Bose Corp.
Moving Beyond
Sound Systems

Communications/Infotainment Systems Next

The dashboard and center-stack is probably the most hotly-contested real estate in the car today. Traditional suppliers of radio head units and audio systems compete with navigation and car information/entertainment systems suppliers, as well as interior systems integrators, for that limited area within the driver's and front passenger's reach and line of sight. The market is already crowded with giants like Bosch, Delphi, Denso, Aisin Seiki, Siemens VDO and many technically proficient audio and navigation suppliers from Japan such as Alpine, Panasonic and Pioneer.

Bose Corp. (Framingham, Massachusetts) sees potential in this automotive market segment and is beginning to move beyond its traditional line of high-end sound systems. While keeping a very low profile, Bose is selectively exploring multimedia systems and component opportunities with carmakers in the United States, Germany and Japan, and developing navigation equipment, network integration and the human machine interface.

For the last couple of years the Bose Automotive Systems Division has been hiring engineers away from carmakers and infotainment suppliers, including Ford, Alpine and Johnson Controls, to beef up its product development capabilities in audio and beyond. Alpine makes audio systems and is a key supplier of navigation systems to Honda. Interior module supplier Johnson Controls has been developing hands-free cellular phone car kits based on Bluetooth for Chrysler.

Presently there are openings at Bose for 23 full-time engineers and product planners with experience not only in acoustics

Turn to Bose, page 3

Connecting Vehichles to the Highways

Car-to-Infrastructure and Car-to-Car Data Communications

The idea of cars communicating with the roadway infrastructure is certainly not new. "Intelligent Vehicle/Highway Systems" were tested and promoted in the 1980s. Advances in wireless communications technology and the proliferation of wireless networks in this decade, however, have carmakers and traffic safety proponents taking another look at the potential benefits of vehicle data communications.

Vehicle Infrastructure Integration (VII), a coalition of carmakers, state departments of transportation and the U.S. Department of Transportation, has been working for about a year trying to decide if carmakers should install data communications platforms in vehicles, and if the coalition should ask the U.S. Congress to invest $3 billion to $5 billion or more in an automotive communications infrastructure. Promoters argue that if vehicles were linked by a high-speed data communications network, thousands of traffic fatalities would be prevented each year, and commuters would spend far less time stuck in traffic jams.

Americans spend, on average, 46 hours per year stuck in traffic. More than an inconvenience, traffic congestion costs the average traveler who drives during peak periods $1,150 per year, according to a publication from U.S. representative Henry Hyde of Illinois. Unless innovative solutions are found soon, the amount of time and money lost will only rise since new highway construction cannot keep pace with increasing highway use.

The VII coalition proposes that with a sufficient number of vehicles on the road transmitting their speed and location, the infrastructure could collect and aggregate the data to assemble perfect real-time

Turn to Connecting, page 2

Potential Applications of Dedicated Short Range Communications (DSRC)

◆ Public Safety
Approaching emergency vehicle warning
Emergency vehicle signal preemption
Road condition warning
Low bridge warning
Work zone warning
Imminent collision warning
Curve speed assistance (rollover warning)
Stop light assistance
Intersection collision warning/avoidance
Railroad collision avoidance
Cooperative collision warning
Green light - optimal speed advisory
Cooperative vehicle system (platooning)
Cooperative adaptive cruise control
Vehicle-based probe data collection
Infrastructure-based probe data collection
Infrastructure-based traffic management
Toll collection
Traffic information
Transit vehicle data transfer
Transit vehicle signal priority
Emergency vehicle video relay
Border clearance
On-board safety data transfer
Vehicle safety inspection

◆ Private
Access control
Drive-thru payment
Parking availability and payment
Data transfer
Traveler information
Diagnostic data
Repair service record
Vehicle computer program updates
Map and music data updates
Video uploads
Data transfer/commercial vehicle/truck stop
Enhanced route planning and guidance
Rental car processing
Commercial vehicle fleet management
Transit vehicle refueling management

Data: GM, Ford, DaimlerChrysler, compiled by Renesas
Traffic information. If vehicles were equipped with a simple display or other user interface, local authorities could direct traffic around accidents or road construction. Drivers could also be directed to available parking.

Speed and location data could be used to determine when traffic has suddenly stopped and approaching vehicles could be warned to slow down. That could prevent nasty high-speed vehicle pileups that are sometimes triggered by severe fog.

Vehicular braking systems that monitor wheel speed vs. vehicle speed can ascertain the extent of wheel slippage. That data could be used to inform oncoming vehicles of slippery road conditions ahead.

A communications infrastructure deployed along the nation’s roadways could also be a critical element in preventing intersection and road departure collisions, which factor into 50% of all crashes and fatalities on U.S. roads.

Technology Is No Longer an Obstacle

Advocates of Vehicle Infrastructure Integration point to a confluence of technological developments already completed or well underway: In October 1999 the U.S. Federal Communications Commission allocated 75 megahertz of spectrum in the 5.9 GHz range for intelligent transportation services to improve highway safety and efficiency. That spectrum, between 5.850 GHz and 5.925 GHz, was intended for a variety of Dedicated Short Range Communications (DSRC) uses such as traffic-light control, traffic monitoring, traveler’s alerts, automatic toll collection, detection of traffic congestion, emergency vehicle signal preemption of traffic lights and electronic inspection of moving trucks through data transmissions with roadside inspection facilities. Engineers in the American Society for Testing and Materials (ASTM) and IEEE standards groups have been working for nearly ten years on DSRC and expect to have the bulk of the standards ready for product development before the end of 2005.

A mong some 38 entities listed as participants in DSRC standard writing are DaimlerChrysler, Denso, GM, Motorola, Nissan, Visteon and ITS America.

Coincident with those developments, the IEEE 802.11p working group is developing extensions to the basic 802.11 radio standards that will form the basis of the DSRC system to provide communications in the 5.9 GHz spectrum. Generally, 802.11 addresses the physical and media access control layers of the OSI (Open Systems Interconnect) networking framework. The 802.11b standard is the physical layer spec from which Wi-Fi was born. Wi-Fi gives laptop computers wireless access to the Internet, to other computers and to wired networks.

Think Long Term

Carmakers and suppliers interested in taking advantage of DSRC should not wait around for the U.S. government to invest the billions of dollars necessary to develop a communications infrastructure that covers the nation’s highways. The VII coalition will take at least until 2008 or 2009 to decide how much investment is required and whether the carmaker members will agree to simultaneously install the mobile equipment necessary to take advantage of the communication infrastructure.

Participants still don’t know exactly what equipment should be installed in each vehicle. “A lot of questions are still unanswered,” declared Bonnie Reid, a GM program manager who has been participating in VII. “We haven’t figured out the necessary penetration [of radio equipped vehicles], we haven’t figured out the final architecture, we haven’t figured out what the density of roadside units should be.” A cording to an email from Ford’s VII representative Ralph Robinson, Ford hasn’t decided yet what its position on VII should be. “We are developing that vision internally, but it will take another year before we know where we need to be,” he wrote.

Chris Wilson, vice president of ITS strategy and planning for DaimlerChrysler Research and Technology North America, along with Nissan’s Ron Helft, is described as a champion of the VII initiative. Mr. Wilson tries to keep a realistic perspective on the timing. “Let’s say we (the VII) decide by 2008 to go ahead and the government money becomes available fairly quickly, then in 2009 or 2010 you could roll out the infrastructure. Maybe equipped vehicles could begin rolling off the production line in 2012, something like that,” he speculated.

AIso among the unknowns in VII are the number and cost of the roadside radio beacons. A cording to one estimate, 500,000 roadside units costing $6,000 each would be needed—a total investment of $3 billion. But that is under debate, says Mr. Wilson: “That number was prorated based on estimates for Florida, which is laying fiber [optic cable] in sand; Colorado doesn’t think that figure is appropriate. But even if the estimate is off by a factor of ten, $30 billion is not that much if you prorate it over the problem. We’ve got a $300 billion a year safety problem and a $100 billion a year traffic problem.”

However, with deficit spending at an all-time high, it’s hard to imagine the U.S. government making huge investments in communications equipment, unless by the time the next highway appropriations bill is submitted, spending on the war in Iraq ends and tax revenues surge—not likely. The present highway bill has been stuck in Congress since October 2003 when the prior legislation expired. The next bill, which would be the one to contain allocations for vehicle integrated communications infrastructure, isn’t due until 2009.

continued on page 3
Without a massive infusion of government funding, industry leaders expect automotive Wi-Fi-like applications to develop, but even more slowly. “My sense is this technology will happen in pockets,” said A nand Ramamoorthy, manager of the CIS/Telematics business unit of Renesas Technology America. “There will be some counties and states that will be more aggressive than the rest.” Private enterprise will also set up hotspots as business cases are made.

European Carmakers Follow Suit

In August 2002 Audi, BMW, DaimlerChrysler and Volkswagen founded the Car2Car Communication Consortium. Renault and Fiat joined the group in 2004, along with suppliers NEC, Philips and Fraunhofer Fokus; PSA signed on in March 2005. With the help of a German government grant, the consortium will work on a European standard for car-to-car communications systems based on wireless LAN (802.11) components. They will also promote the use of a royalty-free radio band exclusively for auto and push to harmonize standards worldwide. For more information visit www.car-2-car.org.

According to Will Specks, in charge of electronics research for Volkswagen Group, Volkswagen didn’t decide to fully participate in car-to-car communications research until recently. “What changed is wireless LAN, which has spread quite significantly in the consumer electronics world.” While the many potential safety benefits of car-to-car communications won’t be realized for a long time, Dr. Specks believes that soon people will be ready to use their home computer’s wireless connectivity to send music files to their vehicles. “Home-to-car communications is something that we have begun to think about offering to our customers in the next upper-class vehicles, perhaps by 2009.”

VII Coalition Members

BMW
DaimlerChrysler
Ford
General Motors
Nissan
Toyota
Volkswagen
U.S. Department of Transportation
FHWA (Federal Highway Administration)
NHTSA (National Highway Traffic Safety Administration)
FMCSA (Federal Motor Carrier Safety Administration)
10 State Departments of Transportation

Bose...

and audio, but also in telematics, navigation, human interfaces, automotive networks (including J1850, CAN, MOST and Bluetooth), OnStar/TeleAid applications, real-time embedded hardware and software, EM1 susceptibility, video circuits and/or systems engineering and integration. Some of the positions call for bilingual English speakers who are also fluent in German or Japanese. Bose is said to pay well for engineering talent, particularly by Detroit standards.

Bose engineers have been working on a variety of development projects with suppliers of microcontrollers, map databases and speech recognition software. Bose engineers had been in discussions with operating-system maker QNX, but they backed off when Harman International acquired QNX. Bose might well be developing radio-navigation products like those made by Harman-Becker. Bose does a great deal of sound-system business with Mercedes; Harman supplies radio-navigation systems to Mercedes.

Strategy: Leveraging the Bose Brand

Bose is known for its high-performance speaker systems, which are customized to fit the physical layout and acoustic fingerprint of the particular vehicle model in which they are factory installed. Bose designs its own digital signal processing and equalization circuits. “The result is much more than sound designed for a particular car. The vehicle itself becomes part of the sound system,” writes Bose on its Web site. Bose designs the speaker system and manufactures speakers and amplifiers. Bose isn’t known for playback mechanisms, head units, navigation, displays or infotainment systems integration.

A long with its ability to deliver noticeably better sound quality than most of its competitors, Bose has maintained high brand awareness among automotive customers. According to the Bose Web site, “For the second consecutive year, Bose is recognized as having the highest brand score in the United States among audio brands included in the J.D. Power and Associates 2004 Automotive Component Branding Study. The study measures the relative strength of select audio brands based on unaided awareness, aided awareness, and impression of the brands recognized by consumers.”

Evidence of the brand’s credibility can be found in Edmunds.com’s 2005 list of the ten best sound systems in cars that cost over $30,000 in the U.S. Three of the top ten were Bose systems, although none were on Mercedes vehicles. Three brands from Bose’s top competitor, Harman International, also made the list. Bose now appears to be getting ready to leverage that brand appeal by expanding its product line and moving up the supply chain to take on responsibility for more—or all—of the infotainment system, including its integration into the vehicle communications network.

It is my view that Bose will proceed slowly by cherry-picking projects tied to luxury brands, so it can charge premium prices. By focusing on the upscale vehicle market, Bose will participate in car-to-car communications systems based on wireless LAN (802.11) components. They will also promote the use of a royalty-free radio band exclusively for auto and push to harmonize standards worldwide. For more information visit www.car-2-car.org.

VII Coalition Members

BMW
DaimlerChrysler
Ford
General Motors
Nissan
Toyota
Volkswagen
U.S. Department of Transportation
FHWA (Federal Highway Administration)
NHTSA (National Highway Traffic Safety Administration)
FMCSA (Federal Motor Carrier Safety Administration)
10 State Departments of Transportation

Top 10 Sound Systems in Cars Over $30,000 for 2005

*Harman International brands

Source: www.edmunds.com

Continued from page 1

Continued from page 2
Marquardt

Background
Marquardt was founded in 1925, by two unrelated men named Johannes Marquardt, to supply “electrical parts and fine mechanics.” Their first customer was a vacuum cleaner maker. The new company began making switches in 1926—and switches remain its primary product today. Marquardt expanded rapidly in Germany after the Second World War and by the end of the twentieth century had manufacturing subsidiaries in France, Spain, Switzerland, Northern Africa, the United States and Asia.

The company began production of electronics systems in 1968, and during the following decade diversified its product line to serve the automotive industry. Electronics content in automotive switches is increasing. Today, on average, about 60% of the value of a Marquardt's product line is electronics content, 40% mechanical content. Roughly 200 engineers in Germany are dedicated to electronics, including hardware and software.

Marquardt is still family-owned today, a rarity in the light-vehicle parts business, where major corporations own nearly 100% of the market. Other privately held German suppliers include Hella (lighting), Brose (window regulators), Kiekert (lighting) and Kostal (switches and electronics).

Each Marquardt family owns 50% of the company. Harald M Marquardt is CEO and runs the automotive business unit. The other family is represented by Mathias Marquardt, who is in charge of finance and administration. A third on the four-person management board are two non-family members: Ernst Kellermann, who runs Marquardt's original appliance and white-goods switch business as well as the entire technical department, and Detlef Kirsch, who runs the power tools switch business. Marquardt says it is the world's largest supplier of power tool switches. Marquardt is overseen by a seven-member advisory board; two board members represent the Marquardt families.

Harald M Marquardt believes that small family businesses survive in Germany because they are “harder driven by dedicated and committed shareholders, who are also in the top management.” He noted, “Managers of small companies can be closer to the needs of customers than big-company managers can. Big companies are usually more interested in growing the business through acquisitions. In the time it takes to integrate the new business, they can lose some of their customers.”

As a private company Marquardt is able to fund growth from cash flow and from bank borrowing. “We don’t give that much money to shareholders; our dividends are extremely small,” Dr. Marquardt said. The company has been modestly profitable for 80 years. While Dr. Marquardt insists the company is not looking for investment partners, he added, “we never say never.” If someone wanted to join forces with Marquardt, the company would talk, “particularly if it increases our business in Asia or the U.S.”

Marquardt’s headquarters in Rietheim-Weilheim, Germany, are located about 100 km south of Stuttgart, home to Mercedes, Marquardt’s largest automotive customer. The production and administration facilities at Marquardt headquarters occupy approximately 38,000 square meters. There the company manufactures plastic, punched metal parts and printed circuit boards for all Marquardt production plants worldwide, including for automotive systems. The plant is certified to ISO/T S 16949:2002.

Since 1999 Marquardt sales have grown by 6.1% annually while the number...
of employees has grown by just 1.6% annually. That increase in productivity is a result of an increasing reliance on automation in high-labor cost countries such as the U.S. and Germany. Marquardt has also built factories in low-labor cost countries such as Tunisia, India and China. In early 2006 the company will begin production in Sibiu, Romania. By the end of 2006 the facility will employ more than 250 people.

Marquardt’s toughest competition for automotive switches comes from Kostal, Valeo, Siemens VDO, Huf, Delphi, Methode Electronics plus the Japanese suppliers Alps and Omron. Dr. Marquardt observed that the Japanese companies are making inroads in the market in Germany and the rest of Europe.

Developing Markets

In the last two decades, Marquardt has become increasingly focused on the auto industry. Ten years ago, the automotive market took 10% of Marquardt’s shipments. By 2004, that percentage had grown to 66%. In five years the automotive market’s share of company sales is expected to grow to 80%. “When you pick up a new piece of automotive business you get to multiply a $5, $10 or $20 part by 300,000 units a year, which gives you as much as $6 million in new sales,” explained Dr. Marquardt. “The power tools business yields smaller figures: If Black & Decker develops a new drill and we supply them completely, the numbers are lower. Even if they sell 500,000 or 1 million units a year, if the switch costs, for example, $2— the most that business will yield is $2 million.” Marquardt believes its automotive sales will grow faster than the market for the company’s automotive products, which is expected to grow annually at the rate of 5% to 6%.

Since Marquardt is a relatively small company, it initially had to be careful to focus on only a few automotive customers, starting with M ercedes, which today is Marquardt’s largest customer by far. Now the company is working to develop business with other carmakers and tier one suppliers, especially those in Germany, China, Japan and the United States.

To illustrate the company’s progress, Marquardt cited its U.S. manufacturing facility near Syracuse, in Cazenovia, New York, which currently makes mostly power-tool switches and a small quantity of automotive switches for G eneral Mo tors. But if Marquardt is successful in landing some major pieces of automotive business it has in the works with GM and others, in five years the Cazenovia facility could be producing over $40 million dollars worth of switches, including $20 million in automotive switches annually.

Getting more business with Chrysler is important to Marquardt. It recently picked up a new order from Chrysler for an accessory switch bank, but Dr. Marquardt acknowledges that the company faces tough competition from Methode Electronics (Chicago, Illinois), Delphi, Siemens VDO, Faurecia, Takata Petri, Hella, Magna, Valeo, and many others, in five years the Cazenovia facility will employ more than 250 people.

Marquardt’s toughest competition for automotive switches comes from Kostal, Valeo, Siemens VDO, Huf, Delphi, Methode Electronics plus the Japanese suppliers Alps and Omron. Dr. Marquardt observed that the Japanese companies are making inroads in the market in Germany and the rest of Europe.

Developing Markets

In the last two decades, Marquardt has become increasingly focused on the auto industry. Ten years ago, the automotive market took 10% of Marquardt’s shipments. By 2004, that percentage had grown to 66%. In five years the automotive market’s share of company sales is expected to grow to 80%. “When you pick up a new piece of automotive business you get to multiply a $5, $10 or $20 part by 300,000 units a year, which gives you as much as $6 million in new sales,” explained Dr. Marquardt. “The power tools business yields smaller figures: If Black & Decker develops a new drill and we supply them completely, the numbers are lower. Even if they sell 500,000 or 1 million units a year, if the switch costs, for example, $2— the most that business will yield is $2 million.” Marquardt believes its automotive sales will grow faster than the market for the company’s automotive products, which is expected to grow annually at the rate of 5% to 6%.

Since Marquardt is a relatively small company, it initially had to be careful to focus on only a few automotive customers, starting with M ercedes, which today is Marquardt’s largest customer by far. Now the company is working to develop business with other carmakers and tier one suppliers, especially those in Germany, China, Japan and the United States.

To illustrate the company’s progress, Marquardt cited its U.S. manufacturing facility near Syracuse, in Cazenovia, New York, which currently makes mostly power-tool switches and a small quantity of automotive switches for G eneral Mo tors. But if Marquardt is successful in landing some major pieces of automotive business it has in the works with GM and others, in five years the Cazenovia facility could be producing over $40 million dollars worth of switches, including $20 million in automotive switches annually.

Getting more business with Chrysler is important to Marquardt. It recently picked up a new order from Chrysler for an accessory switch bank, but Dr. Marquardt acknowledges that the company faces tough competition from Methode Electronics (Chicago, Illinois), Delphi, Siemens VDO, Faurecia, Takata Petri, Hella, Magna, Valeo, and many others, in five years the Cazenovia facility will employ more than 250 people.
Detroit carmakers are in discussions with 8-bit microcontroller, some software, electronic ignition switch is comprised of an fully electromechanical switch, the elec-
est-growing products. Less expensive than Porsche Cayenne.

Touareg, Bentley Continental and the new Audi A6, VW Phaeton, VW with other carmakers: for the Audi A8, 1996, and that success has led to business electronic ignition starter switches in door-handle sensor and control units.

tronic ignition starter switch, electronic of sales, is driver authorization systems

cally pleasing as well.

feel right to the operator and be aestheti-

status must be easy to discern. They must

lighting conditions, and their on or off

connections. They have to be easy for the
to do than simply close or open electrical

◆ printed circuit board painting

M arquardt for electronic ignition starters because of the substantial cost savings the product affords. It also provides a high degree of theft protection through the use of rolling codes—more than 100 million codes are possible, with a code change every time the engine is started. The “key” that starts the engine is electronic (no metal needed) and can be made as a smart card or it could take many other forms. “We actually give the customer the functionality he wants and just surprise him with a new idea of what the key can look like,” said Dr. M arquardt.

M arquardt’s system allows drivers access to their vehicles and engine starter as long as the battery-operated transceiver key is in their possession. To gain access to the vehicle, you walk up to the car and pull on the handle to activate a switch. The car will then look for the proper key, which could be in the driver’s pocket when operating in RF mode. The electronic key used with Mercedes’ system operates in both RF and IR transceiver modes, for backup. The battery lasts for five to seven years. The driver starts the car by stepping on the brake and pressing a switch. Keyless-G o is M ercedes’ (some-

ultrasonic switches like the iDrive are the second of Marquardt’s two fastest-growing products. M arquardt designed and manufactures the updated iDrive switch available as an option on the B MW 1 series and 3 series vehicles.

O perated much like a computer mouse or touch pad, the iDrive switch has multiple functions, which are activated by turning, sliding or pressing the main control knob. M arquardt doesn’t make the much-maligned iDrive switch used in the 7 series. That’s made by A 1ps. A according to Dr. M arquardt, his company’s version of the switch, less expensive than the original, is a new benchmark for iDrive because the switches inside the device were designed to have the right feel. T he improved haptics makes operation of iDrive more intuitive for drivers. To come up with its version for the 1 and 3 series, M arquardt looked at all of the switches accessible to the driver. W hile the iDrive can substitute for a number of switches that clutter the dashboard, M arquardt took a wide view of all driver-accessible switches and suggested which ones should stand as single-purpose switches separate from iDrive, for easier driver access.

O ver time, as more carmakers apply multifunction, touch-pad-like switches, the demand for single-purpose switches will decline. “In some vehicles you can really see that drivers were overwhelmed by too many switches; multifunction switches can help with that,” explained Dr. M arquardt. “N evertheless, you will always need a base of dedicated switches that you use every day, for example, igni-
tion, hazard, horn, seat-heater and light switches. W hile headlamp switches can automatically be turned on and off, many people like to switch on their headlamps when they want,” he elaborated.

◆ Bus-C apable Switches: Taking advan-
tage of its ability to combine software, electronics and mechanical expertise, M arquardt provides switches that are linked into networks using C A N and/or L IN protocols or its in-house developed M A XIS bus protocol used on trucks and commercial vehicles. M arquardt is seeing rapid growth in the demand for bus-ca-

pable switches.

“T he future looks much rosy for us,” said Dr. M arquardt when the was asked about the future demand for electronic ignition switches. “T here are many more applications for this kind of technology, including more widespread use in small cars. We’re looking at a large number of new opportunities for this technology.”
that one of the greatest advantages of this product line is the way it can reduce the inventory of switches held at the carmaker. Mercedes can wait until one day before it needs the switches on the factory floor to custom order a bank of CAN-capable switches from Marquardt. Each bank of switches comes with a CAN electronics module in which an EEPROM is programmed to give each heretofore exact same switch its unique address. Each switch is then labeled according to its function by Marquardt’s patented process for laser etching the plastic.

While Marquardt's customers have used plenty of CAN switches, they are quickly transitioning to the newer LIN standard, which is less expensive than CAN. According to M Marquardt, each CAN node costs at least €5.30 ($6.84) for the microcontroller and chip set, compared with LIN nodes starting at about €1.65 ($2.13) for the microcontroller and chip set. Given the cost of each node, it makes sense to network only if a minimum of five switches are linked to the node. Because the LIN network requires only one wire to connect the nodes compared with two wires for CAN, LIN would require half the number of connection terminals.

Comparison of Network Features

Controller Area Network (CAN)
- Event-triggered communications
- Priority controlled bus access
- No deterministic time behavior
- High flexibility
- Up to 1 M bps at 40m network dimension
- Dual wire system
- Up to 8 data bytes per message
- Broadcast transmission possible
- Multi-master system

Local Interconnect Network (LIN)
- Time-triggered communications
- Bus access with delegated token
- Deterministic time behavior
- Low safety of data
- Up to 20 Kbps
- Single wire system
- Up to 8 data bytes per message
- Broadcast transmission possible
- Single master and multiple slave nodes

Marquardt’s Automotive Production Facilities

<table>
<thead>
<tr>
<th>Location</th>
<th>Production Start</th>
<th>Size in m²</th>
<th>Certification</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rietheim-Weilheim, Germany</td>
<td>1925</td>
<td>38,000</td>
<td>ISO/TS 16949:2002</td>
<td>Assembly parts such as plastic and punched parts, printed circuit boards for all plants worldwide</td>
</tr>
<tr>
<td>Boettingen, Germany</td>
<td>1955</td>
<td>7,400</td>
<td>ISO/TS 16949:2002</td>
<td>Snap-action switches and subassemblies</td>
</tr>
<tr>
<td>Trossingen, Germany</td>
<td>1984</td>
<td>2,900</td>
<td>ISO 9001:2000</td>
<td>Tools and molds</td>
</tr>
<tr>
<td>Tunis, Tunisia</td>
<td>1991</td>
<td>9,500</td>
<td>ISO/TS 16949:2002</td>
<td>Switches</td>
</tr>
</tbody>
</table>

Bose...

While Bose has been very secretive about its infotainment developments, its new electromagnetic suspension system has been seeing plenty of press. Still quite expensive, the system promises to combine passenger comfort and vehicle control—two suspension attributes that have been mutually exclusive. Regenerative power amplifiers allow power to flow into the linear electromagnetic motor to keep the wheels on the road and also allows power to be returned to the motor as the wheel rides up, for example, coming out of a pothole. As a result, the Bose active suspension system requires less than one-third the power of a typical vehicle air-conditioning system. High power demands have severely limited the penetration of active suspension systems into vehicles. Bose has been developing the suspension system for more than 24 years. A private company, Bose invests heavily in R&D and is not forced to show quick investment returns. According to Fortune magazine, Bose annually ships about $1.7 billion worth of products.
Honda, Hyundai, Subaru—Best E/E Reliability

Percentage of Light Vehicles with Electrical Systems Problems

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honda/Acura</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Hyundai/Kia</td>
<td>1.0</td>
<td>1.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Subaru</td>
<td>1.0</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Toyota/Lexus</td>
<td>1.0</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>General Motors</td>
<td>2.5</td>
<td>2.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Nissan/Infiniti</td>
<td>1.3</td>
<td>1.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Mazda</td>
<td>1.0</td>
<td>1.5</td>
<td>1.9</td>
</tr>
<tr>
<td>Ford</td>
<td>2.5</td>
<td>2.1</td>
<td>1.9</td>
</tr>
<tr>
<td>Chrysler</td>
<td>2.2</td>
<td>2.5</td>
<td>1.9</td>
</tr>
<tr>
<td>DaimlerChrysler</td>
<td>2.3</td>
<td>2.8</td>
<td>2.0</td>
</tr>
<tr>
<td>BMW</td>
<td>3.5</td>
<td>4.0</td>
<td>3.1</td>
</tr>
<tr>
<td>Mercedes</td>
<td>2.8</td>
<td>4.9</td>
<td>4.4</td>
</tr>
<tr>
<td>Volkswagen</td>
<td>4.1</td>
<td>2.7</td>
<td>4.7</td>
</tr>
</tbody>
</table>

2005 claims that Mercedes is “now producing the best product quality ever,” but acknowledges problems with a voltage regulator and battery control unit software. Electrical glitches affecting lights and switches also prompted big recalls for Ford and GM.

For customers considering buying a used car, Consumer Reports also includes a list of cars classified as “good bets” and “bad bets,” based on the model’s overall reliability over the years. The good bets have better-than-average overall reliability; the bad bets have shown much worse-than-average reliability. Of the 54 good bets listed, 47 are Japanese makes and the rest are U.S. makes. No Japanese models were included in the bad bets list.

Auto Electronics Conference in Germany

Industry executives who want to keep up with the latest trends or network with top industry officials, especially the Germans, should attend the 9th International Congress, Advances in Automotive Electronics. Automotive electronics experts will convene in Ludwigsburg, Germany (near Stuttgart), June 21–22, 2005.

“T his conference is like Convergence used to be,” said Heinz Leiber, former director of electrical and electronics development at Mercedes-Benz, who helped organize the meeting. “It deals with the big picture; all of the presenters are directors or vice presidents.”

During the single-track event, 18 speakers will cover a variety of important subjects including: complexity management, diagnostics, model-based development, driver-assistance systems, third-generation entertainment systems, architecture, safety systems, vehicle dynamics, microcontrollers, trends in energy management and hybrid vehicles, modularity and systems integration.

VIP presenters include:

- Karl-T. Thomas N. Neumann, Board Member, Continental
- Jürgen Leohold, Director Electrical/ Electronics, Volkswagen AG
- Dr. Wiliibert Schleuter, Director, Electrical/Electronics, Audi
- Bill Mattingly, Vice President Electrical/Electronics Core, Daimler-Chrysler
- Patrick Popp, Director, Electrical and Controls Integration Lab, General Motors
- Karl-H. Einz Gaubatz, Director, Chassis Systems, BMW Group
- Shiro Baba, General Manager Automotive Semiconductors, Renesas Technology Corp., Tokyo

Simultaneous translation to English is available. To register for the €1,295 ($1,671) event and exposition, please visit www.elektronik-tagung.de or call 49- (0)-8191-125-573.

Telematics Update Detroit

Eight hundred automotive electronics professionals are expected to attend Telematics Update’s Detroit 2005 event, which will be held at the Laurel Manor, Livonia, Michigan, outside of Detroit. Starting on May 16 the two-day conference offers a full agenda of panel discussions, keynote speeches, case studies, and interactive roundtable discussions, as well as an exhibition. Exhibitors include Freescale Semiconductor, Siemens VDO, Wind River, NTK Software Systems, Networkcar and Bluetooth experts, Parrot.

On May 16, Paul Hansen will moderate a morning plenary panel discussion called “Partnerships That Increase Telematics’ Value Proposition.” Panelists include John Slossar, director of electronics systems, Visteon; Stell Patsiokas, executive vice president, XM Satellite Radio; George Salmi, business development executive with the IBM telematics and asset-monitoring group; and Paul Drysch, vice president of sales for M2M (machine-to-machine) connectivity provider Aeris.net. For complete details, please visit www.telematicsdetroit.com.