

**MSLV-120 and MSLV-220**  
1U or 2U Level Meter Units with  
20 Channels of Analog Bargraph Meters  
(Also Applies to MSH-4/6/8 Models)  
Document P/N 821503 Rev. C

CONTENTS

Introduction	1
Description	2
Specifications	3
Installation	4
Functional Specification	4
Power Supply	4
Level Meters	4
Level Meter Driver Circuit Descriptions	4-5
Level Meter Calibration DIP Switch Settings Diagram	6

This manual is specifically applicable to the "single-board" versions of the MSLV-120 and MSLV-220 (which include analog meters), which have been in production since the fall of 1997.

For information about any custom options, which are installed in the unit, please refer to the relevant separate addendum, which should be furnished with this manual.

You can now 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**

## INTRODUCTION

Congratulations on your selection of one of Wohler Technologies MSLV series of level meter monitoring products. They represent the best performance and value available, and we guarantee your satisfaction with them.

This section introduces the Wohler Technologies general product Instruction and Service Manual. In the next sections, "Description", "Features", and "Specifications" you will be introduced to the general description and specifications of the product. In the section "Installation" you will be provided with guidance as to installing this product into an audio monitoring system for optimum performance. The "Functional Specifications", "Power Supply", "Level Meters" and "MSLV-120 Level Meter Driver 919017M (LV-1) Circuit Description" sections detail the specific operating parameters and performance characteristics of this device. In Appendix A "Schematics and Layouts" you will find the electrical layout of the product, including all relevant PCBs. In Appendix B, "Parts Lists" you will be provided with a listing of all PCB and other associated electrical components.

Most, if not all, of the information in this manual is proprietary in nature, and copyright is reserved by Wohler Technologies. This manual is provided to legitimate end-users for their exclusive use.

Individuals or groups which are now, or in the future may be, involved in the manufacture of functionally similar products are expressly prohibited from having or using any of the proprietary information in this manual.

Please do not hesitate to write, phone, or FAX "Wohler Technologies" if you have any questions regarding this product or have comments or suggestions.

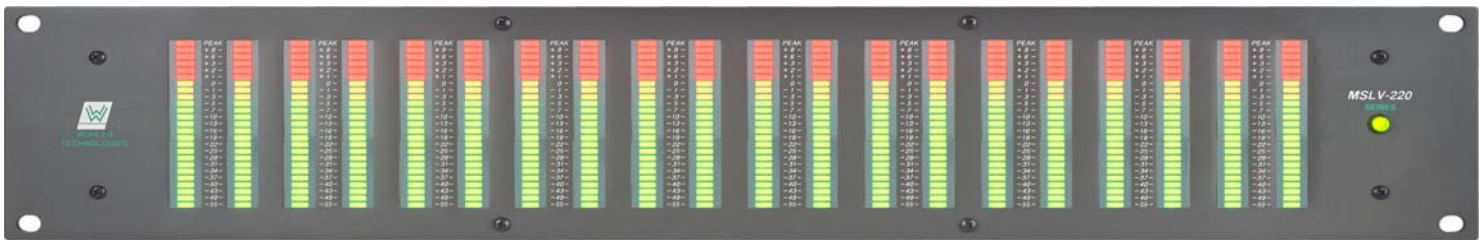
## MSLV-120 and MSLV-220

(Including MSH-4, MSH-6, and MSH-8)

### Multi-Channel Analog Level Meter Units



MSLV-120 Front Panel



MSLV-220 Front Panel

#### Description

The MSLV and MSH series of analog level meter monitoring units are an effective, high quality level monitoring solution. These series provide broadcast professionals with flexible and cost-efficient tools for monitoring and problem solving. These units allow operators of simple or complex systems to monitor multiple audio channels simultaneously and accurately. All rear panel connections are made with Phoenix-type, plug-in terminal blocks with screw clamp cable connections.

The MSLV series of analog level meter units is currently available in two standard configurations:

- 1) MSLV-120 (one rack) unit using twenty channels (10 pair) of 10-segment, tricolor analog (LV-1) bargraph meters.
- 2) MSLV-220 (two rack) unit using twenty channels (10 pair) of 25-segment tricolor analog (LV-25) bargraph meters.

The MSH series is currently available in three standard configurations:

- 1) MSH-4 (one rack) unit with four channels (2 pair) of 25-segment, tricolor analog (LV-25) horizontal bargraph meters.
- 2) MSH-6 (one rack) unit with six channels (3 pair) of 25-segment, tricolor analog (LV-25) horizontal bargraph meters.
- 3) MSH-8 (one rack) unit with eight channels (4 pair) of 25-segment, tricolor analog (LV-25) horizontal bargraph meters.

#### Features:

- **MSH-4/-6/-8 Series:**  
**Simultaneous monitoring of 2, 3, or 4 stereo pairs (4, 6, or 8 mono sources)**
- **MSLV Series: Simultaneous monitoring of 10 stereo pairs (20 mono sources)**
- **Balanced, bridging inputs on "Phoenix" style plug-in terminal blocks**

#### Analog Meters

- **DIP-switch selectable input calibration for accurate "0" indication at -6, 0, +4, and +8dBv.**
- **Switchable for VU or PPM indication**
- **Tricolor LED Indicators (Red, Amber, and Green)**



## INSTALLATION

The MSLV and MSH Series Level Metering Systems should be mounted where convenient for operating personnel, ideally at eye level for best visual monitoring.

The chassis is mechanically secured to the front panel at eight points along its surface. This feature reduces or eliminates rear bracing requirements in many mobile/portable applications. The weight of internal components is distributed as evenly as practical around the unit.

## FUNCTIONAL SPECIFICATION

The MSLV and MSH Series units are audio level monitoring systems. The MSLV-120 (1RU) unit consists of twenty 10-segment, tricolor analog (LV-1) bargraph meters while the MSLV-220 (2RU) unit consists of twenty 25-segment, tricolor analog (LV-25) bargraph meters. The MSH-4, MSH-6, and MSH-8 (1RU) units consist of four, six, and eight (respectively) 25-segment, tricolor analog (LV-25) bargraph meters which are horizontally mounted.

The multiple colored bargraph LEDs (red/yellow/green) provide level indication of the selected connected audio source. The MSLV and MSH models monitor Analog audio signals. Signal input is via Phoenix connectors on the rear panel.

## POWER SUPPLY

The MSLV-120 and MSH models are powered by an *external* Universal Input/24VDC/5VDC desktop power supply through a DC input connector at the rear panel. The MSLV-220 model is powered by an *internal* Universal Input/24VDC @ 2.9 Amp switcher power “brick” through an AC input IEC connector at the rear panel.

Each power supply provides all the power for normal operation. Since the opamp circuitry normally requires a split supply, a bias source is created at 1/2 the 24VDC level for proper opamp biasing.

## LEVEL METERS

The Level Meters, provided on the front panel, come as a set of one or two, (i.e. Left/Right or Source 1/2/3/4). On the MSLV-120 model the level meters (LV-1) represent audio levels of -3dB to -20dB in 10 increments and on the MSLV-220 the level meters (LV-25) cover the range of -3dB to -40 dB in 20 segments.

## MSLV-120 LEVEL METER DRIVER

### 919017M(LV-1) CIRCUIT DESCRIPTION

When installed in the MSLV (or MSH) series products, the 719017M meter driver input is configured for a true balanced input via differential amplifier IC1. Input level selection via S1 and S2 allow the PPM-1 to be configured to house standards of -6, 0, +4, or +8 dB=0 as indicated on the actual display. The input attenuator network consists of R1, R2, R3, R4, R11, R17, R18, and R19. The reference gain of the differential amplifier IC1a is set by R5 with IC5b set for a gain of one, to provide the “true balanced” input function. Bias for the input amplifier is provided by R6 and R7 and filtered by C6. The amplified signal (and its inversion) is coupled to half-wave rectifier IC2a and IC2b and associated components, via R10 (R15) and C7 (C9).

### RECTIFIER AND METER CHARACTERISTIC

The half-wave rectifiers function identically and in conjunction to provide full-wave rectification of the AC signal from the input amplifier. On negative excursions, D2 (D3) conducts to create a very low gain. On positive excursions D1 (D4) only conducts and feeds back through R16 (R27) to create a large gain (determined by the select resistors). During large signal excursions, C8 is charged via R14 (or R28). The time constant of this resistor-capacitor combination determines the attack time of the meter. When the signal drops or is removed, C8 discharges through R14, R16, and D1 (R27, R28, D3) the resulting time constant determines the decay time of the meter. By switching in additional RC (R21, C10) with S3, the attack is increased and the decay decreased to approximate VU characteristics. S4 is closed along with S3 to adjust the reference voltage to compensate for the voltage dividing effects of R21.

### LM3916 BARGRAPH DRIVER

The LM3916 is a 10-segment bargraph driver incorporating an internal reference supply and 10-step comparator resistor ladder. Pin 7 is the reference output and pin 8 the reference sense input. Approximately 1.25 volts is maintained between pin 7 and pin 8. R25 sets the current for the external reference network and the LED current which is about 10X the current taken from pin 7. Q2 buffers the reference supply from the internal resistor ladder the top of which is connected to pin 6 and the bottom to pin 4. The voltage across R25, R26, and P1 is the reference against which the rectifier output at pin 5 is compared. The meter is calibrated by adjusting P1. R23 sets the voltage at the bottom of the resistor ladder and the bias for the rectifier circuit.

## **MSLV-220 AND MSH LEVEL METER DRIVER 919055 (LV-25) CIRCUIT DESCRIPTION**

The LV-25 (919055) display driver circuit provides a total of 70dB of visual audio level indication. For the purposes of the following discussion, the circuitry is divided into seven sections:

1) The input buffer amp (IC2) passes a balanced (or unbalanced) input through a DIP switch selectable attenuator pad. A choice of four different reference levels, -6, +4, and +8 dB for the 0dB indication is available. A chart showing the attenuator settings can be found on the schematic and on the rear panel of the MSLV units.

2) The differential outputs from the input buffer amp drives two half-wave rectifier circuits (IC3). The outputs from the rectifier stages are combined and presented to two different filter circuits that generate both PPM (IC3b) and VU (IC4) characteristic signals.

3) When section 4 of S1 is open, the PPM signal drives the display circuitry. This signal is created by IC5b and associated circuitry. A positive signal from the rectifiers causes the opamp output to go high turning on Q1. This changes C12 through D12 and a resistor (R26). When the signal level decreases, Q3 turns off and C12 discharges through R26, R23, and D9 to the opamp output.

4) Closure of section 4 of S1 allows the VU signal to override the PPM signal. The VU signal is generated by IC4b, IC5a, and associated components with section 4B providing buffering and DC offset adjustment (and an 8dB boost with closure of S3), and section 5A configured as an active filter to average the rectified signal.

5) The signal (PPM or VU) directly drives the LM3916 which drives the upper bargraph display. IC1a provides an additional 16dB of gain to the lower bargraph display driver (LM3915). IC7D1 provides the reference supply to both display drivers. R1, R43, and P4 set display brightness. Pins 6 and 4 are the top and bottom connections to the reference dividers inside the display drivers. Refer to National Semiconductor Linear data books for a detailed discussion of the LM3915 and LM3916 bargraph display drivers.

6) IC4a is configured as a comparator set at 6dB above "0" to drive the topmost segment of the upper bargraph display. It is driven directly from the input stage (IC3) through two diodes (D1 and D2) to charge up C13 for peak hold indication (LED1).

7) The gain of IC1b is switched from 6 to 36 dB when the input level is below the top five segments (-1). Both FETs are "ON" via IC6c sense on segment 6 of bargraph "1", so gain of IC1b is much higher feeding IC7. IC7 operates the bottom four segments in the -55 to -40 range (bottom two are OR'ed for wider input range). IC7 also operates the top 3 segments below peak, to prevent their coming on when the level is somewhat above bottom four (>-40). Q3, D12, and D13 shunt the drive from IC7. When the input is much higher (near the operating range for the top segments) the FETs are switched "OFF", so that IC7s thresholds are moved up to the range of the top segments, and shunt suppression is disabled. To ensure transparency of operation, the transition is made at a level well above the operating range for the lower segments, but also below the operating range of the top segments.

## MSLV-120 (RU1) 919017M (LV-1) Level Meter DIP Switch Settings

### Level Meter Calibration

S1 - Open = -6 dB  
S2 - Open

S1 - Open = 0 dB  
S2 - Closed

S1 - Closed = +4 dB  
S2 - Open

S1 - Closed = +8 dB  
S2 - Closed

### Level Meter Ballistics (PPM or VU Mode)

S3 - Open = PPM Mode  
S4 - Open

S3 - Closed = VU Mode  
S4 - Closed

Below is a graphic representation of the 8 possible DIP switch settings for both the reference level (dB) and ballistics (VU or PPM) characteristics of the 919017M meter driver PC board.

<p>← CLOSED ← OPEN →</p> <p>S1 } } -6 dB S2 } } PPM S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } 0 dB S2 } } PPM S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } +4 dB S2 } } PPM S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } +8 dB S2 } } PPM S3 } } S4 } }</p>
<p>← CLOSED ← OPEN →</p> <p>S1 } } -6 dB S2 } } VU S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } 0 dB S2 } } VU S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } +4 dB S2 } } VU S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } +8 dB S2 } } VU S3 } } S4 } }</p>

## MSLV-220 (RU2) 919055 (LV-25) Level Meter DIP Switch Settings

### Level Meter Calibration

S1 - Open = -6 dB  
S2 - Open

S1 - Open = 0 dB  
S2 - Closed

S1 - Closed = +4 dB  
S2 - Open

S1 - Closed = +8 dB  
S2 - Closed

### Level Meter Ballistics (PPM or VU Mode)

S3 - Closed = PPM Mode  
S4 - Open

S3 - Closed = VU Mode  
S4 - Open

Below is a graphic representation of the 8 possible DIP switch settings for both the reference level (dB) and ballistics (VU or PPM) characteristics of the 919055 meter driver PC board.

<p>← CLOSED ← OPEN →</p> <p>S1 } } -6 dB S2 } } PPM S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } 0 dB S2 } } PPM S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } +4 dB S2 } } PPM S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } +8 dB S2 } } PPM S3 } } S4 } }</p>
<p>← CLOSED ← OPEN →</p> <p>S1 } } -6 dB S2 } } VU S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } 0 dB S2 } } VU S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } +4 dB S2 } } VU S3 } } S4 } }</p>	<p>← CLOSED ← OPEN →</p> <p>S1 } } +8 dB S2 } } VU S3 } } S4 } }</p>

## MSLV-120 and MSLV-220 Level Meter DIP Switch Settings