

MP-2 Microphone Preamplifier

User Guide and Technical Information



General Description

The MP-2 from Sound Devices is a studio-quality two-channel, portable, stereo microphone preamplifier. With its impressive audio performance and comprehensive list of features including headphone monitoring, metering and MS Matrix, the MP-2 is a flexible front end device for professional studio and field applications. Studio,

location, and live music engineers value the compact size and ability to withstand extremes in the field. The MP-2 combines rugged mechanical and electronic construction, compact size, and high-quality components. The MP-2 allows no-compromise performance for any application.

Features

High Performance Microphone Inputs

- Maximum of 66 dB of gain per input.
- Premium Lundahl input transformers provide superior sonic quality and freedom from interference problems.
- Sealed, conductive plastic potentiometers for long-life, reliable gain adjustment.
- Phantom power, selectable between 48-volts and 15-volts.
- High-pass filters with 80 or 160 Hz corner frequencies, 6 dB per octave. Filters are inserted prior to any active circuitry for extra high headroom.

Audio Performance

- Dynamic range exceeding 110 dB.
- 10 Hz to 50 kHz audio bandwidth.
- Exceptionally low distortion characteristics.
- Discrete 6-transistor balanced output drivers provide robust drive for long cable runs.

Headphone Monitoring

- High current headphone monitor circuit enables monitoring of program audio or external stereo tape return audio.
- Headphone level control and peak-indicator.

Level Metering

- Sunlight-readable seven-segment GaN LED output meters.

- Three-position LED brightness switch.
- Two-color LEDs per input channel indicate clipping and limiter activity.

M/S Stereo Matrix

- MS stereo decoder assigned to headphones, or headphones and outputs.
- Allows for flexible post-production processing.

Audio Limiters

- "Unclippable" input peak limiters via two-stage opto-isolator circuit with adjustable limiter threshold (per input).
- Dual mono or linked stereo limiter operation.

Flexible Powering

- Internal battery-power from two AA batteries with easy access battery compartment.
- Chassis-isolated 5 to 18 VDC input for easy external DC powering.
- Power LED indicates low battery power.

Trouble Free Design

- High strength, extruded aluminum chassis with protective metal end panels withstands punishing field conditions.
- All-metal connectors solidly mounted to the chassis for durability and RF immunity.
- Free from "Pin 1" grounding problems.
- RF filtering on all inputs and outputs.

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Specifications

Gain:

Mic Input to Output, per channel, continuously variable

Output	Gain Range
LINE	16 – 66 dB
TAPE	6 – 56 dB

Frequency Response (see graph below):

20 Hz – 30 kHz, +0.1, -0.5 dB

-1 dB at 5 Hz, 50 kHz

(relative to 1 kHz level with 150 ohm source, gain controls set at 50%)

Equivalent Input Noise:

-126 dBu (-128 dBV) minimum

(150 ohm source, flat weighting, 22 – 22 kHz bandwidth, gain control set at 50% or higher, phantom power off)

Input Clipping Level:

-10 dBu minimum, phantom off

0 dBu minimum, phantom on

Output Clipping Level:

Line

+22 dBu minimum with 100k ohm load

+20 dBu minimum with 600 ohm load

Tape

+11 dBu (2.75 V RMS) minimum with 100k ohm load

Dynamic Range:

110 dB minimum

THD + Noise:

0.05% maximum

(from 50 Hz to 22 kHz @ +4 dBu output level, 22 Hz - 22 kHz filter bandwidth, gain control at 50%, phantom off)

Common Mode Rejection Ratio:

100 dB minimum at 80 Hz

60 dB minimum at 10 kHz

Channel Separation:

Greater than 80 dB at 1 kHz (gain controls set to 50%)

Inputs:

Transformer-balanced, 2k ohm input impedance

Outputs:

XLR

Active, impedance-balanced, 120 ohm output impedance

Tape (3.5 mm)

Unbalanced, tip-left, ring-right, sleeve-ground, 2.4k ohm output impedance

High Pass Filters:

80 Hz or 160 Hz (switch selectable), 6 dB per octave

Phantom Power:

15 V through 680 ohm resistors or 48 V through 6.8k resistors (switch selectable)

Limiters:

Thresholds independently adjustable from -10 dBu to +18 dBu

10:1 limiting ratio

5 mS attack time, 100 mS release time

Amber/Red LED indicates limiting/clipping

Dual mono or stereo linked

Internal Voltage Rails:

+15 V and -15 V, regulated

Metering:

7 segment GaN (Gallium Nitride) meter with three levels

Peak responding

Power:

Internal

2 AA alkaline batteries, 6 hours life typical with +4 dBu signal into 600 ohms, no phantom power

External

5 - 18 VDC via threaded coaxial connector (5.5 mm outer diameter, 2.1 mm inner diameter)

Pin positive, sleeve negative (50 mA min. at 12 VDC)

Voltages above 14 VDC cause no damage to unit, but will open an internal poly fuse. Poly fuse will reset when voltage is removed.

Power LED:

Green indicates power and good battery.

Red indicates power and low battery. LED turns red when approximately 1 hour of battery life remain (with phantom power off).

Green with external DC power.

Polarity:

All inputs to all outputs, non-inverting. Pin 2 of XLRs "hot" to unbalanced inputs and outputs.

Operating Temperature Range:

0 to 70 degrees C

32 to 160 degrees F

Dimensions:

43 mm x 94 mm x 140 mm (h x w x d)

(1.7" x 3.7" x 5.5")

Weight (unit only):

0.8 kg

2.0 lbs.

Weight (packaged):

1.2 kg

3.0 lbs.

Certifications:

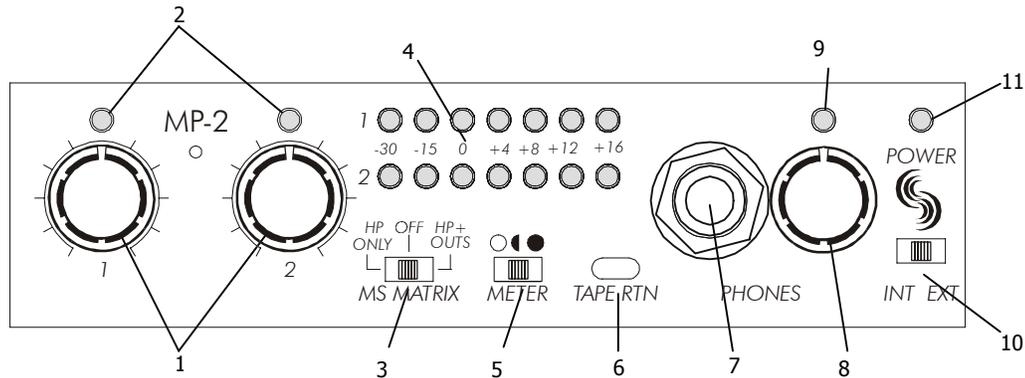
Meets FCC Part 15 Class B

Eligible to bear CE mark (see conformance statement)

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Front Panel Controls, Connectors, and Indicators

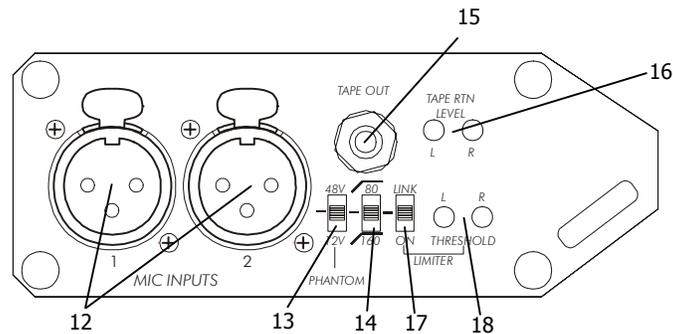


- 1. Gain Controls**
Adjusts the input gain from 16 to 66 dB via sealed, conductive plastic rotary potentiometers.
- 2. Input Peak/Limiter LED**
Two-color LED illuminates red at 3 dB below clipping; illuminates amber to indicate limiter activity.
- 3. M/S Stereo Matrix Switch**
Three-position switch assigns the MS decoder. Left position decodes M/S to the headphones, center position is off, and right position is M/S decoding to the headphones and outputs (Line Outputs and Tape Out). Connect Mid signal to Input 1, Side signal to Input 2.
- 4. Output Meter**
Indicates peak output level in dBu appearing at the left and right outputs.
- 5. Meter Brightness Control Switch**
Three-position switch adjusts the intensity of illumination of the output meter; low illumination, normal illumination, or super-bright illumination.
- 6. Tape Return Switch**
Toggle switch allows external audio to be monitored in the headphones. The center position is MP-2 program audio. The left and right positions monitor tape return audio; the left position is locking, and the right position is momentary.
- 7. Headphone Connector**
Accepts stereo and mono headphones with 1/4" connectors.
- 8. Headphone Volume Control**
Adjusts the level in the headphones.
- 9. Headphone Peak LED**
Illuminates 3 dB before clipping of either channel of the headphone circuit. Also illuminates 3 dB before clipping of either channel of Tape Return audio.
- 10. POWER Switch**
Three-position switch selects the power source. The unit is powered from internal batteries when in the left position; powered from external DC source when in the right position. Center position is off.
- 11. POWER LED**
Two-color LED illuminates green when the unit is powered and changes to red when batteries require changing. For external DC, the power LED is always green.

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Input Panel Connectors and Controls



12. MIC INPUTS

Transformer-balanced XLR inputs accept microphone level signals. Pin 2 = hot, pin 3 = cold, pin 1 = ground.

13. PHANTOM Power

Three-position switch selects either 48-volt or 15-volt phantom power for both inputs. Center position turns phantom power off.

14. High Pass Filter Switch

Three-position switch selects 80 Hz or 160 Hz corner frequency filters, 6 dB per octave. Filters affect both inputs. Center position of switch removes filters from the signal path.

15. Tape Output

3.5 mm TRS stereo output (unbalanced) can be used to feed consumer level DAT, MiniDisc, and CD recorders. Tip = left, ring = right, sleeve = ground.

16. Tape Return Level Control

Recessed potentiometers adjust Tape Return level feeding the Headphone Monitor.

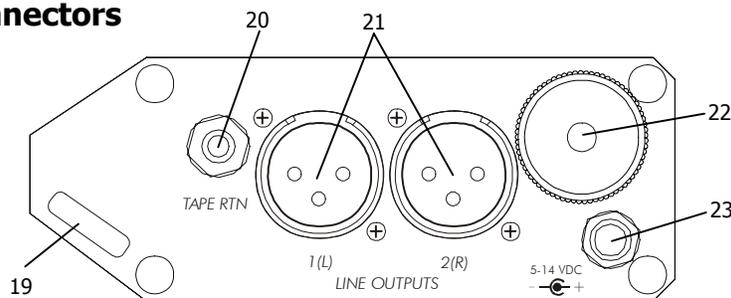
17. Limiter Switch

Activates input peak limiter. ON position functions as a dual mono limiter, with each input signal controlling its own limiter. LINK functions as a stereo limiter, with both left and right inputs controlled simultaneously. Center position of switch turns limiter off.

18. Limiter Threshold Level Control

Recessed potentiometers adjust peak level of limiter activation. Can be independently controlled for each input.

Output Panel Connectors



19. Strap Slot

Attachment point for camera straps.

20. Tape Return Input Connector

3.5 mm TRS stereo (unbalanced) connector allows external audio sources to be monitored in the MP-2 Headphone circuit. Tip = left, ring = right, sleeve = ground.

21. Left and Right Line Level Outputs

Active-balanced XLR line-level outputs. +22 dBu peak output level. Pin 2 = hot, pin 3 =

cold, pin 1 = ground. Pin 3 can be grounded or ungrounded to drive unbalanced inputs.

22. BATTERY Compartment

MP-2 operates on two AA batteries. Insert positive (+) end of batteries first.

23. External DC Power Input

Accepts external DC power source (battery supply or AC to DC transformer) from 5 - 18 VDC. Locking, threaded coaxial connector. Center pin = positive, sleeve = negative.

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Operational Notes

Input Circuitry

The isolation characteristics of transformers are superior to other balancing techniques for the adverse and uncontrolled environments of field production. Input transformers provide complete galvanic isolation from the source, meaning there is no direct electrical connection. Signals are "transformed" magnetically. The MP-2 features expensive Lundahl input transformers, which are unparalleled in sound quality. Lundahl input transformers use premium magnetic core material and advanced winding techniques to achieve high signal handling capability and flat frequency response while keeping distortion to a minimum. Because of their inherently high common mode impedance, transformers are unrivaled by any other type of input for common-mode noise rejection.

Output Circuitry and Tape Output

Each line level XLR output of the MP-2 uses a discrete, six-transistor, "impedance balanced" output stage. The circuit uses oversized, high speed transistors to achieve low-distortion, robust line driving capability. Pin 2 is driven with signal, and pin 3 is not. [A common misunderstanding is that a "balanced" output refers to equal and opposite signals on pins 2 and 3. Correctly, "balanced" refers to equal *impedances* from each signal (pin 2 and pin 3) to ground, *not the signal voltage.*] To drive unbalanced inputs, pin 3 can be grounded or left unconnected. There is no change in signal level driving balanced or unbalanced inputs.

The Tape Output is designed to feed consumer level devices, such as computer sound cards, DAT or MiniDisc recorders, and cassette recorders. A cable wired with 3.5 mm TRS to 3.5 mm TRS or, 3.5 mm TRS to Left/Right phono (RCA) connectors, is useful when directly connecting the MP-2 to portable consumer audio electronics.

Phantom Power

Microphones requiring phantom power should use the lowest voltage acceptable to maximize MP-2 battery life. Condenser microphones that can operate on phantom voltages from 11-52 volts will not have a performance benefit with 48-volt phantom; therefore 15-volt phantom is appropriate. The 15-volt setting will increase battery life versus the 48-volt setting.

Microphones requiring 48-volt phantom will not operate, or may operate with lower headroom and increased distortion at the 15-volt setting; therefore use 48-volt phantom for these mics. Consult your microphone documentation.

Dynamic microphones do not require phantom power. A properly connected balanced, dynamic microphone will not be affected by the presence of phantom power nor will it draw any current. However, it is good practice to turn phantom power off when not needed. Poor or incorrectly wired microphone cable can cause audible artifacts in microphone signals. Some wireless receivers outputs are adversely affected by the presence of phantom power, therefore, consult the wireless receiver documentation.

High Pass Filter

The two-position high pass (low cut) filter in the MP-2 is useful for removing excess low frequency energy in audio signals. This excess energy can be caused by multiple sources, including wind noise, vibration, unidirectional proximity effect, or high ambient noise levels. The 80 Hz position is appropriate when recording general speech, music, and ambient sound. The 160 Hz position is useful to enhance speech clarity. The MP-2 high pass circuit topology is unique in that the filters are placed immediately after the input transformer, *before* any active gain circuitry. This gives the MP-2 higher headroom with low frequency signals, as the low frequency signals are not amplified before they are removed, as in most other designs. The high pass filter is a single pole design (slope of 6 dB per octave) and uses high quality film capacitors for very low distortion. The high pass filter switch controls both inputs. The center position of the switch removes the filter from both audio paths.

When possible, attempt to equalize at the sound source with microphone selection, use of windscreens, shock mounts, microphone placement, and onboard microphone filtering. Multiple high pass filters (filters on microphones and on the MP-2) will give an additive effect, increasing the slope of the filter.

M/S Stereo Matrix

Mid/Side stereo recording is an often used stereo technique for live music and sound effects applications. With the implementation of the 5.1

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audio specification for DTV, M/S stereo is often used to capture stereo ambience.

The *HP ONLY* position routes M/S decoded signal to the headphones, while sending unaffected Mid and Side signals to the outputs. This allows the flexibility of decoding later in post production while monitoring in stereo to optimize microphone placement. The *HP + OUTS* position can be used to decode directly to the Line Outputs, Tape Out, and Phones for decoding on location. The width of the stereo image can be varied by changing the gain of the Side (Input 2) signal relative to the Mid (Input 1) signal. More side signal relative to the mid signal widens the stereo image. Mono compatibility is maintained with M/S stereo.

Headphone Monitoring and Tape Return

Headphone monitoring is an essential need in production audio. The MP-2 enables monitoring of program (mixer) audio or a second audio source. In normal operation the headphones monitor the output bus directly. Using the Tape Return input, a second audio source can be monitored in the headphones. This is useful to verify that signal is reaching cameras and tape machines. The three position Tape Return switch on the front panel selects the audio source being monitored. The left and right positions monitor the tape return audio. Left is locking, and right is momentary. The center position monitors the Left and Right outputs of the MP-2. As the MP-2 can drive headphones to very high levels, care should be exercised when monitoring.

Limiters

The MP-2 has two built-in peak responding limiters, one for each input channel. The three-position LIMITER switch on the input panel activates both channels limiters. Each limiter in the MP-2 is a two-stage circuit; the first stage keeps the input gain stage from clipping; the second stage limits the variable gain stage to the level set by the Limiter Threshold control. This unique two stage topology limits the gain stage directly after the mic input transformer, to make the front end virtually "unclippable", but does not change the input impedance as other "at the mic" limiters do. The circuit enables the MP-2 to limit, when necessary, in excess of 50 dB, making it very difficult to clip the unit no matter the gain setting.

The three-position Limiter switch can be set to operate in either dual mono or stereo linked

operation. Dual mono operation (ON switch position) allows each input to limit independently, responding only to its input signal. Stereo linked operation (LINK switch position) connects both limiters, ensuring that the limiters control both channels identically. This linking is important for stereo operation to maintain a proper stereo image. When the limiters activate, the Peak/Limiter LED on the front panel illuminates amber in proportion to the amount of limiting for each channel.

Metering

Above each input gain control is a two-color LED that illuminates red when the input approaches clipping (3 dB before clipping). This clip circuit monitors both the front end gain stage and the variable gain stage. If the audio signal clips anywhere, this LED will show it. Above the headphone level control, the headphone clip LED shows when either channel of the headphone circuit is nearing clipping level. The headphone clip LED also shows when either channel of the tape return audio is nearing clipping level. Between these three clip indicators, any clipping, anywhere in the mixer will be seen before it is heard.

When the limiter is activated, the input LED's illuminate amber in proportion to limiting action.

The MP-2 has a highly visible, seven segment LED output meter. The meter is peak responding, showing the instantaneous output level in dBu. Peak readings are essential when the outputs feed digital devices. The meter uses expensive Gallium Nitride (GaN) LED's which allow for excellent viewing (with minimal current draw) under all lighting conditions, including direct sunlight. The front panel Meter Brightness switch controls the meter brightness (low, normal, or super-bright). The meter indicates a signal range of 46 dB. From left to right the first three LED's are separated by 15 dB and the next four LED's are separated by 4 dB. This calibration provides a large dynamic range with good resolution in the critical signal level range.

Power Sources

The MP-2 is designed to operate from two internal AA alkaline cells for approximately 6 hours with typical signal levels (without phantom power). External DC sources such as AC to DC transformers and external battery supplies can also power the MP-2. Because of its regulated power supply

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circuitry, audio performance does not change depending on battery or external DC voltage.

The external DC input supply is galvanically isolated (floating) from the chassis and the rest of the circuitry. The isolation provides trouble free interconnection to other pieces of equipment sharing the same DC power source. The center pin of the locking DC connector is positive, and the sleeve is negative. As the external DC supply is floating, the positive or the negative can be connected to the chassis with no adverse effects.

Battery Life

Two factors determine battery life - battery power and current draw.

Battery Power

For internal power the MP-2 uses two AA sized 1.5-volt batteries. Different batteries have different power capacities depending on their battery chemistry, age, operational temperature, and amount of current being drawn. Alkaline cells are a popular and cost-effective battery type. Lithium cells have higher power per cell with higher current draws and yield significantly longer battery life, at a cost premium. AA carbon cells and AA nickel-cadmium cells are not recommended internal battery types in the MP-2 since these batteries have lower power capacity than other types and will result in very short service life. Temperature has a significant effect on the life of batteries. Lithium batteries are significantly better than alkaline batteries at lower temperatures.

Current Draw

The MP-2 can vary significantly in the amount of current it draws. Several functions of the MP-2 directly affect current draw in different ways. The following list highlights the larger current drawing functions. (listed from highest to lowest current draw).

1. *Phantom power*– the main source of extra MP-2 current draw. (See Phantom Power) 48V Phantom can draw copious amounts of current out of the batteries depending on what model microphone is used. Two phantom powered microphones draw twice as much current as one. Microphones vary widely in their current draw depending on type and phantom voltage applied.
2. *Headphone output circuit* – high headphone output levels increase current draw.
3. *Meter illumination intensity* – higher meter brightness increases current draw. The meter can be switched to low for battery conservation.
4. *Output drive level* – higher output drive levels into low impedance inputs increases current draw.

Experimentation is recommended to determine battery life for each individual setup and application. The chart below can be used as a starting point to estimate battery life.

<i>Battery Type</i>	<i>Microphone Type</i>	<i>Battery Life</i>
Eveready AA No. L91 (lithium)	2 dynamic handheld microphones, low meter, no headphones	11 hrs.
Duracell AA MN 1500 (alkaline)	2 dynamic handheld microphones, low meter, low headphones	6 hrs.
Duracell AA MN 1500	2 condenser, 12-volt phantom powered microphones, normal meter intensity, normal headphone drive level	4 hrs.
Duracell AA MN 1500	2 studio condenser, 48-volt phantom powered microphones, super bright meter intensity, cranking headphones	2 hrs.

(Test conditions: 70 degrees F, 42 dB of gain with an acoustic music source, 600 ohm load, +4 dBu output)

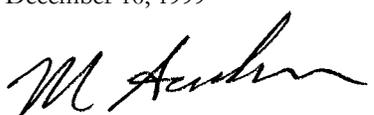
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FCC Statement

This device has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

CE Conformity Statement

Declaration of Conformity According to ISO/IEC Guide 22	
Manufacturer's Name:	Sound Devices, LLC
Manufacturer's Address:	Sound Devices, LLC 300 Wengel Drive Reedsburg, WI 53959 USA
declares that the product:	MP-2 Professional Microphone Preamplifier
is in conformity with:	
<i>Document No.</i>	<i>Description</i>
EN55103-1 (1997)	Emissions standard for product family audio devices for professional use
EN55103-2 (1997)	Immunity standard for product family audio devices for professional use
EN55022 (1995)/ CISPR 22 (1997)	Radiated and Conducted emissions, Class B
EN61000-4-2 (1995)/ IEC1000-4-2 (1995)	ESD – 6kV contact, 8kV air-discharge
EN61000-4-3 (1995)/ IEC1000-4-3 (1995)	Radiated RF Immunity, 10 V/m, 80% 1 kHz amplitude modulation
EN61000-4-4 (1995)/ IEC1000-4-4 (1995)	EFT/Burst, I/O lines, +/- .25 kV to +/- 1.0 kV
EN61000-4-6 (1996)/ IEC1000-4-6 (1996)	Conducted RF Immunity, 10 V, 80% 1 kHz amplitude modulation
Tested by:	L. S. Compliance, Inc. Cedarburg, Wisconsin
December 16, 1999	
	
Matthew Anderson Director of Engineering	

Warranty

Sound Devices, LLC warrants the MP-2 Microphone Preamplifier against defects in materials and workmanship for a period of ONE (1) year from date of original retail purchase. This is a non-transferable warranty that extends only to the original purchaser. Sound Devices, LLC will repair or replace the product at its discretion at no charge. Warranty claims due to severe service conditions will be addressed on an individual basis. THE WARRANTY AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. SOUND DEVICES, LLC DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SOUND DEVICES, LLC IS NOT RESPONSIBLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING FROM ANY BREACH OF WARRANTY OR UNDER ANY OTHER LEGAL THEORY. Because some jurisdictions do not permit the exclusion or limitations set forth above, they may not apply in all cases.

For all service, including warranty repair, please send the MP-2, along with proof of purchase date to:

Sound Devices, LLC
Service Repair
300 Wengel Drive
Reedsburg, WI 53959 USA