SPL

Subwoofer
OWNER'S MANUAL AND INSTALLATION GUIDE

SOUNDSTREAM
T E C H N O L O G I E S

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SOUNDSTREAM
T E C H N O L O G I E S

CONGRATULATIONS! You now own The Mule, a first-of-its-kind subwoofer designed to reproduce extremely high levels of SPL at a point in the spectrum where the resonance god lives. This precision component, when properly installed, is capable of exciting the air in your vehicle to a level where it can vibrate the metal skin of the car and shake your world.

Should your woofer ever require service or replacement, recording the information below for your own records will help protect your investment.

*Model Number:*_____

Serial Number: _____

Dealer's Name: _____

Date of Purchase: _____

Installation Shop: _____
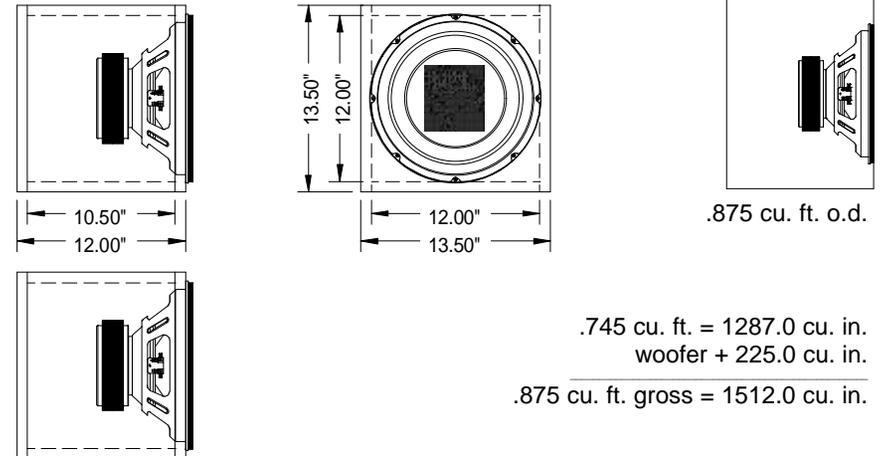
Installation Date: _____

DESIGN FEATURES

- **New Custom Cone with Large Roll Polyether Surround** provides longer excursion and better control.

- **New Revolutionary Computer Numerically Controlled (CNC) Machined Aluminum Heat Sinks** surround the voice coil and remove heat to vastly increase power handling.

- **New Custom Non-Resonant Polypropylene Dust Dome** for added structural rigidity providing solid, well controlled performance.

- **New Heavy Gauge Steel Silver Powder-Coated Basket** provides extra rigidity and damping.

- **Ultra-High Power Handling 2½" Voice Coil with Kapton/Epoxy former** increases power handling and performance.

- **Aerospace Grade Adhesives and Materials** insure longevity and high performance.

- **CNC Machined Magnet Plates** and pole piece precisely focus the magnetic energy for optimum performance.

- **High Emissivity Coating** on all metal plates improves power handling.

- **Double Magnet Structure** for increased linear strength and throw.

- **Vented Pole Piece** for greater voice coil cooling.

DESIGNATED ENCLOSURE

This is a unique subwoofer and it has been designed to operate at peak efficiency **only in the enclosure shown below.** Installing it in other

13.50" 12.00"

10.50"
12.00"

12.00"
13.50"

.875 cu. ft. o.d.

.745 cu. ft. = 1287.0 cu. in.
woofer + 225.0 cu. in.
_____
.875 cu. ft. gross = 1512.0 cu. in.

SOUNDSTREAM®
TECHNOLOGIES
R & D Loudspeaker Performance Projection
SPL vs. Frequency (2.83 volts input / 1 meter)
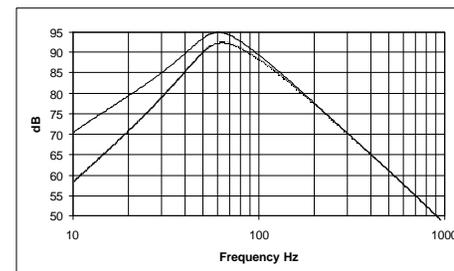
Application Notes:
_____
_____
_____
_____
_____
_____
_____

Two frequency response curves are shown for this design, one for predicted "In-Car" response and the other for "Half-Space Anechoic" (out-of-car) response. The performance difference between the two curves is a result of the natural acoustics of an "average" automotive environment. This "average" transfer function is only an approximation of what you may expect to see in your car. Every car is different.

The curves were generated using 2.83 Volts and measured at 1 meter. Also, each frequency response curve includes a 12 dB/octave low pass filter at 100 Hz.

```
┌─────────────────────────────────────────┐
│    Measure maximum possible dimensions    │
└─────────────────────────────────────────┘
                     │
                     ▼
┌─────────────────────────────────────────┐
│        Multiply wall thickness by 2       │
└─────────────────────────────────────────┘
                     │
                     ▼
┌─────────────────────────────────────────┐
│   Subtract this from each dimension to    │
│   arrive at Gross Internal Dimensions     │
└─────────────────────────────────────────┘
                     │
                     ▼
┌─────────────────────────────────────────┐
│        Multiply LxWxD to arrive at        │
│          Gross Internal Volume            │
└─────────────────────────────────────────┘
                     │
                     ▼
┌─────────────────────────────────────────┐
│   Deduct Vf (volume of the speaker frame) │
│        from Gross Internal Volume         │
└─────────────────────────────────────────┘
                     │
                     ▼
┌─────────────────────────────────────────┐
│                 Braces?                   │
└─────────────────────────────────────────┘
     ╱                              ╲
  ( No )                         ( Yes )
     │                              │
     │                              ▼
     │        ┌──────────────────────────────┐
     │        │  Calculate brace volume and   │
     │        │  deduct from Gross Internal   │
     │        │            Volume             │
     │        └──────────────────────────────┘
     │                    │
     ▼                    ▼
┌─────────────────────────────────────────┐
│      You are at Net Internal Volume       │
│         in cubic inches  (in³)            │
└─────────────────────────────────────────┘
```
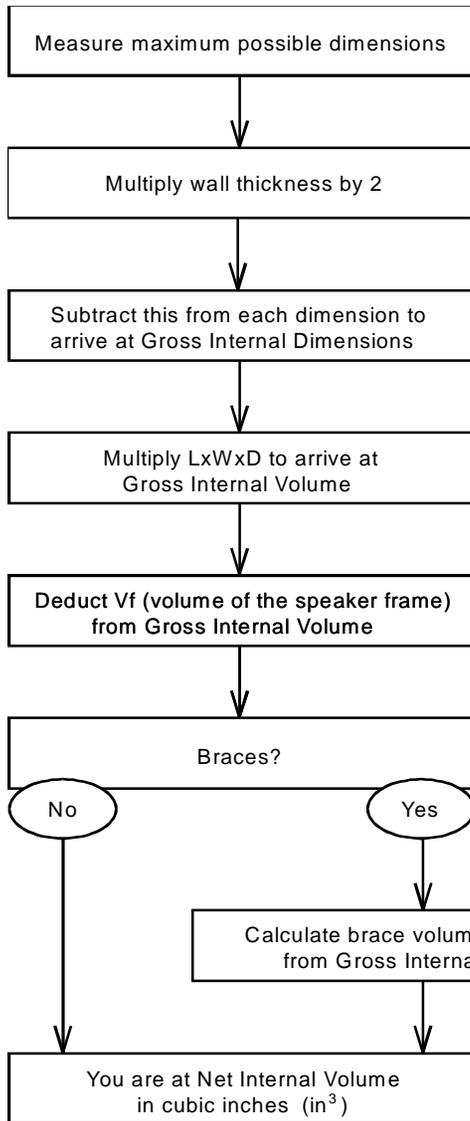
To convert to LITERS:
Divide in^3 by 61.03

To convert to CUBIC FEET:
Divide in^3 by 1728

### CAVITY RESONANCE TUNING AND POWER HANDLING IN THE MULE

One of the unique features designed into the SPL Mule is an ability to play extremely loud when installed in a typical vehicle. Its peak output frequency and Q (Quality Factor) are targeted toward the "Cavity Resonance" of a car's passenger compartment.

Resonance occurs when a body (e.g., an enclosed volume of air) capable of producing sound receives impulses at one of its fundamental or harmonic frequencies. If, for example, a car has a fundamental resonance of 65Hz, a loudspeaker with high output at that frequency will excite the metal at the resonance and produce sound in addition to the speaker.

Another Mule design feature is improved heat transfer. Aluminum heat sinks and steel plates with high emissivity coatings extract heat from the voice coil. By providing a path for heat in the voice coil, we not only allow it to accept more wattage but also reduce its electrical resistance and allow higher current flow. The effect is higher power handling and more output.

The Mule is also designed to operated effectively in a small enclosure. An example would be an installation of 16 Mule drivers which could be accomplished within a space just a bit larger than 4ft by 4ft by 1ft deep!

16 Mules would produce tremendous output. Since sound pressure level increases by 6dB every time you double the number of drivers, the system would produce 24dB more output than a single Mule at the same power/
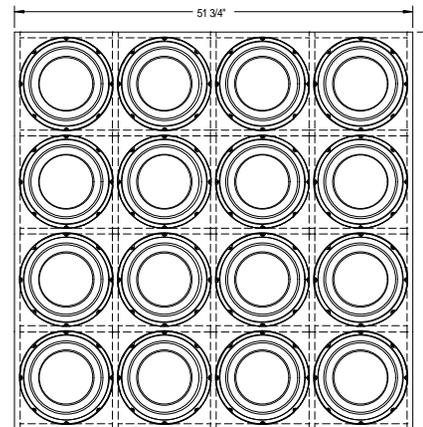
Wall of Mules:

Each individual enclosure measures 12" W x 12" H x 10½" D inside for a net internal volume of .745 ft^3.

External dimensions of the multiple driver enclosure are 51¾" W x 51¾"H x 12"D

Parameter	Value
Frequency Response (Hz)	25-400
Sensitivity (2.83v/1m)	92 dB
Impedance (nominal Z, ohms)	4
Rated Program Power, Watts	500
Fs (Hz)	26.8
Qts	.85
Qms	10.6
Qes	.92
Efficiency Bandwidth Product (Fs/Qes)	29.1
Vas (ft^3)	3.32
Vas (liters)	94.1
Vas (m^3)	.094
Cms (um/N)	298
DCR (ohms)	3.64
Levc (mH) @ 1 KHz	1.35
BL (Tesla m)	9.49
Sd (in^2)	73.0
Sd (m^2)	.047
Sd (cm^2)	471
X max; one way (linear mm)	11.0
X max; one way (peak mm)	28.7
Vd (linear cm^3)	518
Vd (peak cm^3)	1352
Vd (linear m^3)	0.000518
Vd (peak m^3)	0.001352
Mms (grams)	118
Magnet Assembly (oz)	256
Magnet Weight (oz)	104
Vf (volume of frame, in^3)	225

BUILDING THE ENCLOSURE

This owner's manual contains an enclosure for your subwoofer. The following are general procedures to follow to build this enclosure:

- Determine the dimensions of your enclosure.

- Be certain the box you have designed will fit into the location you have chosen. Sometimes making a cardboard box with the same outside dimensions is helpful.

- Use 3/4 inch thick Medium Density Fiberboard (MDF) or High Density Particleboard. It is preferable to cut the wood with a table saw to ensure straight, even joints. If a table saw is not available, a circular saw is acceptable.

- Use a "T" square to verify precise right angle gluing.

- Use a high quality wood glue and air nails or wood screws to assemble the enclosure. Elmer's® woodworker's glue and Weldwood® work well. To guarantee an airtight box, seal each inside joint with silicone sealant.

- Stuff the chamber with 50-75% filling (approximately 1.5 pounds per cubic foot) of fiberglass insulation or Dacron®.

- Use the supplied gasket to seal the woofer in the enclosure and eight (8) wood screws or T-nuts and bolts. Progressively tighten each of the bolts or screws to prevent warping the woofer frame.

- Use slide-on connectors to attach speaker wires. **DO NOT** solder wires to the provided terminals as this may cause damage to the factory wire connection. This may also void the speaker's warranty.

CALCULATING NET INTERNAL ENCLOSURE VOLUMES

When constructing any type of enclosure, you must be aware that the outside dimensions DO NOT represent the true (net) volume inside. Such things as woofers, thickness of enclosure material, dividing walls, and any internal bracing will reduce the total amount of the actual air space available. The following worksheet has been designed to provide you with the necessary steps to accurately calculate the net internal volume of any given enclosure.