

MX399

SoundPro
Microphone Multiplexer
Operation and Application Manual



SENCORE

3200 Sencore Drive, Sioux Falls, SD 57107

WARNING

Please observe these Safety Precautions

There is always a danger present when using electronic test equipment.

Unexpected voltages can be present at unusual locations in defective equipment and distribution systems. Become familiar with the equipment with which you are working, and observe the following safety precautions.

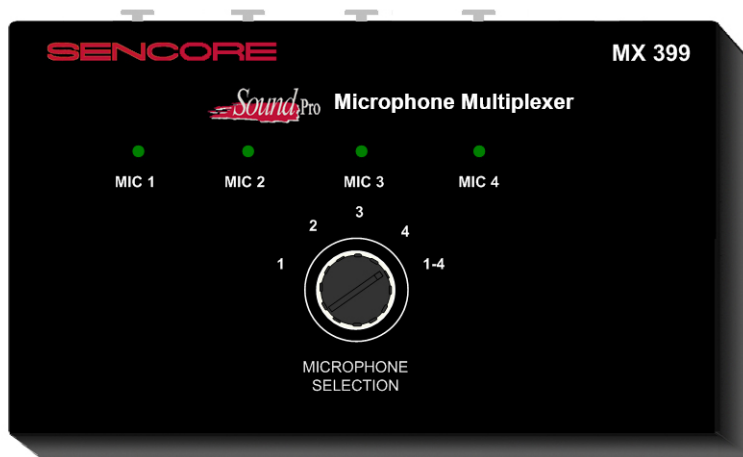
Every precaution has been taken in the design of the MX399 to insure that it is as safe as possible. However, safe operation depends on you, the operator.

1. **Never exceed the limits of the MX399** as given in the specification section or other special warnings in this manual.
2. **Always be sure that your equipment is in good working order.** Broken or frayed test leads or cables can be dangerous, exposing you to circuit voltages.
3. **Remove test leads** immediately following measurements to reduce the possibility of shock.
4. **Do not work alone when working under hazardous conditions.** Always have another person available in case of an accident.
5. **Never assume that a cable shield is at earth ground potential.** Both static and electrical voltages can be present on a cable's sheath.
6. **Always follow standard safety procedures.**

When in doubt, be careful.

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Description

Introduction

The MX399 Microphone Multiplexer is the perfect companion to the Sencore SP395 or SP495 SoundPro Audio Analyzers to help test, adjust, and document the acoustically averaged frequency response of cinema theaters, home theaters, churches, halls, banquet rooms, meeting rooms, clubs, or any other venue in which great sound in the least amount of time is a requirement. The MX399 features common XLR input and output microphone connections.

Because room resonance modes cause different low frequency response in different parts of any small room, equalizing the response for multiple listening positions can be a long process of repeated measurements at multiple locations and change-and-check equalization adjustments. Adjusting for smooth response in just one or two listening positions may leave other positions with uneven, boomy, or wimpy bass response. Manually averaging multiple measurements is time-consuming and doesn't give you a real-time dis-

play to immediately indicate results of room adjustments.

The MX399 Microphone Multiplexer, with the SP395 or SP495, provides measurements of the average response of a listening room or multiple listening positions. This allows you to position subwoofers or adjust equalizers as you immediately see the measured results of your adjustments. When you complete your adjustments, you can store one RTA measurement to document the average response of the room.

Features

- Provides a single, spatially-averaged acoustic input from up to four microphone positions for Real Time Analyzer measurements.
- Provides a continuously updated average measurement of the overall response of the listening area to allow easy equalization adjustments and average response documentation.
- Avoids the problem of making room adjustments based on the acoustic response of just a single point in a room or of manually averaging measurements to determine needed adjustments.
- Performs four microphone multiplexed sampling, as used by all major cinema/home theater organizations, for a good average of overall room response.
- Measure the averaged output of two, three, or four attached microphones, or monitor individual microphones for gain equalization.
- Internal microphone supply voltages and preamps eliminate the need for extra boxes and simplify setup.
- Portable, battery-operated design eliminates the need for AC power connections.
- Unit power switched with phantom voltage from an SP395 or SP495 SoundPro.

Specifications

Frequency Response: 20Hz-20kHz +/- 2 dB
Dynamic Range: 25 dB to + 120 dB (SPL) input

Inputs

Microphone Inputs: Four
Type: Balanced
Connector: XLR Female
Input Impedance: 40 kohms nominal
Frequency Response: 20Hz – 20kHz +/-2 dB
Dynamic Range: 25dB to = 120dB SPL
Maximum Input Level: 135 dB SPL
Gain Adjustment: ±4 dB
Phantom Mic Power: 48 volts

Output

Output: One
Type: Balanced
Connector: XLR Male (pins 2 & 3 signal,
pin 1 ground)
Output Impedance: 110 ohms +/- 20%

Microphone Selection: Manual selection of Mic 1, Mic 2,
Mic3, or Mic 4
Automatic alternating switched
selection of attached microphones

Microphone Switching: Approximately one second dwell time
per microphone

Mic. Dwell Time Range: 0.5 sec to 1.5 sec. (Factory
adjusted to approx. 1 sec.)

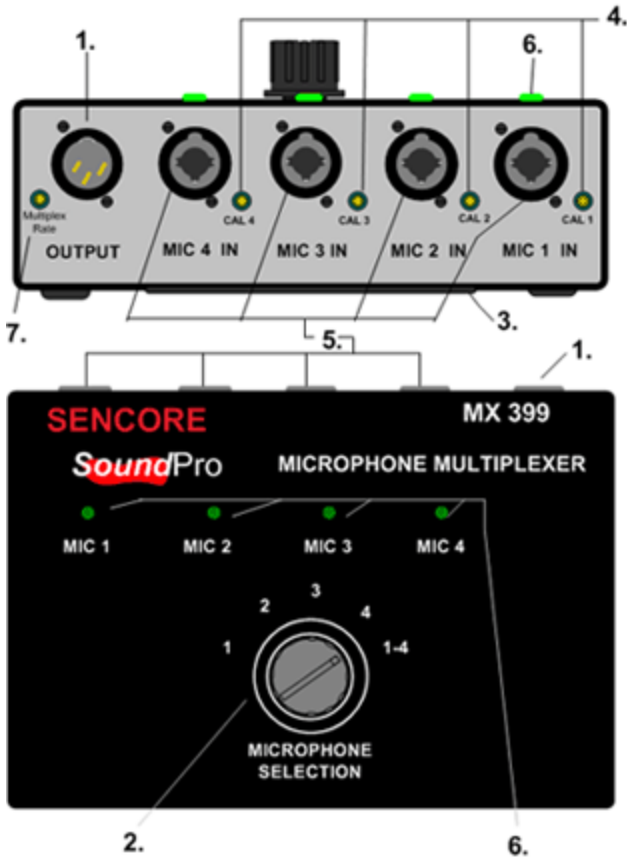
Power

Power: Internal 9 V battery Pack (6 AA cells)
Power Switching: Controlled from SoundPro (Phantom
voltage on/off)

General

Case: Metal
Size: (3.25" x 7.5" x 4.25") HWD
Weight: 1 lb. 5 oz. w/supplied battery installed

Controls

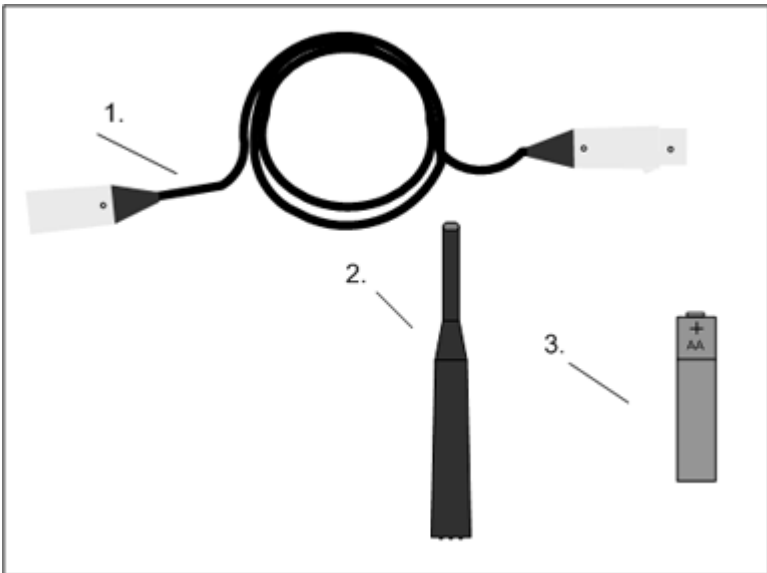


- 1. MIC OUTPUT CONNECTOR:** Connects output of MX399 to the MIC INPUT jack of the Sencore SP395 or SP495 for sound measurements.
- 2. MICROPHONE SELECTION SWITCH:** Switches the microphone inputs (5) to the SP395 MIC INPUT Connector (1).
- 3. BATTERY COMPARTMENT:** Contains AA batteries used to power the MX399 and provide phantom power to microphones.
- 4. CAL 1, 2, 3, 4 MIC LEVEL CALIBRATE ADJUSTMENTS:** Variable gain controls to adjust the microphone input levels for proper calibration of the individual microphones.
- 5. MIC 1, MIC 2, MIC 3, MIC 4 INPUT CONNECTORS:** Connects the external individual microphones to the inputs of the MX399.

6. **GREEN LED(s) TEST CONDITION INDICATORS:** A flashing LED indicates the SP395/SP495 is connected and turned on to activate the MX399. Constant LED illumination indicates that microphone input is selected and a microphone is connected and powered.
7. **MULTIPLEX RATE CONTROL:** Adjusts dwell time or the time each microphone is sampled.

Supplied Accessories

1. **12 foot microphone extension cable, XLR male to XLR female (13G122):** Connects the individual microphones to the MIC INPUTS of the MX399. Three cables are supplied with the MX399.
2. **Microphone (39G1156):** Meets or exceeds ANSI S1.4 Type 2 specifications. Measurement microphones that connect to the MIC Inputs of the MX399. These microphones match the microphones supplied with the Sencore SP395 and SP495. Three microphones are supplied with the MX399.
3. **AA Batteries:** Comprise nine volt battery pack to power the MX399. Six batteries are supplied with the MX399 to be installed into the battery compartment.



Operation

Introduction

The MX399 Microphone Multiplexer connects to a Sencore SP395 or SP495 SoundPro to provide acoustic analysis of rooms using multiple microphones. The MX399 provides accurate sound speaker equalization by enabling the simultaneous use of up to four microphones placed throughout the room.

The standard microphone supplied with the SP395 or SP495 is used as mic one, and the three matching microphones supplied with the MX399 are used as mics two through four. The MX399 alternately switches the audio from each microphone to the SP395 or SP495 for sound analysis.

Power – On/Off Switching

The MX399 contains no on/off switch. The MX399 circuitry is powered by a 9 volt battery pack consisting of 6 AA batteries mounted inside the battery compartment of the MX399. Phantom microphone voltage supplied to the unit from the Sencore SP395 or SP495 switches on the MX399. The phantom microphone voltage is supplied from the SP395 or SP495 ANALOG INPUT jack to the "OUTPUT" jack on the MX399.

The SP395 or SP495 must be connected, powered on, and the phantom voltage of 48V selected in the top tool bar before microphone voltage is output to the MX399 and its internal circuits are powered on.

Green LEDs on the MX399 provide an indication when the unit

is powered on and ready for operation. When any LED is blinking or illuminated, the MX399 is powered on and ready for use.

Battery Installation / Replacement

The Sencore MX399 requires six AA batteries for proper operation. The MX399 draws very little current from the batteries, so the battery lifetime will be close to 24 hours. The batteries are replaceable.

To install or replace the AA batteries:

1. Remove the battery compartment on the MX399 by gently releasing the tab holding the battery compartment door.
2. The battery compartment door releases and may be

lifted away. Lift gently and remove the cover.

3. Pull each of the batteries out of the battery compartment.
4. Install AA batteries into the battery compartment observing proper polarity.
5. Reinstall the battery compartment door. Slide door tabs into the compartment on the one side and latch the door down into place.

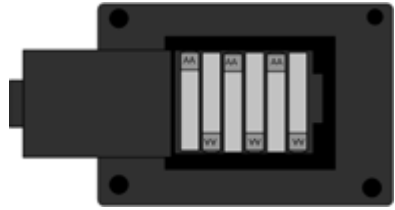


Figure 1. The MX399 is powered by replaceable AA batteries.

Microphone Selection Switching

The MX399 has four separate microphone inputs. These inputs are switched to the TO SP395 or SP495 ANALOG INPUT jack by the five-position MICROPHONE SELECTION switch on the MX399. The first four positions are labeled 1, 2, 3, and 4. These positions switch only the respective single microphone input to the TO SP395 or SP495. These positions are used to calibrate the individual mic inputs or to monitor the response of only one location in a multiple microphone setup.



Figure 2. Microphones are selected or multiplexed to the SP395 with the MICROPHONE SELECTION switch. Green LEDs indicate which microphone(s) are selected or active.

The fifth position of the MICROPHONE SELECTION switch is labeled “1-4.” This position electronically selects each of the MX399’s MIC IN jacks momen-

tarily. The MX399 alternately switches to each of the active microphone inputs, providing a path from these inputs to the OUTPUT jack.

The multiplex switching action is done only between active MIC Inputs. An MX399 MIC Input jack is active if a microphone is connected to the jack. MIC IN jacks that do not have a microphone connected to them will be omitted from the multiplex switching sequence.

Each active microphone input is selected for approximately one second. The MIC input selected

is indicated by an illuminated green LED. As different inputs are alternately selected, the different LEDs light, indicating multiplex switching.

NOTE: MIC Inputs are active only when a microphone is connected and drawing current from the MX399. If a microphone is not connected to a particular input, the MX399 will not switch to that MIC In jack. This permits the MX399 to multiplex switch to only the active inputs. In this manner, the MX399 can multiplex switch between 2, 3 or 4 active microphones

To multiplex between microphones to analyze with the SP395 or SP495 SoundPro:

1. Connect a cable from the SP395 or SP495 ANALOG INPUT (L) jack to the MX399's OUTPUT jack. Turn on the SP395 or SP495. Select 48V in the left side of the top tool bar on the SP395 or SP495 to apply phantom voltage (48V) to the MX399.
2. Select position "1-4" on the MX399 MICROPHONE SELECTION switch.
3. Connect desired microphones to MX399 MIC IN jacks.
4. Green LED indicators indicate the MIC Inputs that are being alternately selected by the MX399.

The dwell time, or time each MIC Input is selected, is factory set by the MX399 internal circuits to about one second. This time has been optimized for Real Time Analyzing (RTA) when using the Sencore SP395 or SP495 SoundPro. This time can be made longer or shorter for special applications by changing the Multiplex Rate control located near the OUTPUT jack of the MX399.

Microphone Input Calibration Controls _____

The calibration control for each microphone input is located beside each of the MIC IN jacks. The CAL controls are multi-turn pots, adjustable with a miniature screw driver.



Figure 3. Calibration controls on each microphone input provides level adjustment for accurate measurements.

The calibration controls are used to adjust the level from each microphone input to the MX399. Each microphone and its respective input should be calibrated to a reference level before using the MX399. This insures that each microphone and its respective input of the MX399 is providing a proper level to the SP395/495.

The microphones supplied with the MX399 are labeled as MIC

2, MIC 3, and MIC 4. This helps keep each microphone with the MX399 input it was calibrated to and eliminates the need to calibrate the inputs every time you use the MX399. Connect the microphones to the correctly labeled input and calibrate each input the first time you use the MX399. Adjust the CAL controls so the level measured by the SP395 on the MIC input matches the level indicated by the microphone supplied with the SP395/495 SoundPro connected directly into the SP395/495. Each input should then be properly calibrated. If the respective microphone is connected to the same input each time, calibration is maintained and re-calibration with every use will not be necessary.

Application

Introduction

The Sencore MX399 allows the Sencore SP395/495 Acoustic Analyzers to average sound from multiple microphones in a room, providing a single RTA or FFT test display.

When sound is time averaged from multiple microphones, measuring different positions in the room, the resulting test display is called “spatially averaged.” Spatial averaging indicates the average response of the room across the entire seating or listening area rather than from a single point in the room.

Calibrating the Microphones

Before testing for the first time with the MX399, you should calibrate the microphone levels. Calibration adjustment controls are located near each MIC IN jack on the MX399. To avoid measurement errors, the microphones used with the MX399 should match the microphone supplied with the SP395/495. This insures frequency response and level compatibility for accurate testing results. Three microphones matching the SP395/495 SoundPro microphone are provided with the MX399. Using these four matching microphones provides optimum testing accuracy when using the MX399.

Using any microphone other than the Sencore 39G1156 should be avoided.

The first step in calibrating the MX399 MIC Inputs and microphones is to establish a reference SPL. Connect the microphone supplied with the SP395/495 directly to the ANALOG INPUT jack and output 48V phantom power. Apply pink noise to a room and measure the SPL with the SP395/495. Set the pink noise level to a reference level commonly used to analyze the room levels or record the level indicated by the SP395/495. This is a reference level to calibrate the MX399 MIC Inputs and microphones.

To establish a reference SPL Level:

1. Connect the microphone supplied with the SP395/495, through an extension cable, directly to the SP395/495 analog input.
2. Place the microphone on a mic stand, with the mic pointing straight up, in the center area of a room.
3. Place the SP395/495 in the Sound Level Meter function, with Slow averaging.
4. Supply pink noise to the room at a level significantly above the room's ambient noise level (75-85 dB) and note the precise SPL measurement.
5. (Use this as a reference level to calibrate the MX399 MIC Inputs and microphones.
6. Once the reference noise level has been established with the SP395's supplied, calibrated microphone, use that microphone to calibrate the MX399 MIC 1 Input.

To calibrate the MX399 MIC 1 input:

1. Leaving the first microphone on the mic stand, reconnect the

mic extension cable to the MX399 MIC 1 IN and connect the MX399 OUTPUT to the SP395/495 ANALOG INPUT. (Phantom 48V ON)

2. Switch the MX399 Microphone Selection switch to position 1.
3. Adjust the CAL 1 pot to obtain the same reading as was obtained in step 4, above.
4. Calibrate mic inputs and microphones 2, 3, and 4 in a similar fashion.

To calibrate the remaining MX399 MIC inputs:

1. Place Mic 2 (label on microphone) on the mic stand in place of Mic 1, and connect it to the MX399 MIC 2 IN. Switch the MX399 Microphone Selection switch to position 2.
2. Adjust the CAL 2 pot to obtain the same reading as was obtained in step 4, above.
3. Repeat for microphones 3 and 4, maintaining the same microphone position and the same noise test level in each case.

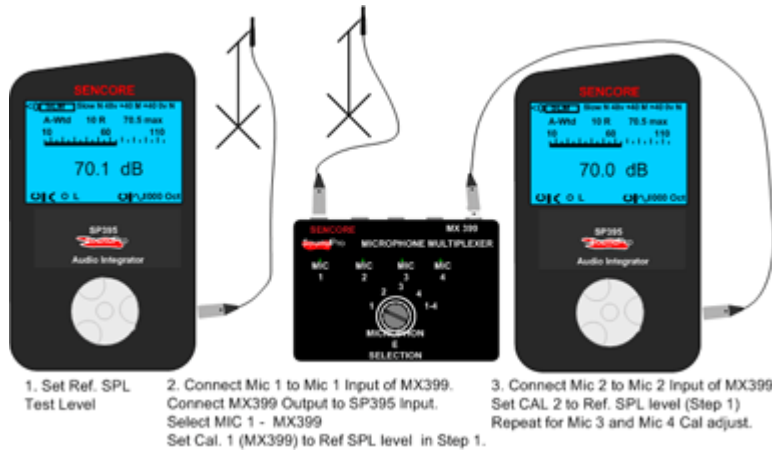


Figure 4. Calibration of the measurement microphones is a process of matching the sound pressure level of each microphone.

When using the MX399, always connect each numbered microphone to its respective input on the MX399. This insures proper levels from the microphones and eliminates the need to calibrate the MIC inputs every time you use the MX399.

MX399 - Testing Setup

To use the MX399 and SP395 SoundPro to measure a room's spatially-averaged frequency response, use the setup illustrated in Figure 5. Run cables from the microphones to the respective MIC IN jacks of the MX399. Connect the cable from the SP395 to the MX399.

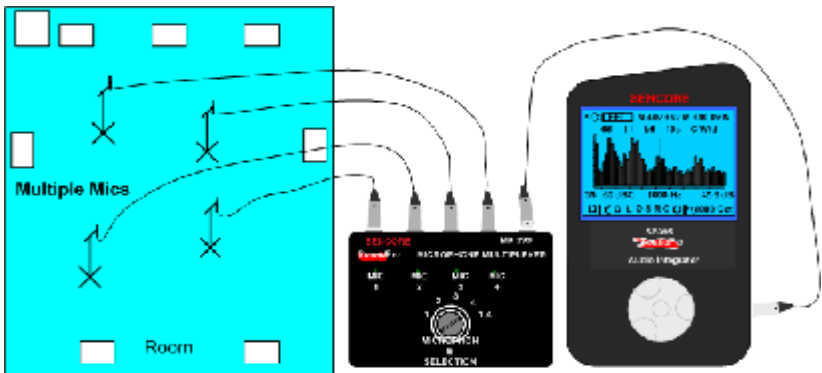


Figure 5. Typical setup for analyzing a room with the MX399 & SP395 SoundPro.

Microphone Room Placement

The microphones should be placed in the room so they are in the reverberant sound field.

Avoid placing the microphones directly in front of a speaker, so as to avoid direct sound energy from the speaker. Also avoid the center axes of the room, as strong room mode peaks and nulls at these positions can unduly influence the measurement.

Microphones should be mounted on microphone stands at the listeners' ear height. Point the mi-

crophones straight up for the best omni-directional pickup.

When measuring a room with multiple rows of seating, use a staggered parallelogram or diamond microphone placement formation. Each microphone should be a different distance from the side walls and a different distance from the end walls. This will provide a uniform sampling of the sound field in the room.

Real Time Analyzing – Multiplexing Microphones for Spatial Average

Multiplexing microphones placed throughout the listening position provides a single continuous measurement of the overall response of the listening area. This permits easier equalization adjustments, as you can see an average of the entire listening area. Sequentially switching to each microphone briefly with the MX399 and accumulating a running active average on the SP395's Real Time Analyzer provides an average room response.

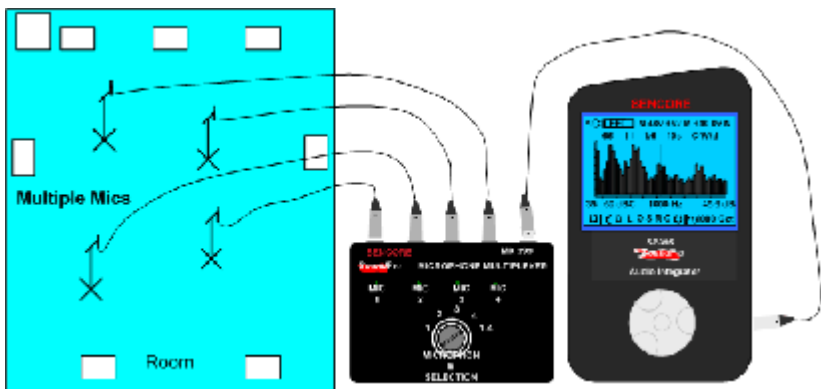


Figure 6. Select the multiplexing position of the Microphone Selector Switch “1-4” to measure a spatial average response using the SP395.

To perform a spatially averaged RTA measurement, connect the SP395, MX399 and microphones as shown in Figure 6. Place the microphones in the room as described in the Testing Setup Section of this manual. Set the MX399 Microphone Selection Switch to the “1-4” position. This position cycles through the microphone inputs, switching the

sound from each mic to the SP395 at approximately one second intervals.

The SP395 RTA function averages the alternately selected microphone measurements over a period of time, creating a spatially averaged display. The SP395 RTA averaging time period is able to be set to 1, 3, 6, 10 or 30 seconds. This setting is the second reading from the upper right on the top line of the display information. When using the MX399, use the 10 second, or longer, averaging time of the SP395 RTA.

To multiplex microphones for a spatial average RTA measurement:

1. Set up as shown in Figure 6.
2. Power on the SP395.
3. Set MX399 Microphone Selection Switch to position “1-4”.
4. Select & perform the SP395 RTA test.
5. Set for a 10 second, or longer, Averaging Time.
6. Adjust speaker placement, equalization, treatments for best over-all room response.

WARRANTY AND SERVICE INFORMATION

WARRANTY

Your MX399 Microphone Multiplexer has been built to the highest quality standards in the industry. Each unit has been tested, aged under power for at least 24 hours and the every function and range was retested to insure it met all published specifications. Your instrument is fully protected with a 1-year warranty.

SERVICE

Save the original shipping carton and packing material for reuse should you ever need to ship your MX399, or return it to the Sencore factory for repair.

1. If you are returning the unit to Sencore for service call the service department at the number below and enclose the following information: owner's address, billing information, purchase order (if applicable), name and phone number of contact person, description of problem and reason for return. No return authorization is required.
2. Completely enclose the unit inside a plastic bag to protect its finish and prevent foreign material from getting inside.
3. Cushion the unit equally on all sides with a minimum of 3 inches of padding material. Pack the padding tightly enough to prevent the unit from shifting during shipment.
4. Seal all seams on the container with strapping tape.
5. Send the packed unit to the following address (we recommend shipping via United Parcel Service):

SENCORE FACTORY SERVICE

**3200 Sencore Drive
Sioux Falls, SD 57107**

Most service repairs are completed within 72 hours. If you need to ask about your unit, the Sencore Service Department phone number is:
1-800-SENCORE (736-2673) or FAX (605) 339-7032

Fill in for your records:

Purchase date: _____

Serial Number (on bottom of unit) _____

SENCORE

**3200 Sencore Drive
Sioux Falls, SD 57107**

Call 1-800-SENCORE (736-2673)

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