



GENERATIONS AHEAD IN SONAR & ULTRASONIC TECHNOLOGY

OVERVIEW OF SOME OF MASSA PRODUCTS CORPORATION'S CAPABILITIES IN INDUSTRIAL ULTRASONICS

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Ultrasonics is the Best Technology for Many Industrial Non-Contact Measurement Applications

- Electroacoustic transducers are the heart of ultrasonic systems.
- To properly optimize the design of most ultrasonic systems, the design of the transducer must first be optimized for the particular application;
 - Systems designed using “standard transducers” usually are not as functional, reliable, robust, or cost effective as those in which the transducer was optimized first.
- Massa Products Corporation is one of the few companies that can custom design and manufacture both transducers and systems to optimize virtually any electroacoustic application.

Massa Is the Best Strategic Partner for the Development and Manufacture of Ultrasonic Sensors

- Electroacoustics is a very specialized technology that must be properly understood to insure that an optimal system is designed;
 - Transducers and interface electronics must be custom designed to insure best system performance and uniform response in production;
 - “Off the shelf” components will seldom work best for a particular requirement;
 - It takes many years of experience and training to learn how to design and manufacture transducers, and how to best design the electrical circuit interfaces.

Massa Products Corporation Is a World Leader In the Specialized Field of Electroacoustics

- Massa has been developing and mass producing specialized electroacoustic transducers and systems for over 55 years.
- Massa has been awarded over 150 patents for electroacoustic transducers and systems.
- Massa has two basic product lines;
 - Air Ultrasonic Transducers and Systems for industrial applications;
 - Underwater Sonar Transducers and Systems for the U.S. and Allied Navies.
- An Article Sensors Magazine requested Massa to write on Ultrasonic Sensing is contained in Appendix A.

Overview of the Facilities at Massa Products Corporation



Design and Manufacturing Facility for Transducers and Electronics

- 70,000 Sq. Foot Plant
- Mil-Q-9858A Certified
- ISO 9001:2008 Certified
- Cleared Secret
- Engineering Laboratory
- Engineering Model Shop
- Rubber Molding Facility
- Plastic Molding Facility
- Machine Shop
- Clean Room
- Acoustic Test Pond
- Pressure Testing Facilities

Brief Overview of Some of the Industrial Ultrasonic Capabilities At Massa

- Massa created the first standard microphones for accurately measuring sound fields in the ultrasonic range.
- Massa created the first standard accelerometers to measure vibrations and shock pulses up to 100 kHz.
- Hundreds of different transducers and systems have been designed and manufactured by Massa in the frequency range of 20 - 500 kHz.
- Millions of transducers and systems have been manufactured by Massa for applications such as remote control of TV Sets, Intrusion Alarms, Bowling Scoring Systems, Occupant Sensing, Audible Alarms, Level Control, Web Break Detection, Anti-Collision, etc.

A Few Typical Industrial Group Applications

- Ultrasonic Occupant Detection Systems.
- Vehicle Crash Avoidance Systems.
- Ultrasonic Automobile Water Leak Detection Systems.
- Measurement Systems for Distance, Bulk or Liquid Level, Profile and Thickness.
- Printing Press Web-break Detection Systems, Web Tension Systems and Roll Diameter Systems.
- Alarm Systems.
- Automatic Faucet and Urinal Control Systems.
- Contraband Detection Systems.
- Acoustic Repeater for Smoke Alarm System.
- Automatic Bowling Scoring Systems.

Massa Can Provide the Best Possible Transducers and/or Systems for Virtually Any Ultrasonic Sensor Application

- Massa has a line of “standard” ultrasonic transducers.
- Massa has the electroacoustic design and production engineers to enable us to quickly develop the exact transducer that is best for a particular application.
- Massa has designed, fabricated and tested several hundred experimental models of different ultrasonic transducers over the last half-century;
 - Transducers for many applications can be rapidly and inexpensively developed by using a variation of one of these already existing designs.
- Massa can also rapidly develop a complete customized electroacoustic system that is optimized to meet each specific ultrasonic application.

Many Major Corporations Have Chosen Massa To Be Their Strategic Partner and OEM Manufacturer for Ultrasonics

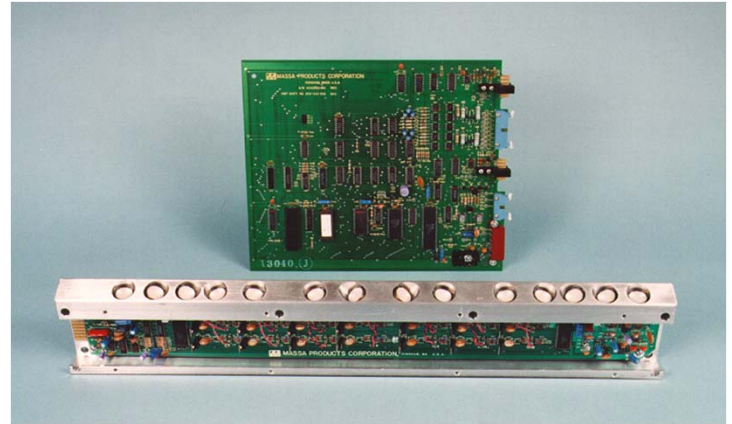
- Including GE, AMF, GM, TRW, Lucent, AT&T, Mallory, Dupont, Heidelberg Web Systems, RCA, Raytheon, Lockheed, General Dynamics, JLG, Brooks-PRI Automation, and others.

Massa Can Share with Its OEM Customers Some of Its Proprietary Concepts Already Developed that may be Applicable to Each Specific System

- This will allow system design to be finalized very rapidly.
- By using already proven technology and design concepts, the operation of the system will be optimized and the reliability will be high.
- The OEM Customer will receive the benefit of Massa's decades of experience in the very specialized field of ultrasonic sensing.

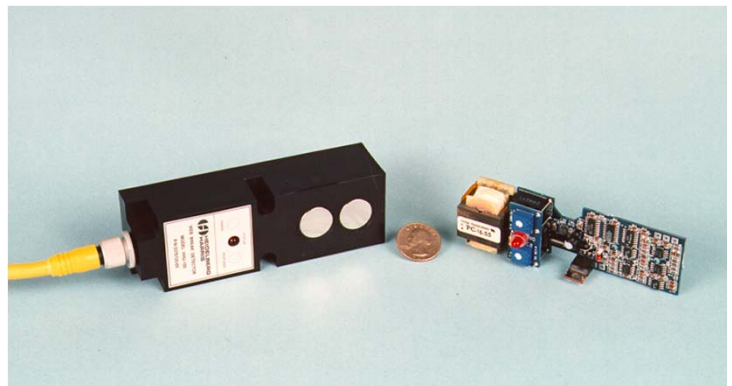
Examples of a Few OEM Industrial Ultrasonic Systems Custom Designed and Manufactured by Massa

Massa AccuScore Ultrasonic Bowling Scoring System Developed and Manufactured for AMF



- AMF needed to automatically detect exact locations of all standing pins after each ball was rolled, regardless of where they slid on the pin-deck.
- Ultrasonic echo ranging was the only practical solution;
 - Dusty environment and changes in pin coloration due to wear made infrared systems impractical.
- Less than one error in 10,000 balls rolled with a very simple algorithm.
- Massa developed a robust subsystem which was integrated into the AMF manufactured scoring system.
- Massa has outfitted over 25,000 bowling lanes with the ultrasonic scoring system.

Massa Model E-328 Web-break Detector for Heidelberg Web Systems, Inc.



- Heidelberg developed the industry standard for a high speed quality printing press;
 - Paper moves at 3,000 feet per minute;
 - Sale price of the press is \$10,000,000.
- Needed an ultra-reliable system to sense a web-break to protect the press;
 - Up to 50 sensing systems needed per press.
- Ultrasonic echo ranging was the only practical solution because of the hostile and dusty environment.
- Massa developed the model E-328 to solve the problem.

Massa Model M-3001 Ultrasonic Leak Detector



- Massa developed the Model M-3001 Ultrasonic Leak Detector for GM;
 - Detected location and size of water leaks in car bodies;
 - Successfully tested in Cadillac plant.

Massa Model M-3009 Ultrasonic Occupant Sensing System



Photograph Showing the M-3009 Mounted
on the Instrument Panel of a Test Car

- Used to measure the position of passengers in automobiles to control the air bag deployment;
 - Also measures the velocity and acceleration of the passengers if they move;
 - Determines if the target is a rear facing infant seat.
- System uses a linear array of three 80 kHz ultrasonic transducers with fan-shaped radiation pattern;
 - Transducers are low Q;
 - Transducers are completely sealed units.

Ultrasonic “Back-Up” Obstacle Detection Sensors

- Massa has developed several ultrasonic back-up sensors;
 - Mounts on rear of vehicle;
 - Detects any obstacle behind the vehicle and measures the distance to the obstacle.
- These sensors utilize unique transducers with fan-shaped beams.



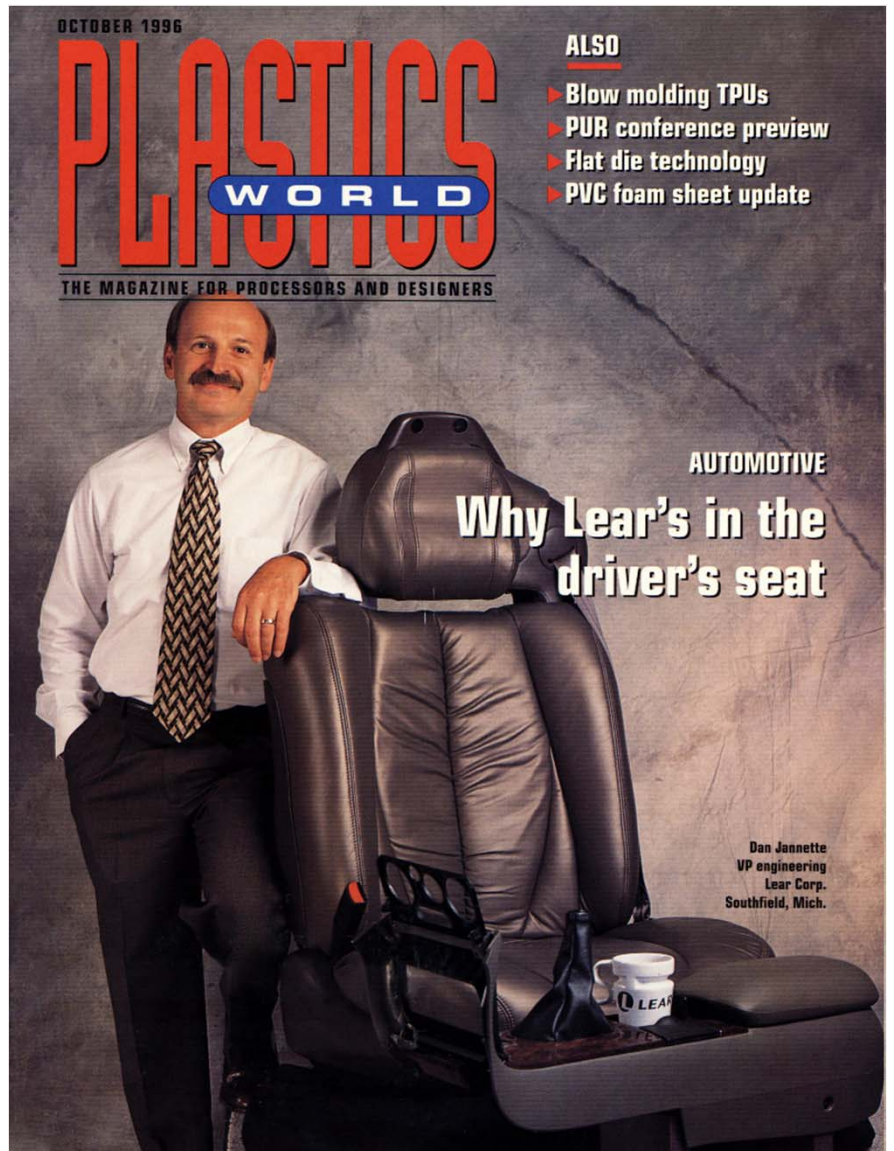
Massa Model E-397
Back-Up Sensor



Massa Model E-398 Back-Up Sensor

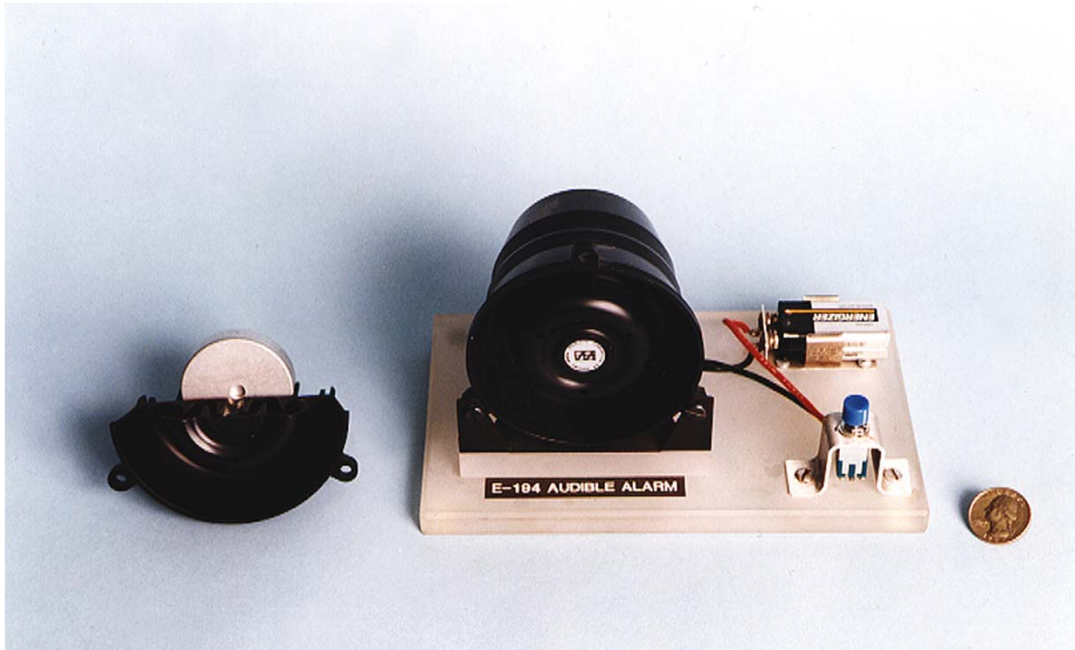
Massa Model E-344 Experimental Ultrasonic Head Rest Adjustment System

- Massa developed the E-344 System in conjunction with Lear Corporation.
- The system measures the location of an occupant's head and automatically adjusts the position of the head rest.



Cover of *Plastics World* Showing the Lear Experimental Seat Using the Massa Model E-344 System

Massa Model E-194 Audible Alarm



- Developed as part of GE contract for 250,000 acoustic repeater systems.
- Manufactured over 300,000 units under private label for such companies as AT&T, Mallory, and Ademco.

Sonar Capabilities At Massa

- Massa is also a world leader in the design and manufacture of major sonar transducers and systems for the U.S. and Allied Navies.
- Over 500 sonar production contracts;
 - Over 100 contracts since 1990;
 - All completed on or ahead of schedule.
- Many different applications;
 - Low Frequency (Less Than 1,000 Hz) High Powered Sonars for Surveillance;
 - Mid Frequency (3 KHz - 15 KHz) Sonars for Surface Ships;
 - Submarine Sonars;
 - Torpedo Sonars;
 - Diver Hand-held Sonars;
 - Anti-mine sonars;
 - Underwater Navigation & Communication Systems;
 - Underwater Robotics.