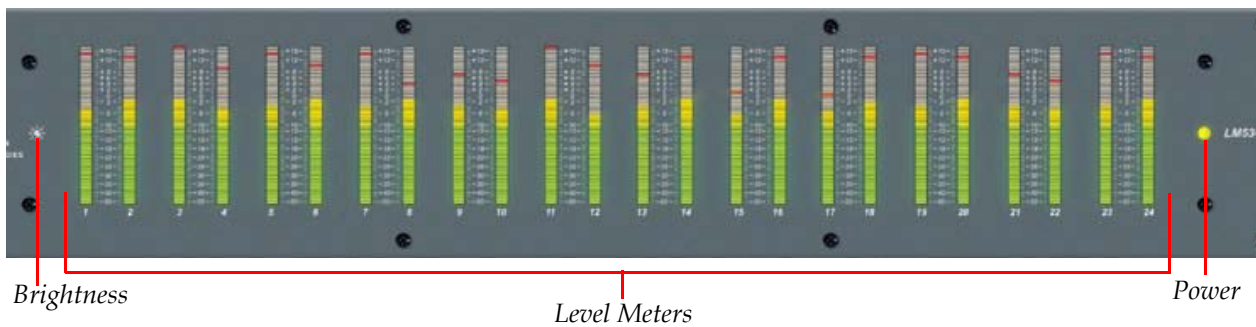


Figure 1-2 above illustrates the 53-segment type of LED bar graph display. Each pair represents two channels. These bar graphs have a total length of 2.24" and feature high-resolution segments, which are easy to visually monitor for distances up to six feet.

## LM106-4 Features

Figure 1–3 LM106-4 Front Panel

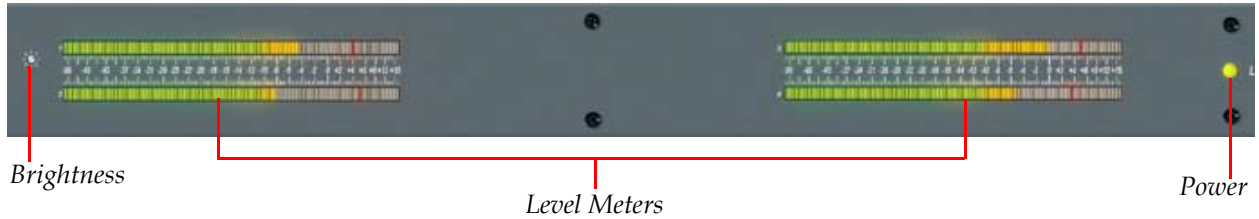


Figure 1–3 above illustrates the 106-segment type of LED bar graph display. Each pair represents two channels. These bar graphs have a total length of 4.42" and feature high-resolution segments, which are easy to visually monitor for distances up to six feet.

## Rear Panel Features

### Rear Panel Connectors

The 1RU rear panels are comprised of modular panel sections. One to three of the modular panel sections have the audio input connectors (and DIP switch module), with any remaining sections being a blank panel. This arrangement permits mixing of different types of input modules, although such mixes are considered special order items.

Figure 1–4 LM26-24 Rear Panel

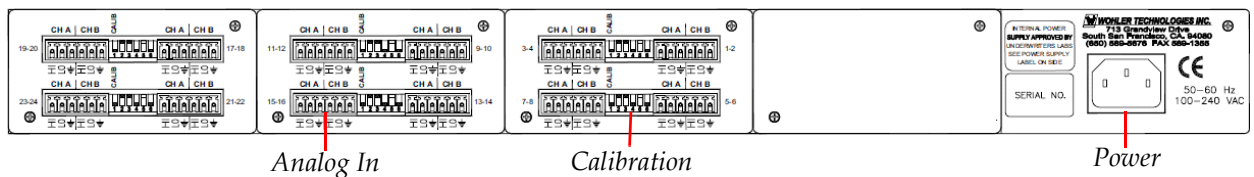


Figure 1–5 LM53-24 Rear Panel

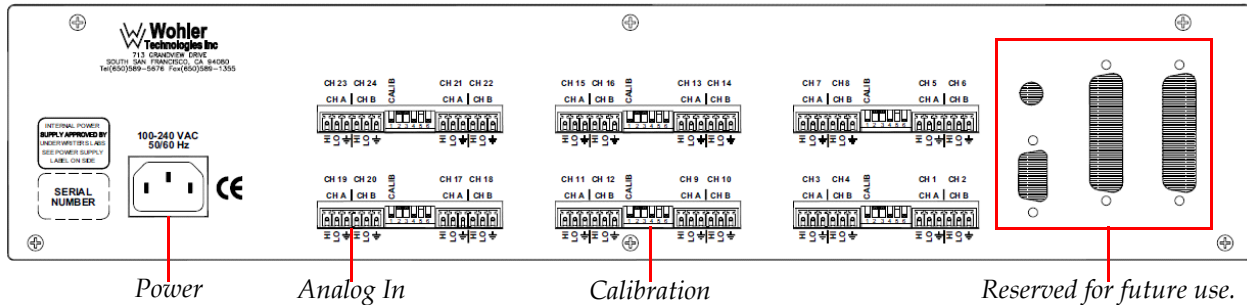
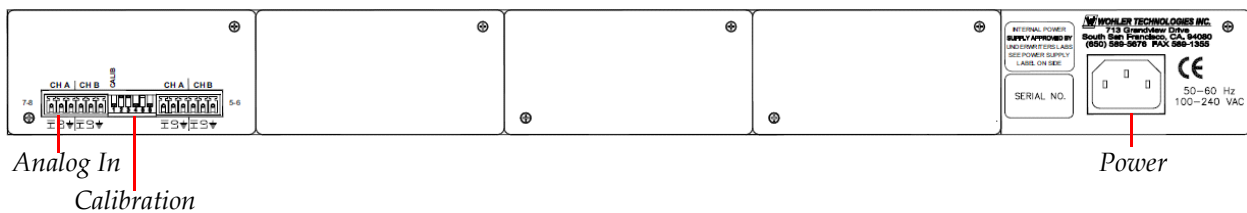


Figure 1–6 LM106-4 Rear Panel



- **Analog Input Connectors:** These 3-pin male “mini” Phoenix connectors accept standard Analog audio signals and are configured for balanced connections (27k  $\Omega$  impedance).
- **DIP Switch:** This DIP switch sets the line level calibration, reference level, and PPM/VU display mode. See the descriptions and diagram below for setting information.
- **Power Connector:** Attach the supplied IEC-320 power cord between this connector and mains power (100 to 240VAC nominal, 50/60 Hz). The front panel power indication LED will glow green to indicate operating voltages are present.

## Rear Panel Configuration

### Line Level (Auto) Calibration

The unit is calibrated at the factory. To recalibrate:

1. Turn on the power.
2. Apply the desired reference level (nominal 0) signal to all channels.

3. Make sure the reference level DIP sections are set to the nearest level of the input signal being applied for calibration (i.e., 0, +4, +6 or +8 dBu). Verify that the signal applied to all four channels is within  $\pm 4$  dB of the reference level selected by DIP switch sections 2 and 3.
4. Place DIP section 1 in the down position.
5. Wait 10 seconds. The unit will remove the previous calibration and the *new* calibration will be applied.
6. Place DIP section 1 in the up position and return unit to service.
7. Only one auto-calibration attempt may be made for each cycling of AC power to the unit. Once the **Line Level Calibration** DIP switch has been placed in the **CAL** position, it is necessary to cycle the power before that DIP switch will be functional again, **EVEN** if a calibration attempt was unsuccessful.

If you want to re-calibrate, turn off the power to the unit and repeat Steps 1 through 6.

**Note:** For more accurate indication of signal levels, meters are tuned to effect a “rounding” function, which occurs *between* the thresholds of any two bargraph segments. This means the level meter zero LED segment will turn on before that segment’s scale indication, the amount being one-half the smallest spacing between LED segments (mid-scale resolution) or 0.5 dBu, whichever is smallest.

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**Example:** Using the analog (extended VU) scale, a meter calibrated for a +4 dBu nominal level will actually turn the zero LED segment of the level meter on at 3.5 dBu and all segments will turn on at 0.5 dBu before each segment’s silk-screened scale indication.

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## Reference Level

DIP switch sections 2 and 3 determine the reference level, which adjusts the level of the input signal and the resultant level displayed on the LED bargraphs. Factory setting is +4 dBu. See DIP switch diagram below for settings.

## Bar Graph Display Mode

DIP switch sections 4 and 5 determine how peak levels are displayed for the associated meters on the front panel. There are four possible

settings; VU Only, VU-PPM floating segment, PPM Only, and PPM-PPM floating segment. The VU Only selection has a VU floating segment when a Peak Hold value is selected using the Internal 10-Position DIP switch module (see [DIP Switches on page 12](#)). The factory default setting is VU-PPM floating segment.

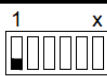

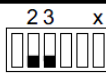
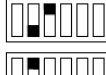

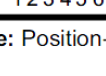
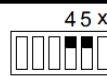


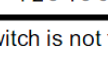
### PPM Characteristics (Ballistics)

The PPM characteristics determine the integration time (rise time) and return time (fall time) of the level meter. The integration time is the time it takes for the lighted segments of the level meter, after application of a 5 KHz tone at a certain reference level, to rise within a specified number of dB of that level. The return time is the time it takes for the lighted segments of the level meter to fall a certain number of dB after removal of a 5 KHz tone of a certain reference level.

## DIP Switches

### Six-Position DIP Switch Settings


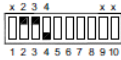
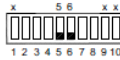
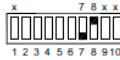












Figure 1–7 Six-Position DIP Switch Settings

LM Analog Series Rear Panel DIP Switch Settings		
Meter Calibration	Reference Level	Display Mode
1            x  Calibrate   Operate 1 2 3 4 5 6	2 3            x  +8 dB   +6 dB   +4 dB   0 dB 1 2 3 4 5 6	4 5 x  VU Only   VU-PPM Floating Segment   PPM Only   Not Used 1 2 3 4 5 6

Note: Position-6 of DIP switch is not functional

## 10-Position DIP Switch Settings

Figure 1–8 10-Position DIP Switch Settings

LM26 Analog Series Level Meter Internal 10-Position DIP Switch Settings			
Scale Selection		Peak Hold (Bargraph Display)	PPM Ballistics (Bargraph Display)
 AES Scale (Digital Models ONLY)	 NORDIC Scale	 Peak Hold - Manual	 IEC268-10, Type 1
 Extended VU Scale (Standard Analog)	 DIN Scale	 Peak Hold - 3 Second	 IEC268-10, Type 2
 VU Scale	 Alternate AES Scale (Digital LM26 & LM30 ONLY)	 Peak Hold - 10 Second	 DIN 45406
 BBC Scale	 Legacy Ext. VU Scale (LM30 & LM60 Only)	 Peak Hold - Off	 Single Sample Rise Time (SSRT) (Digital Models ONLY)

Note: Switch positions 1, 9, and 10 are NOT used and should be left at the factory setting.

The PPM characteristics available for selection using DIP switch sections 7 and 8 of the 10-position internal DIP switch (Figure 1–8 above) are listed in Table 1–2 below.

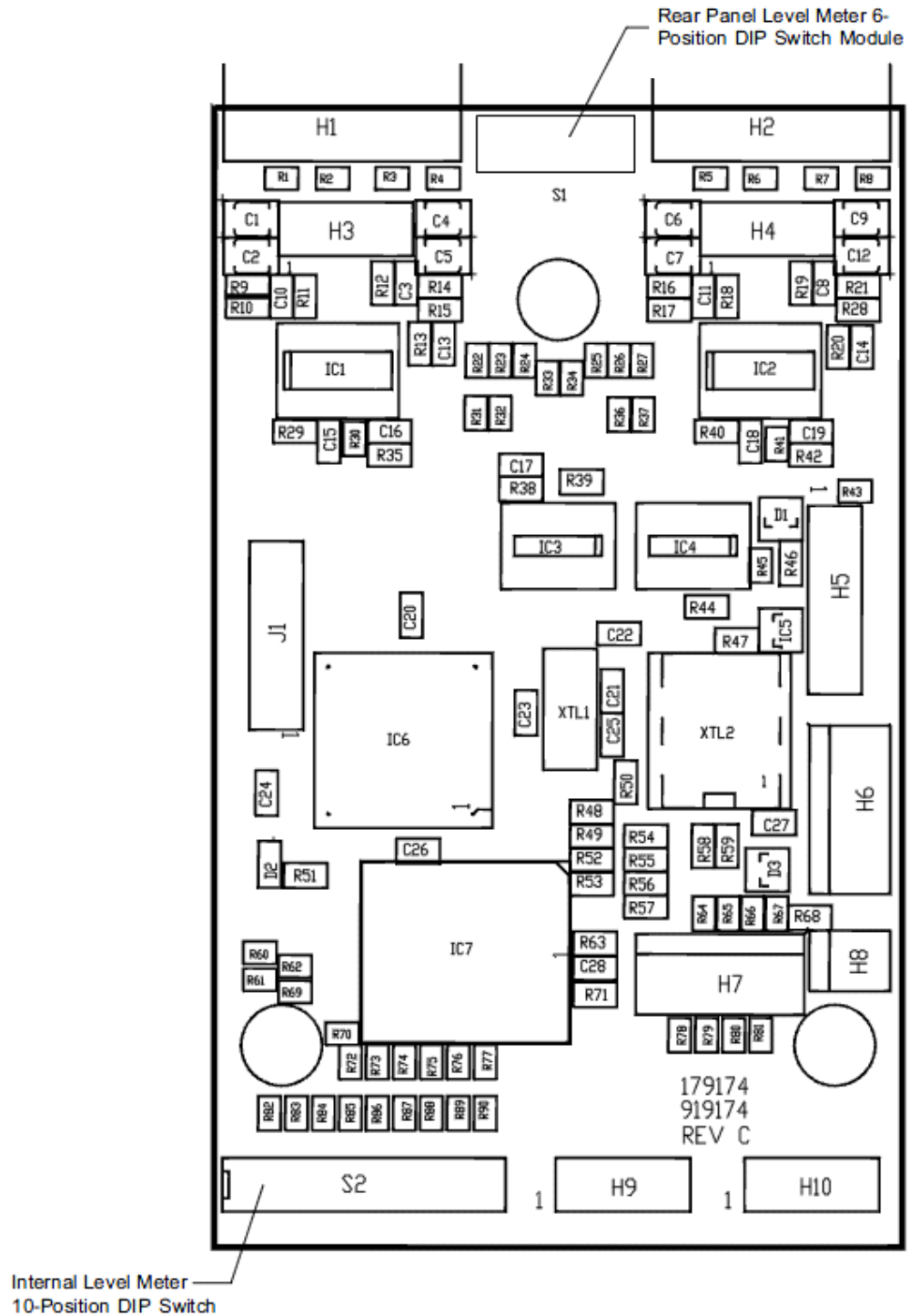
Table 1–2 PPM Settings

Type	Integration/Return Times
IEC268-10, Type 1	Integration time is 5 ms (-2 dB); return time is 1.7 seconds (20 dB)
IEC268-10, Type 2	Integration time is 10 ms (-2 dB); return time is 2.8 seconds (24 dB)
DIN 45406	Integration time is 5 ms (-2 dB); return time is 1.5 seconds (20 dB)
Single Sample	Integration time is a single sample; return time is 1.5 seconds (20 dB)

## DIP Switch Locations

This 10-position DIP switch is accessed by removing the top cover of the LM unit and is located on the 919174 PCB (the same PCB on which the 6-position rear panel DIP switch is located). See Figure 1–9 on page 14 for a diagram of the 919174 PCB and the DIP switch location.

Figure 1–9 DIP Switch Locations

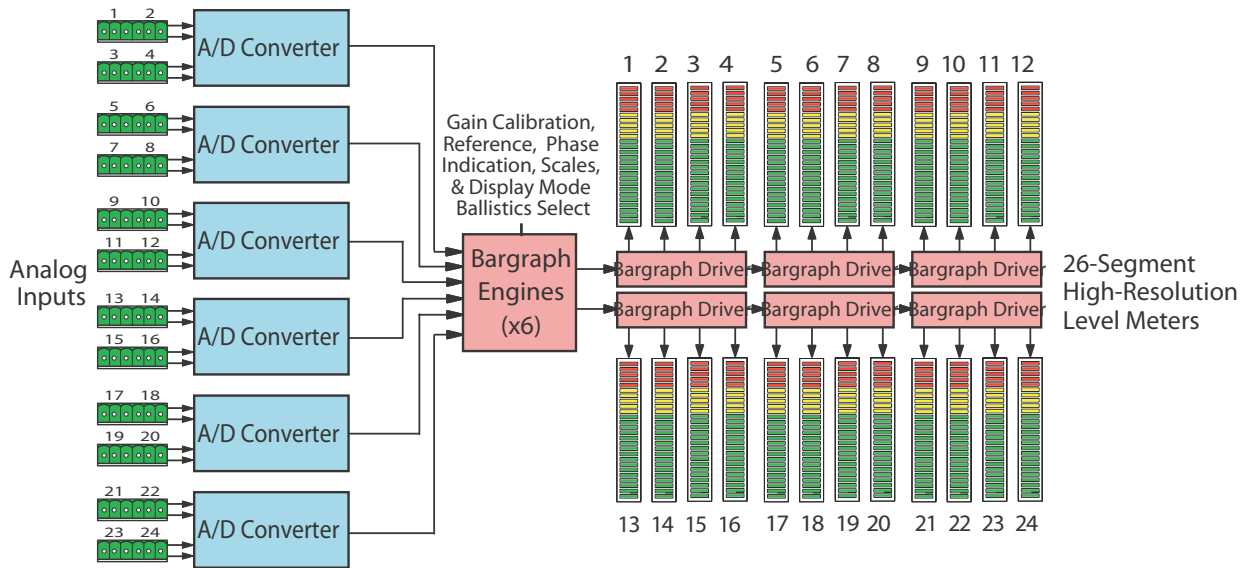




# Technical Functional Overview

Figure 1-10 and Figure 1-11 below and Figure 1-12 on page 16 illustrate the overall functionality of the three monitors.

**Figure 1-10 LM26-24 Block Diagram**



**Figure 1-11 LM53-24 Block Diagram**

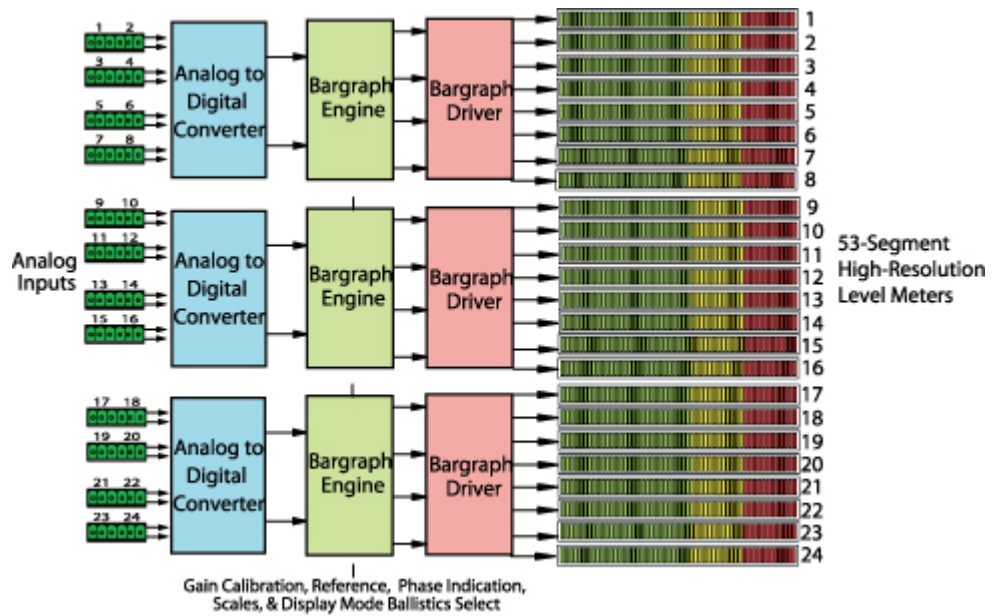


Figure 1–12 LM106-4 Block Diagram

