LM53-16M

2U 16-Channel HD/SD-SDI Level Metering Unit

Document P/N **821619**, Rev-**A**

Sixteen Channels, HD/SD-SDI Input and
Re-clocked Output on BNC,
Sixteen 53-Segment LED Bargraph Level Meters,
with Input Signal Lock Indication LEDs

User Manual

CONTENTS

Title and Contents 1

Important Safety Insdtructions and Introduction 2

Section 1: General Features and Specifications ... 3

Description and Features 4

Applications and Specifications 5

Installation 6

Section 2: Operation 7

Front Panel Features 8

Rear Panel Features 10

Section 3: Technical Information 13

Level Meter Internal 10-Position DIP Switch Settings 14

Level Meter DIP Switch Locations 15

Level Meter Alternate Scales 16

Phase Correlation Indication and Labeling 16

LM53-16M Interconnect Block Diagram 17

Important Safety Instructions

1) Read these instructions.
2) Keep these instructions.
3) Heed all warnings.
4) Follow all instructions.
5) Do not use this apparatus near water.
6) Clean only with dry cloth.
7) Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8) Do not install near any heat source such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9) Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10) Protect the power cord from being walked on or pinched, particularly at plugs convenience receptacles and the point where they exit from the apparatus.
11) Only use attachments/accessories specified by the manufacturer.
12) Use only with the cart stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13) Unplug this apparatus during lightning storms or when unused for long periods of time.
14) Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as when power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
15) Do not expose this apparatus to rain or moisture.
16) The apparatus shall be connected to a mains socket outlet with a protective earthing connection.

CAUTION!

In products featuring an audio amplifier and speakers, the surface at the side of the unit, where the audio amplifier heat sink is internally attached, may get very hot after extended operation. When operating the unit excercise caution when touching this surface and ensure that external materials which may be adversely affected by heat are not in contact with it. There is a Hot Surface label (see diagram) attached to the aforementioned surface of the product.

Introduction

Congratulations on your selection of a Wohler Technologies product. We are confident it represents the best performance and value available, and we guarantee your satisfaction with it.

If you have questions or comments you may contact us at:

Wohler Technologies, Inc.
31055 Huntwood Avenue
Hayward, CA 94544
Phone: **(510) 870-0810** Fax: **(510) 870-0811**
US Toll-Free: **1-888-596-4537**
www.wohler.com **support@wohler.com**

Section 1

General Features and Specifications

Description

Features

Applications

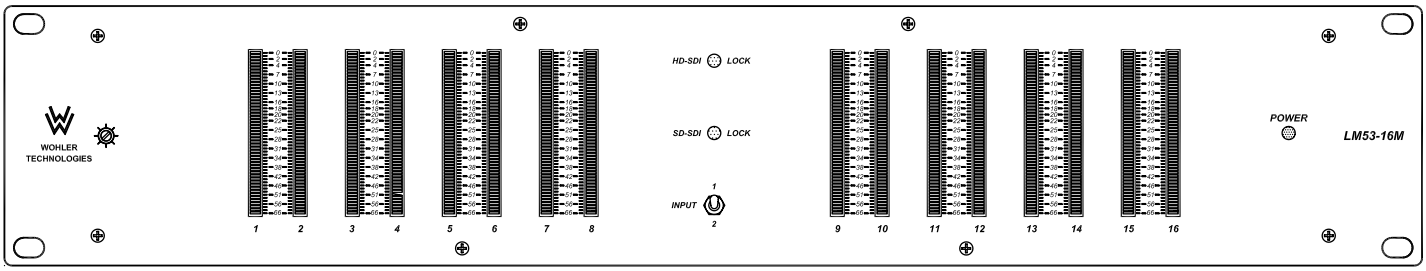
Specifications

Installation

713 Grandview Drive,
South San Francisco, CA 94080
650 589-5676 Fax: 650 589-1355

LM53-16M

16-Channel HD/SD-SDI Digital Level Metering Unit



LM53-16M Front Panel

Description

The **LM53-16M** is double rack (2U) level metering unit for visual monitoring of the sixteen audio channels available for de-embedding from digital **HD-SDI** or **SD-SDI** signals. The unit features two unbalanced **HD/SD-SDI** inputs with an impedance of 75 Ω (ohm) and one re-clocked output, all on female BNC connectors. The inputs accept either **SD-SDI** or **HD-SDI** digital signals and a front panel toggle switch is used to select between the two inputs. The input level is adjustable for gain via rear panel DIP switch modules. Signal lock status is indicated by two separate LEDs on the front panel; one for **SD-SDI** signals and one for **HD-SDI** signals.

The sixteen vertical audio level meters are 53-segment high-resolution tri-color (red/amber/green) LED bargraph displays with a wide dynamic range. Bargraph meters in groups of four may be adjusted for a number of parameters, including **Display Mode**, **Peak Hold**, **PPM Ballistics**, **Alternate Scales**, and **Phase Correlation** via rear panel and internal DIP switch modules. The **Display Mode** is factory set as a single segment **PPM 'dot'** above a **VU bar**; the color of each segment being fixed according to its position on the scale, but other modes are also selectable. A recessed trimpot on the front panel is used to adjust the brightness of the sixteen LED bargraph displays.

Features

- Sixteen 53-segment tri-color bargraph level meters provide wide dynamic range
- Two HD/SD-SDI inputs and one re-clocked output on BNC connectors
- Front panel toggle switch for selecting between the two HD/SD-SDI inputs
- Separate lock status LEDs for SD-SDI and HD-SDI input signals
- Front panel power indication LED
- Front panel bargraph brightness control
- Selectable input **Referrence Level** (-9, -18, -20 dBfs)
- Selectable level meter **Display Mode** (VU Only, VU/PPM, or PPM Only)
- Selectable level meter **Peak Hold** (Manual, 3-Second, 10-Second, or Off)
- Selectable level meter **PPM Ballistics** (Type I, Type II, DIN 45406, or SSRT)
- Selectable level meter **Phase Correlation** feature (on/off)
- Selectable level meter alternate **Bargraph Scales** (AES, BBC, NORDIC, and DIN)

Applications

The **LM53-16M** level metering unit is an adaptable and effective way to monitor **SD-SDI** or **HD-SDI** digital audio in many applications. The following are some of the applications where an **LM53-16M** 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

Level Meter Type:	53-Segment LED bargraph
Level Gain (DIP switch selectable):	-9, -18, -20 dBfs
Bargraph Length:	2.22" (56.4 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 Emmision Wavelength:	Green: 570 nm, Red: 630 nm
Segment Brighness, (If = 20 mA):	3.5 mcd
Segment Brightness, Uniformity:	<10% difference between segments
Adjacent Segment "Off" Brightness:	<1% of brightness of active segment
Dynamic Range, AES Scale (Standard Digital):	66 dB
Midscale Resolution, AES Scale (Standard Digital):	1 dB
Input Connectors:	Female BNC x 2
Output Connectors:	Female BNC x 1
Input Impedance:	**75 Ω** unbalanced
Input Signal Types:	**SD-SDI** (SMPTE259M @ 270 Mb/s) **HD-SDI** (SMPTE292M @ 1.5 Gb/s)
Maximum Equalized Cable Length:	**Belden 8281 - 100m** @ 1.48 Gb/s and **280m** @ 270 Mb/s **Belden 1694A - 140m** @ 1.48 Gb/s and **350m** @ 270 Mb/s
AC Mains Power:	**100-250 VAC**, **50/60 Hz** universal input, auto-switch
Power Consumption:	**25 watts**
Dimensions:	3.5 x 19 x 8" (89 x 483 x 203 mm)
Weight:	7 lbs (3.1 kg)

Units are certified to meet, at time of manufacture, all currently applicable product safety and EMC requirements, such as those of CE. 0 dbv ref. 0.775V RMS. Features and specifications subject to improvement without notice.

Installation

Mounting

The unit should be mounted where convenient for operating persons, ideally at approximately eye level for best viewing.

Heat Dissipation

No special considerations for cooling are necessary as long as the ambient temperature inside the rack area does not exceed approximately 40°C (104°F). Note that if the internal heat becomes elevated in the unit, it is advised to *lower* the brightness of the LED bargraph level meters using the **Bargraph Brightness Adjust Control** (**Item 1**, page **8**) as this can significantly reduce the heat generated inside the chassis.

Mechanical Bracing

The chassis is securely attached to the front panel at six points along its surface, not just at the four corners of the chassis ears. This feature will reduce or eliminate rear bracing requirements in most mobile/portable applications. The weight of internal components is distributed fairly evenly around the unit.

Input Connections

Connection of the inputs is straightforward. The system interconnect block diagram located on page **17** may be referred to for clarification of the general signal paths into the **LM53-16M** units.

Electrical Interference

The internal circuitry common is connected to the chassis. As with any audio equipment, maximum immunity from electrical interference requires the use of shielded cable; however, satisfactory results can sometimes be obtained without it. Care should be exercised to avoid mismatched cable types and other similar causes of undesired reflections in RF signal systems. If severe enough, such reflections can result in corruption of the digital datastream. Recommended cable types are as follows:

Recommended cable type for **analog audio** signals is: **Belden 9451** or equivalent.
Recommended cable type for **digital audio** signals is: **Belden 1800B** or equivalent.

AC Power

The unit's AC mains connection is via a standard IEC inlet, with safety ground connected directly to the unit's chassis. The universal AC input (100-240VAC, 50/60 Hz) switching power supply is a self-resetting sealed type, with automatic over-voltage and over-current shutdown. There is no user-replaceable fuse in either the primary or secondary circuit.

Level Meter Parameter Settings

The **Peak Hold**, **PPM Ballisatics, Phase Correlation**, and **Alternate Scale** level meter settings are selected using a DIP switch accessable *only* by removing the top cover of the unit. Should the user wish to change these settings, it should be done *before* installation into an enclosed rack or difficult to access area. See page **14** for setting information.

The input **Reference Level Gain** calibration and bargraph **Display Mode** settings may be selected *after* installation via the DIP switch(es) on the rear panel as long as the rear panel is easily accessable. If installation makes the rear panel difficult to access, then these adjustments should be made *before* installation. See **Item D**, page **10** for setting information.

Section 2

Operation

Front Panel Features

Rear Panel Features

Front Panel Features

Please refer to **Figure-2a** on the following page to familiarize yourself with the front panel features of the **LM53-16M** unit. The following sections describe these features and are referenced, by number, to **Figure-2a**.

1 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 and will simultaneously affect the brightness of all bargraph displays on the front panel.

2 Level Meters (1-16)

Audio levels for the sixteen source channels are displayed via sixteen vertical 53-segment high-resolution tri-color LED bargraph meters. The four **SDI** groups are de-embedded from the **HD/SD-SDI** source signal and applied to the level meter bargraphs in the following format:

Group **1** = Bargraphs **1-4**
Group **2** = Bargraphs **5-8**
Group **3** = Bargraphs **9-12**
Group **4** = Bargraphs **13-16**

All LED segments are of the tri-color type (green, amber, red) and each group of *four* bargraph meters (as shown above) is user adjustable for **Referrence Level**, **Display Mode**, **Peak Hold**, **PPM Ballistics**, and **Alternate Bargraph Scales** via four DIP switches on the rear panel and one inside the unit. See **Item D**, page **10** and page **14** for more information regarding level meter DIP switch settings.

3 Input Source Select Switch (1/2)

This 2-position toggle switch is used to select which of the two **HD/SD-SDI** inputs (**Item B**, page **10**) will be monitored in the audio level meters (**Item 2**); **1** or **2**.

4 Input Signal Lock LEDs (SD-SDI and HD-SDI)

One of these two LEDs will glow GREEN to indicate that the applicable type of input signal (**SD-SDI** or **HD-SDI**) entering the **SDI Input Connector** (**Item B**, page **10**) is locked.

5 Power LED

This LED glows GREEN to indicate the unit is connected to mains power and an operation voltage is present.

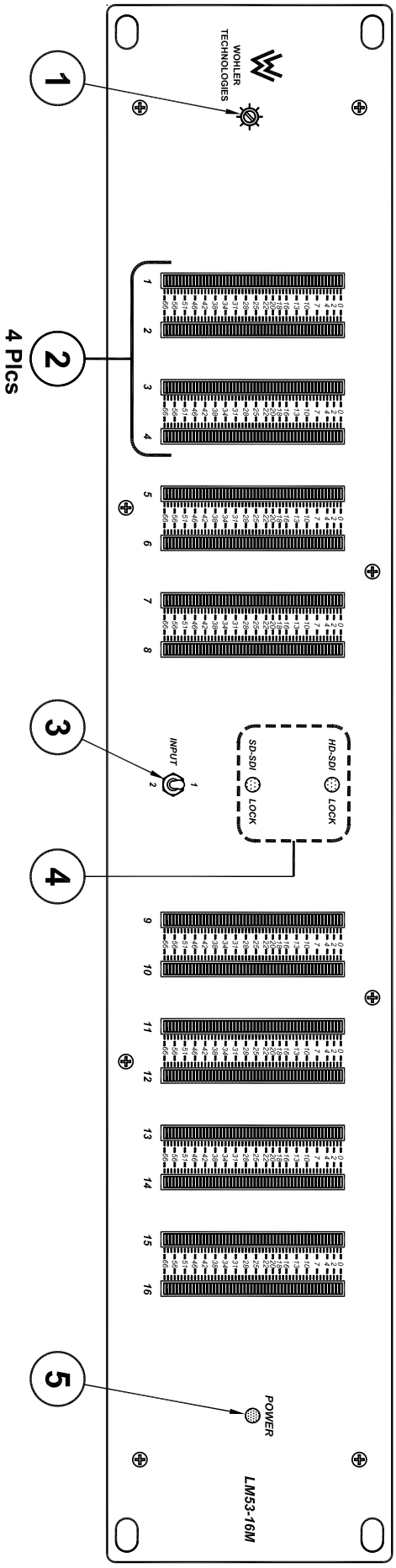


Figure-2a: LM Analog Series Front Panel Features

Rear Panel Features

Please refer to **Figure-2b** on the following page to familiarize yourself with the rear panel features of the **LM53-16M** units. The following sections describe these features and are referenced, by letter, to **Figure-2b**.

A Power Connector

Attach the supplied **IEC-320 power cord** between this connector and mains power (100 - 240VAC nominal, 50/60 Hz). The front panel **Power LED** (**Item 5**, page **8**) will glow GREEN to indicate operating voltages are present.

B SDI Input Connectors (IN 1 and IN 2)

These two BNC connector inputs are configured for **75 Ω** unbalanced connections and accept **HD-SDI** (High-Definition, 1.5 GB/s) *or* **SD-SDI** (Standard, 270 MB/s) digital audio signals. When an **SDI** input signal is locked, either the **SD-SDI Lock LED** or **HD-SDI Lock LED** (**Item 4**, page **8**) on the front panel will light up GREEN respectively, according to the signal type being monitored. The front panel **Input Source Select Switch** (**Item 3**, page **8**) is used to select which input will be monitored in the units **Level Meters** (**Item 2**, page **8**) and output from the **SDI Output Connector** (**Item C**).

C SDI Output Connector

This connector outputs a re-clocked copy of the **SD-SDI** or **HD-SDI** signal fed to the *selected* (**1** or **2**) **SDI Input Connector** (**Item B**).

D Rear Panel DIP Switch Modules (1-4, 5-8, 9-12, 13-16)

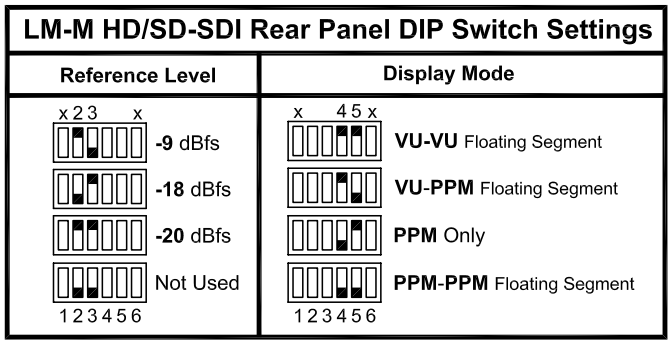
Each of four DIP switch modules is used to select the bargraph **Display Mode** and **Reference Level** for four of the bargraph displays. Each DIP switch module has, silk-screened next to it, the four channels it is associated with; the *lower-right* DIP switch module affects bargraphs **1-4**, the *upper-right* module affects bargraphs **5-8**, the *lower-left* module affects bargraphs **9-11**, and the *upper-left* module affects bargraphs **12-16**. See the descriptions and diagram below for setting information for these modules.

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 **-20 dBfs**. See diagam below for settings.

Bargraph Display Modes:

DIP switch sections **4** and **5** determine how peak levels are displayed for the four associated meters on the front panel. There are four possible settings; **VU Bargraph with VU Floating Segment**, **VU Bargraph with PPM Floating Segment**, **PPM Bargraph Only**, and **PPM Bargraph with PPM Floating Segment**. The factory default setting is **VU Bargraph with PPM Floating Segment**. See the diagram below for settings. See the **Level Meter Internal 10-Position DIP Switch Settings** diagram on page **14** for how to set the **Alternate Scales**, **Peak Hold**, **PPM Ballistics**, and **Phase Correlation** characteristics.



Note: DIP sections **1** and **6** are not used.

E OPTION Mode Select Switch

This recessed 10-position rotary switch sets the mode of operation. When set to position **0**, the unit is configured to download programing information throughthe **RS232 Connector** (**Item F**). When set to positions **1** through **9**, the unit will operate normally. See below for setting information.

Position	Function
0	Program Download
1-9	Operate

F RS232 Connector

This DB-9 connector is used for downloading programming information into the **919212 audio de-embedder**.

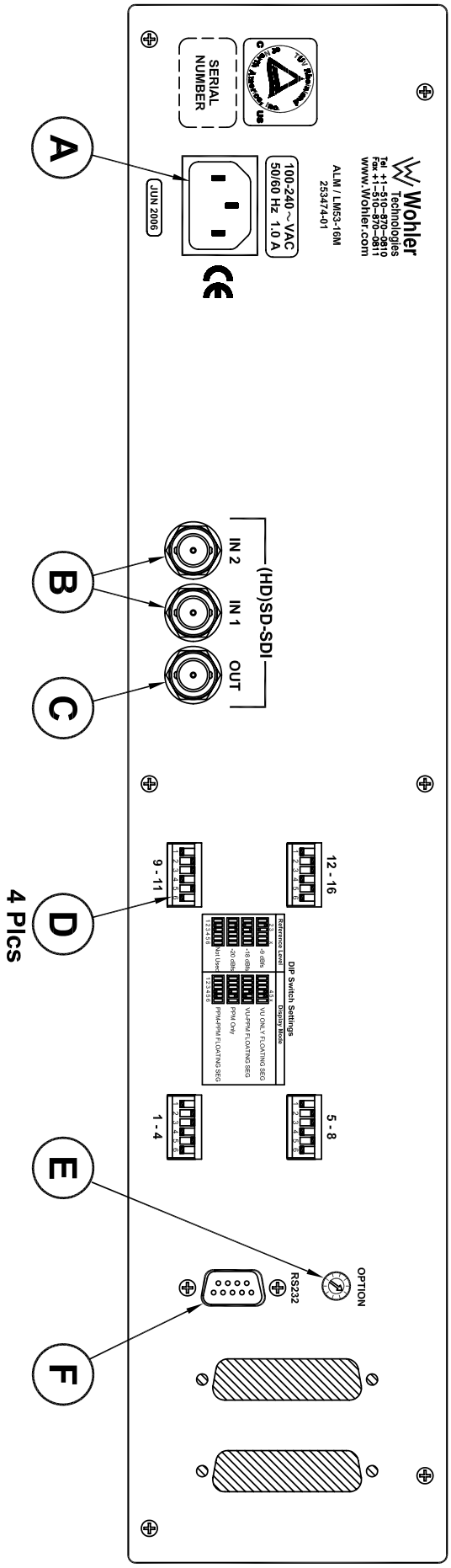


Figure-2b: Rear Panel Features

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Section 3

Technical Information

Level Meter Internal 10-Position DIP Switch Settings

Level Meter DIP Switch Locations

Level Meter Alternate Scales

Phase Correlation Indication and Labeling

LM53-16M Interconnect Block Diagram

Level Meter Internal 10-Position DIP Switch Settings

The 10-position DIP switches are accessed by removing the top cover of the **LM** unit and are located on the **919175** PCBs (the same PCBs on which the 6-position rear panel DIP switch module is located). See **Figure-3a**, page **15** for a diagram of the **919175** PCB and the DIP switch locations.

LM53-M SD/HD-SDI Level Meter Internal 10-Position DIP Switch Settings

Scale Selection	Peak Hold (Bargraph Display)	PPM Ballistics (Bargraph Display)
AES Scale (Standard **Digital**)	Peak Hold - **Manual** (See Note **2**)	IEC268-10, Type 1
NORDIC Scale	Peak Hold - **3 Second**	IEC268-10, Type 2
NOT USED	Peak Hold - **10 Second**	DIN 45406
DIN Scale	Peak Hold - **Off**	Single Sample Rise Time (SSRT)
VU Scale		
NOT USED		
BBC Scale		
NOT USED		

Phase Correlation Display

PC **Off** PC **On**

Notes:

1) Switch positions **1** and **10** are NOT used and should be left at the factory set position.

2) The **Peak Hold - Manual** setting allows the bargraph display meters to indefinitely maintain the peak hold value until it is reset by the operator by removing power and then reapplying power to the unit (unplugging/replugging power cord).

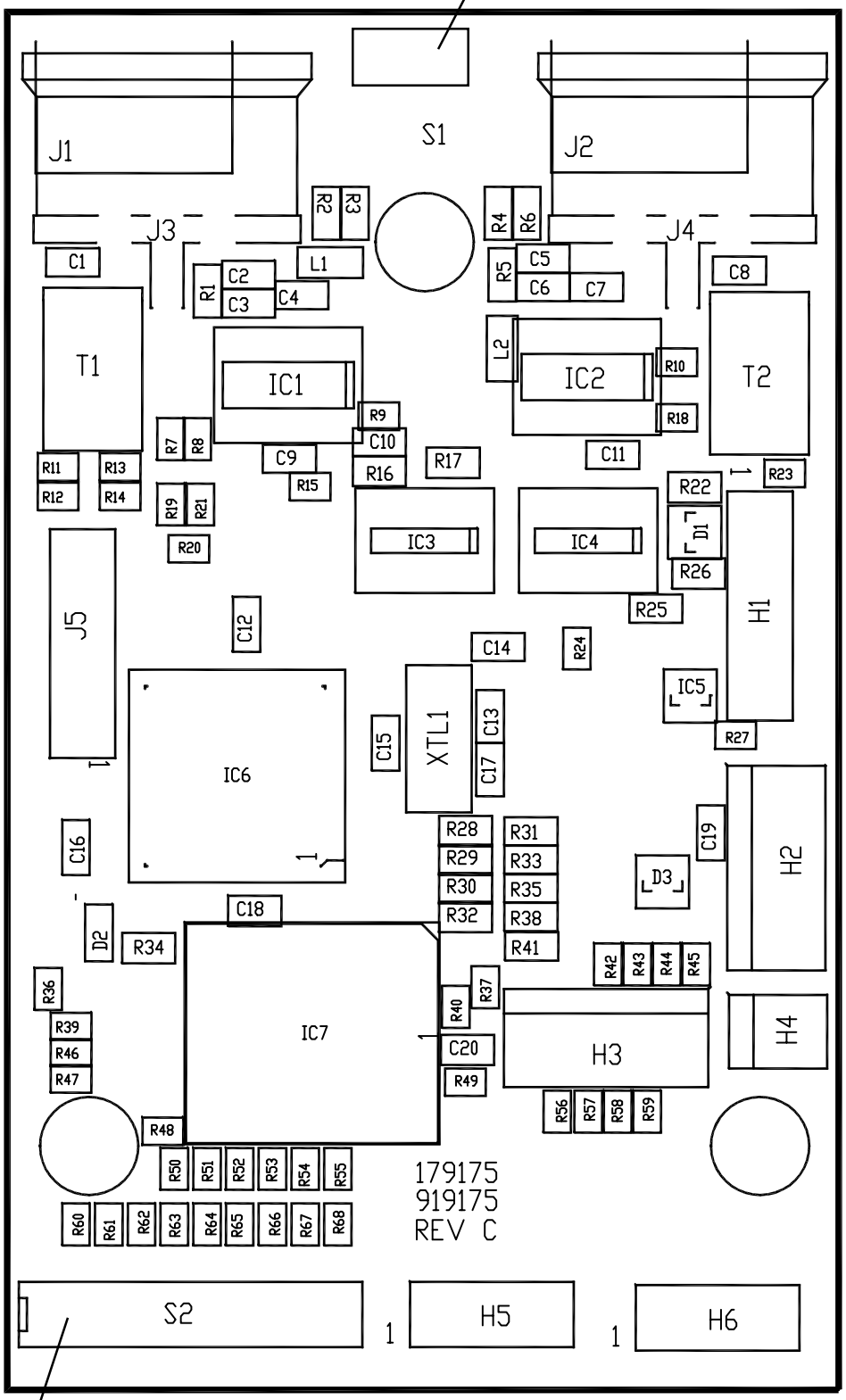
PPM Characteristics (Ballistics):

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. **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. The **PPM** characteristics available for selection using DIP switch sections **7** and **8** of the 10-position **Internal DIP Switch** (as shown in the above diagram) are as follows:

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)

Level Meter DIP Switch Locations

Rear Panel Level Meter 4-Position DIP Switch Module (see Item D, page 10)

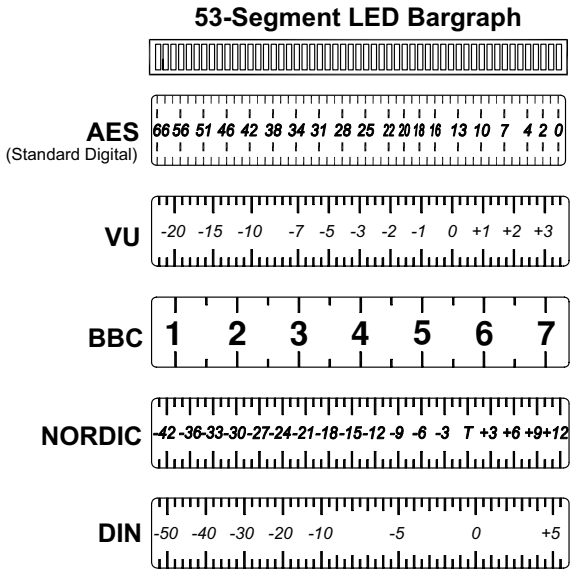


Internal Level Meter 10-Position DIP Switch Module (see page 14)

Figure-3a:
DIP Switch Locations on 919175 PCB

Level Meter Alternate Scales

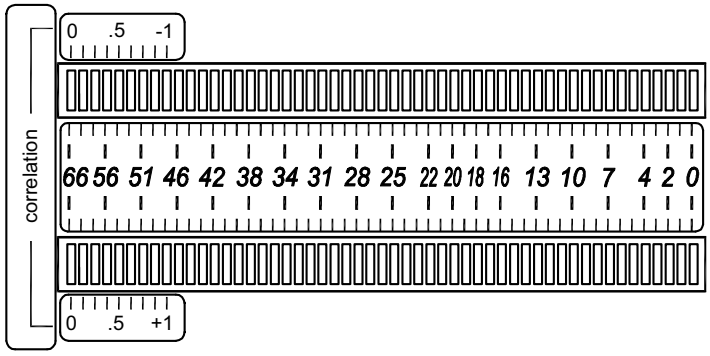
The standard scale used on the **LM53-16M** level meter unit is the **AES** scale. However, if alternate scale characteristics are selected for the level meters by setting the **Alternate Scale** DIP switches (see page **14**), it is recommended that a label with the appropriate scale be applied to the front panel LED bargraph level meters. Alternate scales include the **VU**, **BBC**, **NORDIC**, and **DIN** scales. See the diagrams below for **53**-segment alternate scales. Contact **Wohler Technologies** for more information about **Alternate Scale** labels.



Phase Correlation Indication and Labeling

Since it is sometimes helpful to observe phase relationships between two signals being monitored, a **Phase Correlation** feature can be implemented within the lower section of an existing bargraph pair in the **LM53-M Series** units. This feature may be turned ON and OFF by setting the **Level Meter Internal 10-Position DIP Swich** module (see page **14**). Below are illustrations of the level meter bargraphs with the **Phase Correlation** labels applied.

LM53 Horizontal Bargraph
with Phase Correlation Labels

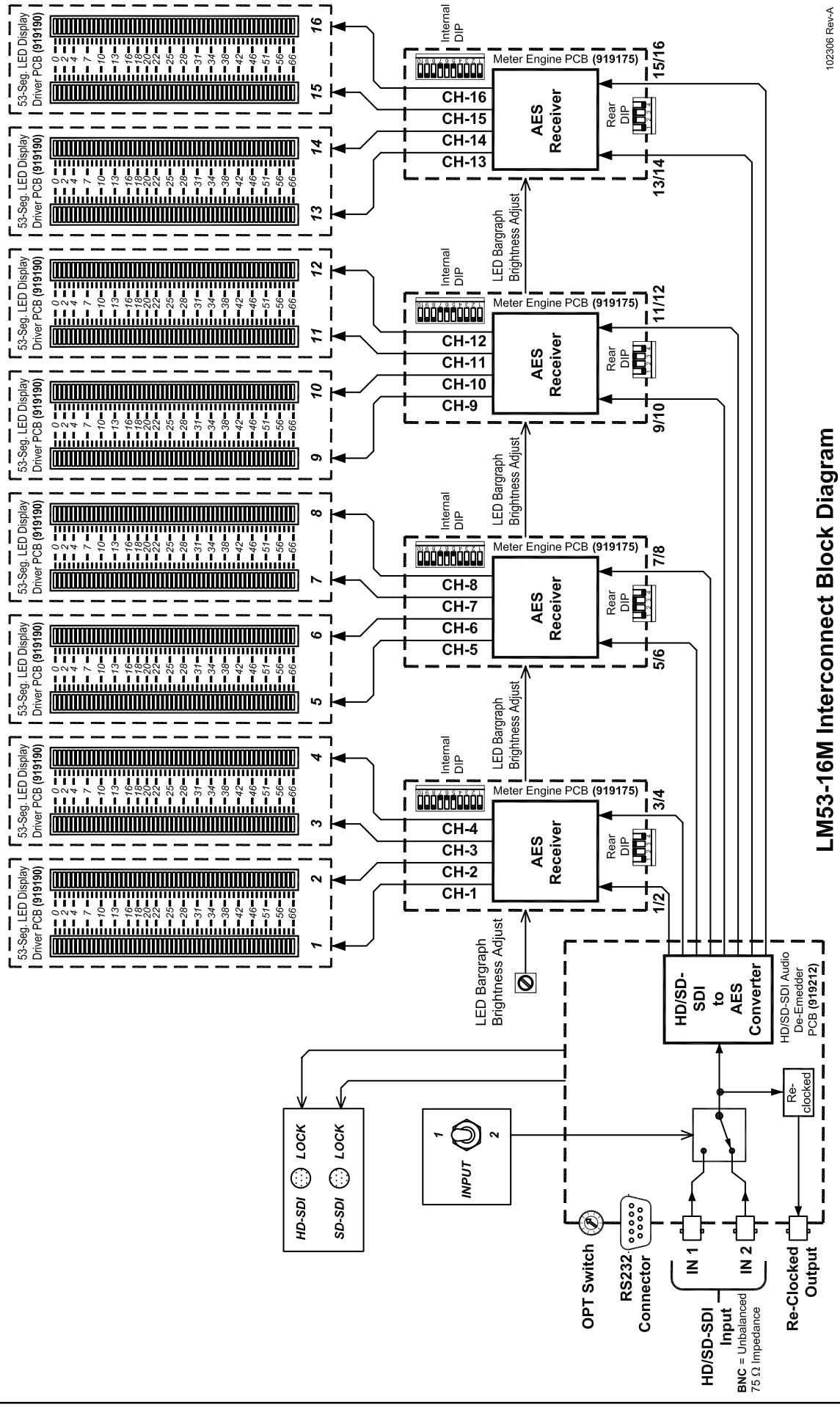


When the audio level in BOTH channels is high enough, the **Phase Correlation** display occupies the lower few segments of both bargraphs of a stereo pair. Behavior of the **Phase Correlation** indication is as follows:

Positive correlation = ascending AMBER bar in the *lower* (or *right*) bargraph
Negative correlation = ascending RED bar in the *upper* (or *left*) bargraph

The first nine (9) segments from the bottom (left-side on horizontal bargraphs) are used to indicate the phase correlation. One additional segment above the active correlation region is always OFF, to serve as a marker. The **Phase Correlation** display is visible ONLY so long as the VU audio level is above this blank segment (*tenth* from the bottom).

LM53-16M Interconnect Block Diagram



Wohler Technologies, Inc.
31055 Huntwood Avenue
Hayward, CA 94544
Phone: **(510) 870-0810** Fax: **(510) 870-0811**
US Toll-Free: **1-888-596-4537**
www.wohler.com support@wohler.com

e-mail: **support@wohler.com**