StarTuned®

Information for the Independent Mercedes-Benz Service Professional

August 2012 U.S. $6.00 € 9.00 Volume 12 Number 3

Getting the MOST

Second Time Around

Scan Tools

TPC

Mercedes-Benz

startekinfo.com

. . . getting you in gear since 2002.

Your Workshop Resource to Get the Job Done

- WIS-net (Workshop Information System)
- Wiring Diagrams
- Technical Bulletins
- Mercedes-Benz Special Tools
- Maintenance Sheets
- Star Diagnosis System (SDS)
- Mercedes-Benz Workshop Equipment

Mercedes-Benz

TO OUR READERS:

Welcome to STARTUNED, the magazine for independent service technicians working on Mercedes-Benz vehicles. Your Mercedes-Benz dealer sponsors STARTUNED and provides the information coming your way in each issue.

Mercedes-Benz wants to present the information you need to know to diagnose and repair Mercedes-Benz vehicles accurately, quickly and the first time; text, graphics, on-line and other technical sources combine to make this possible.

Feature articles, derived from approved company sources, focus on being useful and interesting.

Our digest of technical information can help you solve unanticipated problems quickly and expertly.

We want STARTUNED to be both helpful and informative, so please let us know just what kinds of features and other diagnostic services you'd like to see in it. We'll continue to bring you selected service bulletins from Mercedes-Benz and articles covering the different systems on these vehicles.

Send your suggestions, questions or comments to us at:
STARTUNED
One Mercedes Drive
Montvale, New Jersey 07645
Phone: 1 800 225 6262, ext. 7112
E-mail: andrew.webb@mbusa.com

Editorial and Circulation Offices: 134B River Road, Montague, NJ 07827.

Group Publisher
Christopher M. Ayers, Jr.
cayers@automotivedatamedia.com

Editorial Director
Bob Freudenberger
bfreud@automotivedatamedia.com

Contributing Editor
Bob Chabot
bchabot@automotivedatamedia.com

Contributing Editor
Kerry Jonsson
kjonnson@automotivedatamedia.com

Contributing Editor
Tom Nash
tnash@automotivedatamedia.com

MBUSA Technical Content Advisor
Donald Rotolo
Donald.Rotolo@mbusa.com

MBUSA Project Manager
Adam Green
adam.green@mbusa.com

Art Director & Circulation Mgr.
Christopher M. Ayers III
ayersc3@automotivedatamedia.com

Visit us at our web site www.MBWholesaleParts.com to view this issue and all past issues of StarTuned, along with a wealth of information on Genuine Mercedes-Benz Parts.

To locate a Mercedes-Benz dealer near you, go to www.mbusa.com.

In This Issue

Getting the MOST

Nowhere is technological sophistication more evident than in automotive entertainment systems. These days, a Mercedes-Benz has so much more than a radio and CD player. Interconnectivity with peripherals, DVD, GPS, and Navigation make a lot of information available to the vehicle's occupants. How do we keep this going?

People who purchase Mercedes-Benz vehicles do so because they want something exceptional. Exceptional performance, exceptional safety, and exceptional technology are only some of the reasons behind this. Nowhere is this more evident than in the entertainment and navigation systems. Engine management, ABS, stability control, etc. all have to process information at high speed to make them function as closely to real-time as possible. When it comes to media-based information systems, the needs are different. You know from you digital camera and video recorder that high-resolution files are huge. It is not critical that the information run at real-time speeds because buffers can store the information temporarily. But there is a lot of information that needs to move around. A new form of transporting this information was necessary for these systems to function the way Mercedes-Benz owners expect.

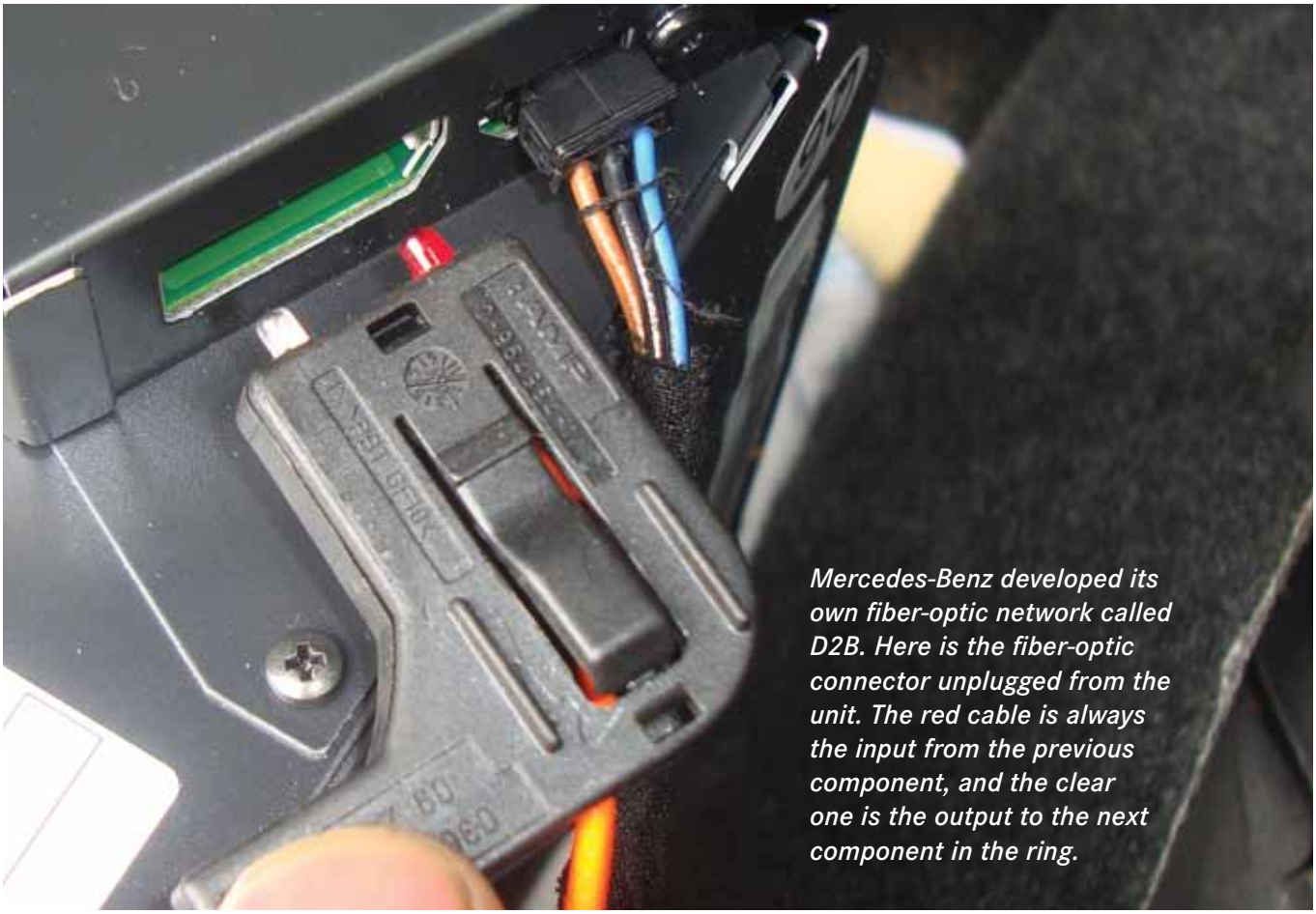
Light Speed

The answer to this digital data transfer problem is fiber-optics, which can channel large amounts of data quickly and accurately. They can operate in temperatures from -40 deg. to 85 deg. C., so they can easily withstand the interior environment of a vehicle. A fiber-optic cable can handle up to 20MB of data per second through light pulses, which must be shielded or the light will refract out of the path. Reflective cladding protects the light signal, and is also insulated with an orange outer jacket. This ensures that the pulses of light stay within the confines of the cable core.

Using a fiber-optic network has more benefits than just being able to move around large amounts of data. Light pulses are impervious to electro-magnetic interference. This means the cables can be run through the vehicle with the wiring harness and high current flow will not distort the signal. Fiber-optic cable is lighter than metal wiring and requires fewer connections. Unfortunately, fewer connections means the cables are not easily serviceable. It takes special equipment to sever a connection and re-attach it. Most of the time, it is easier to replace the entire cable rather than repair it, depending on the extent of the damage.

Mercedes-Benz implemented its version of a fiber-optic network called the Domestic Digital Bus (D2B). D2B operates the sound system, CD Changer, cellular telephone (now digital), voice recognition (if the car is so equipped), and Tele Aid control units. These features communicate with one another through an optical and electrical network. D2B transfers data at 5.6MB per second, well within the limits of the cable.

This network follows slightly different rules from the electrical networks you are used to. Most

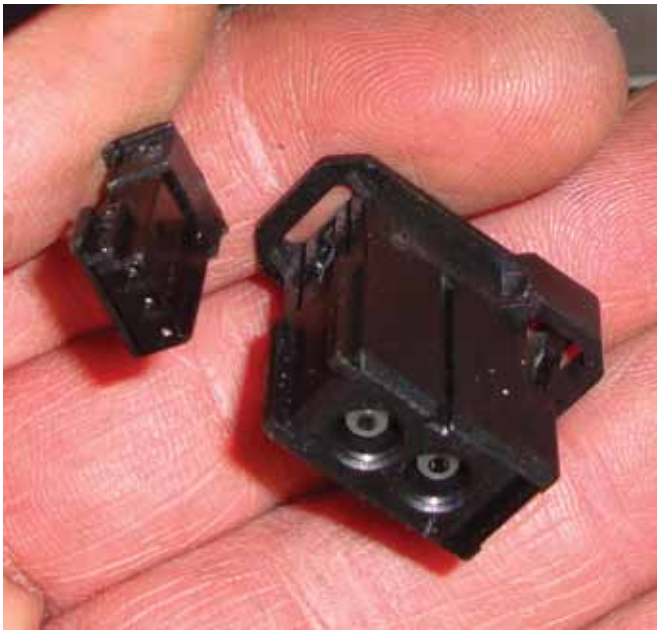


Mercedes-Benz developed its own fiber-optic network called D2B. Here is the fiber-optic connector unplugged from the unit. The red cable is always the input from the previous component, and the clear one is the output to the next component in the ring.

conventional CAN systems are wired in parallel with each control unit transmitting and receiving data according to priority. The D2B bus, like all fiber-optic networks, is not connected in parallel. It is connected in a "ring." The optical signal originates from a master and is sent to the second component in the ring through the cable. A second fiber-optic cable leaves the second component and carries the signal on to the third component, and so on. The final component sends the signal back to the master to complete the ring. A complete ring is required for the D2B to function. If there is a break anywhere in the ring, none of the components will function.

Early to Bed, Early to Rise

Fiber-optic components draw a high amount of electrical current to operate. Not only do they have to perform their function, but they also have to convert electrical signals to light pulses and send them to the next component. It also has to receive signals and interpret these light pulses coming from



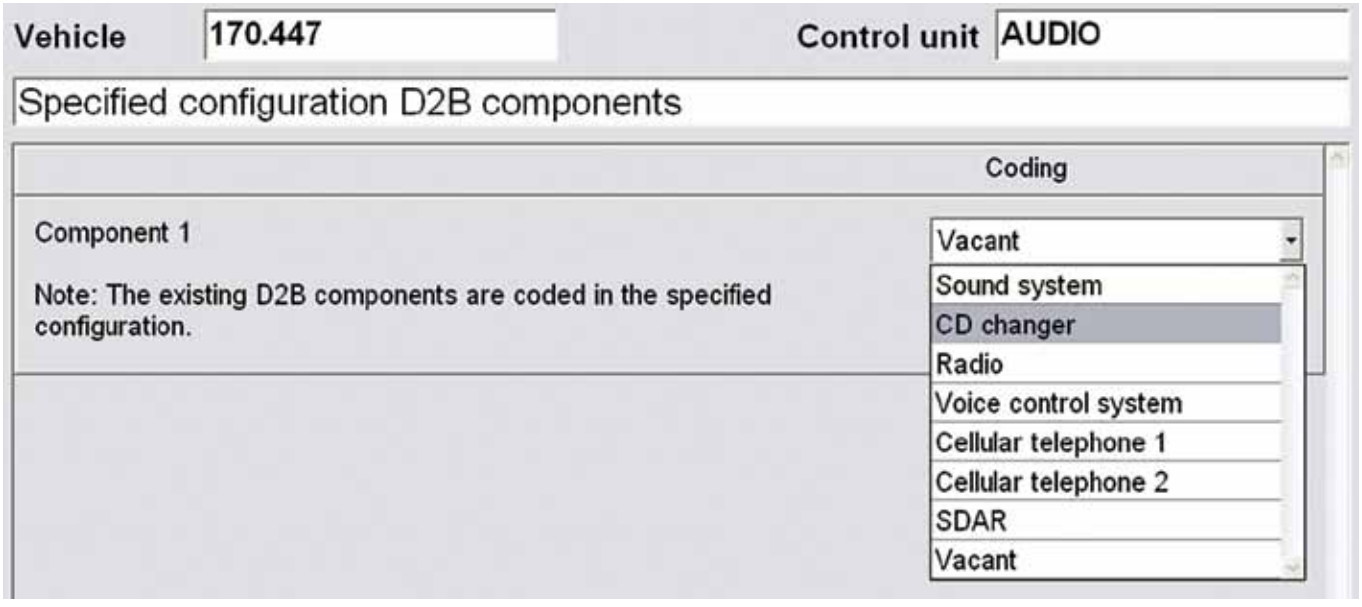
Here are two MOST connectors that plug into the CD changer. There is a three-pin electrical connector for power, ground, and wake-up signal. The two-pin plug is for the fiber-optic cable. One cable brings the light-pulse message in, and the second cable sends it out to the next component.

the previous component. When the system is shut down, each component has to be put into sleep mode. This requires a wake-up signal when the ignition key is turned on. This wake-up is achieved with both a fiber-optic signal and through the electrical star network. Each component needs to be signaled in its order in the ring. This is important when replacing or retrofitting components. When the master is coded, it is vital that each component is added in order starting from when the ring leaves the master. This will affect how the master wakes up the D2B network. If the coding is incorrect, none of the components in the system will work. On older vehicle, the master can be the radio, Command Console, or the navigation MCS unit.

In an effort to assist with self-diagnostics, both the fiber-optic network and the electrical network are not only awakened by the master, but each component also answers back on both networks. Specialized equipment is required to monitor the fiber-optic signal. Mercedes-Benz dealerships use a D2B tester manufactured by Berger Electronics. It is capable of testing the integrity of the light signal at the connector. In the absence of this tool, you can use the vehicle's existing self-diagnostic capability to help find the problem component or cable. As mentioned earlier, the wake up signal is put out on both the fiber and electrical networks. Each control unit that wakes up sends a response signal on both networks as well. The master of the D2B monitors the response from the control units on the electrical network and compares it to the fiber-optic side. If all the control units respond on the electrical network, but only two out of five respond on the fiber-optic network, the master can determine that the failure is between components 3 and 4 or component number 3 has failed to issue a fiber-optic signal. Remember, the fiber-optic wake-up signal must have made it to components 2 and 3 because they responded on the electrical network, but could not respond on the fiber-optic. Components 4 and 5 responded on the fiber-optic network, but 3 did not. Therefore, the problem with the fiber-optic network must be between component 3 and 4.

Onward and Upward

The next evolution of the fiber-optic network is referred to as the MOST (Media Oriented System Transport) bus. The layout of the system has changed to incorporate more sophisticated electronics, but the basic structure and principles are still the same. The MOST bus incorporated a whole host of improvements. It is a standard protocol that is used by multiple manufacturers for their entertainment systems. This means a greater

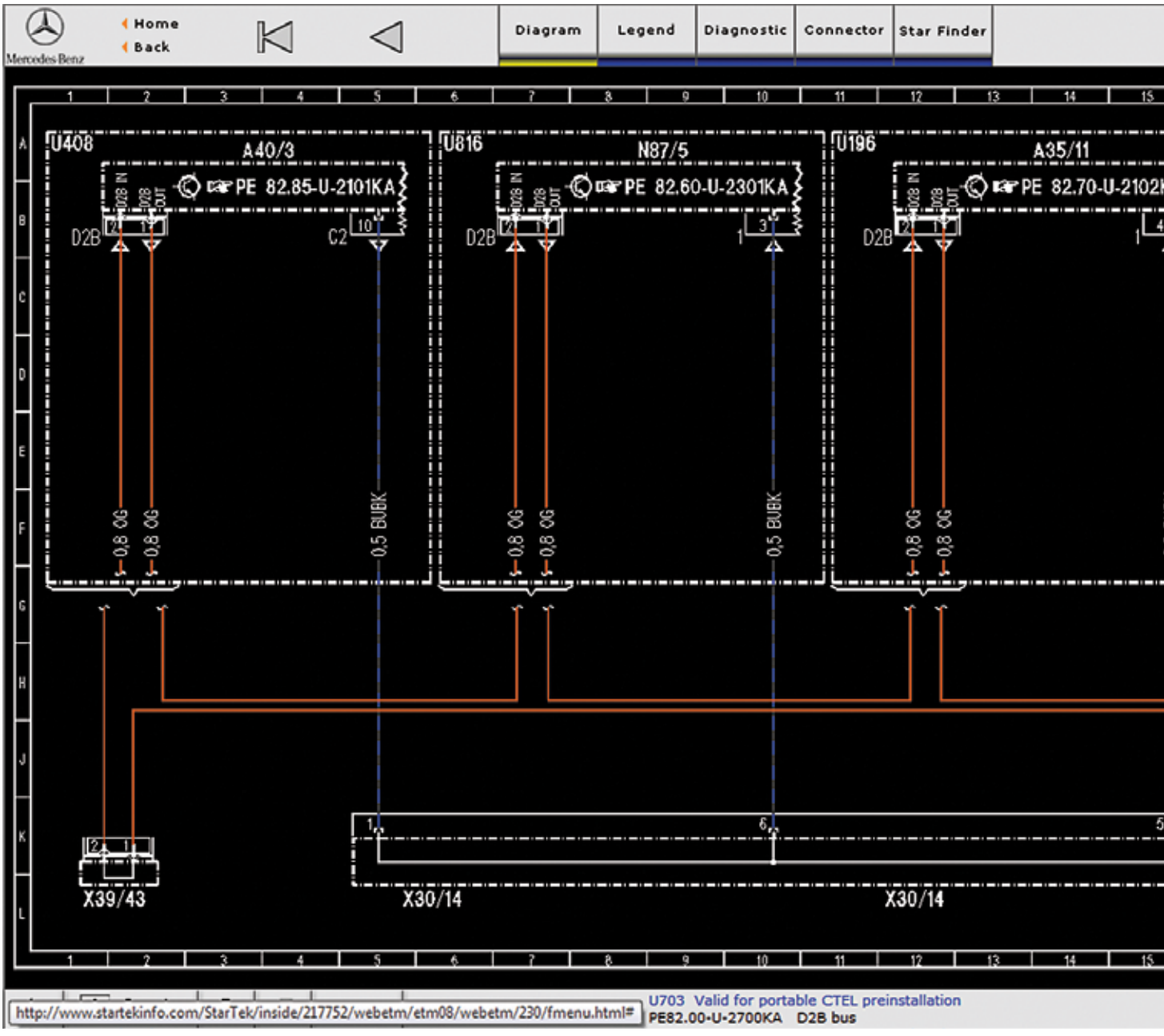


Using the SDS, you can add a CD changer in the second slot of the D2B. With the SDS, go into the audio master, which in this case is the radio, and under the retrofitting heading select the components you want to add to the fiber-optic ring. Otherwise, the audio master will not wake up the CD changer and start communicating with it.

number of component options are available from numerous manufacturers of electronics. Mercedes-Benz started integrating this new protocol with the 211 chassis in 2003. Not all Mercedes-Benz vehicles converted to the MOST bus, but it is being added to more and more vehicles as they develop. The D2B bus was limited to a maximum of six components in the ring. With the MOST system, it currently runs about 16 components, but you can have up to 64 in the ring. Also, network speed has improved to 24.8Mbps, but can handle speeds up to 50Mbps.

A new development with the MOST bus is the watchdog function. If a component on the ring has a failure, it is possible to put that component in watchdog mode. This mode allows the malfunctioning unit to serve as a repeater and allow the optical signal to continue on and complete the ring.

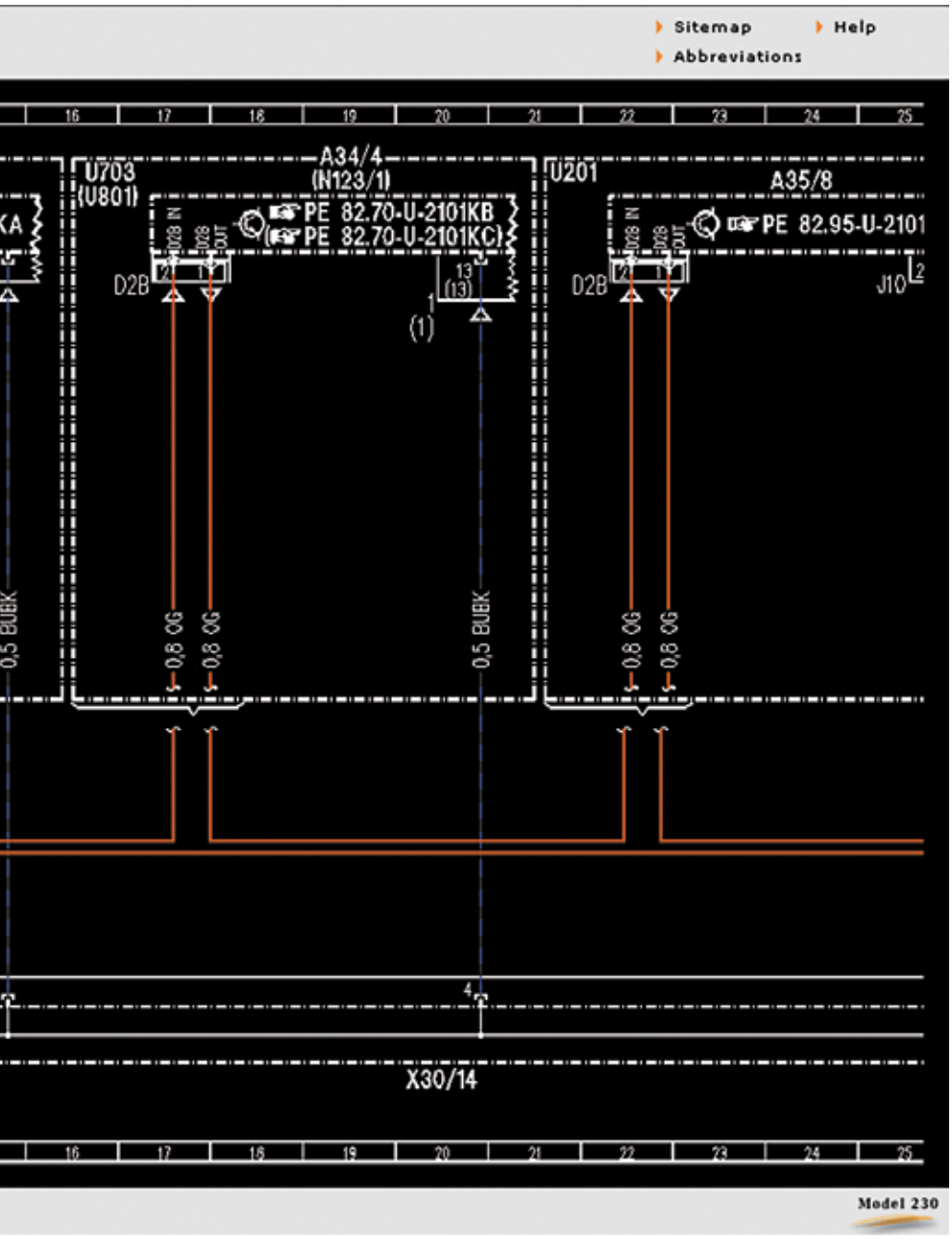
On the older D2B network, the control unit head is the master of the entire network. Now, for the first generation of the MOST network an Audio Gateway Module (AGW). or an Audio 20 is in charge of all the other components. The Audio 20 is the display



head in the vehicle, but the AGW can be mounted anywhere. After 2005, the second generation of the MOST bus incorporates the master back into the head unit as in the Audio 20. Either unit holds the ring configuration in its coding. This means you can retrofit or remove components from the ring as your customer desires. There are many more components on the ring, and therefore there are many more options. Like the D2B bus, the master still sends an optic and electrical wake-up signal to each component in the ring. Each component still responds back both through the fiber-optic bus and the star configuration electrical network. The master monitors the ring performance and sets self-diagnostic fault codes if problems are found. The master is also responsible for transmitting this self-diagnostic information to the other CAN networks. Your SDS does not directly connect to the MOST bus, but it can communicate with the master and access it for diagnostic purposes. The master also has many other functions.

Who is In Control?

The AGW has many different configurations depending on the equipment level of the vehicle. As an example, the AGW may have the sound amplifier built into it, or the vehicle may have a separate sound amplifier. If the amplifier is built into the unit, the speakers will be wired to it. It will also have the radio tuner built into it. The radio tuner is not built into the display as with the older D2B network. The head unit only functions as a display and operator interface. When the driver changes the radio station or volume through the head unit, this information is passed onto the AGW through the fiber-optic network. The electrical network is only to wake up the system, put it to sleep, and assist in self-diagnostic functions.



With a paid subscription to Startekinfo.com, you can access a fiber-optic cable diagram. This allows you to see the possible connections and the order the components are supposed to be in illustrated by the orange wires. The lower part of the diagram illustrates the electrical star wake-up network with the blue wiring.

The AGW can be "reflashed" as changes and improvement are made to the MOST bus. If you have intermittent problems with MOST bus components, you should check for software updates under diagnostic technical bulletins on the Mercedes-Benz service website www.startekinfo.com. With a paid subscription to Startekinfo and your SDS, you can reprogram the AGW as updates become available. If the system is malfunctioning, you will still need to look at self-diagnostic information and verify that you have power and ground to any component malfunctioning on the MOST bus.

Other components on the MOST network are the Head Unit, multiple disc CD changer, navigation, satellite radio receiver, hands free module/voice control system, TeleAid including GPS, and optional external amplifier. These components are sometimes referred to as bus slaves, taking their orders from the master. All of these units are capable of putting out an electrical wake-up signal unlike the D2B network. They are also all capable of performing self-diagnosis of their own operation and report their findings to the master unit. This way, the SDS can interrogate the master for problems in the MOST bus. Within the software of the SDS and all of the components of the MOST bus is a diagnostic wake-up feature that checks the entire system. As mentioned earlier, the master and you both need to know the order of each of these slaves relative to the master unit. You can find this information by looking at the coding of the master with your SDS. Each of these components has a built-in temperature sensor. They will not function over 194 deg. F., so the MOST system may not work right away if the vehicle has been parked out in the sun where interior temperatures can get quite hot during the summer months.

How Are We Going To Fix It?

Now that you know the basic layout, function, and operation of the D2B and MOST bus networks, you will need to have a diagnostic plan if you are to proceed in a cost-effective manner. Since these systems are complicated, self-diagnostics with a capable SDS scan tool are essential to speed up troubleshooting. There are some basic steps you can perform as well. Remember, when any component fails on the fiber-optic network the entire network goes down. You need to know all of the different components in the vehicle, but if they are not communicating then you cannot use the SDS to tell you the layout of the ring. You can get a fiber-optic diagram in the ETM on Startekinfo.com.

You should start off by quickly checking the power supply to the D2B or MOST master. Checking fuses first makes sense. The next step would be to see if the master is transmitting data on the fiber-optic network. You can physically go to the next component on the list and unplug the fiber-optic connector. Look at the connector and turn on the ignition key.

In the case of the D2B network, the master attempts to start the ring up to four times. This means you should see four light pulses at the second component in the ring. Once you have verified this you can move onto the next component and perform the same test. Move onto the next component until you no longer see the red light pulse at the connector. This means either the fiber-optic cable is damaged, the component it is coming from has failed or has lost its power or ground supply. In the case of the MOST bus, the ring start from the master is nine pulses of red light. Move onto the next component in the ring and recheck the optical start signal. Obviously, since there are many more components in the MOST network this can be quite time-consuming, which is why the SDS is such an invaluable tool when diagnosing MOST bus problems. There are two special tools available from Mercedes-Benz to bypass components in both the D2B and MOST networks. These bypass connectors plug into the fiber-optic plug of the component you want to bypass. This will keep the ring complete and allow it to function without the bad component. If you find you have a problem with the electrical bus, you can unplug the buss bar that links this network together and test each wire individually for a short to power or ground, or an open circuit.

Although the D2B and MOST bus systems are technologically advanced, understanding the basic layout of a fiber-optic network and the electrical network that supports it will help you isolate problems . If you use your SDS, you can reduce your diagnostic time and come up with a more accurate answer. |

Like Chip Foose, BASF Brings A Little Extra To The Party.

BASF
The Chemical Company

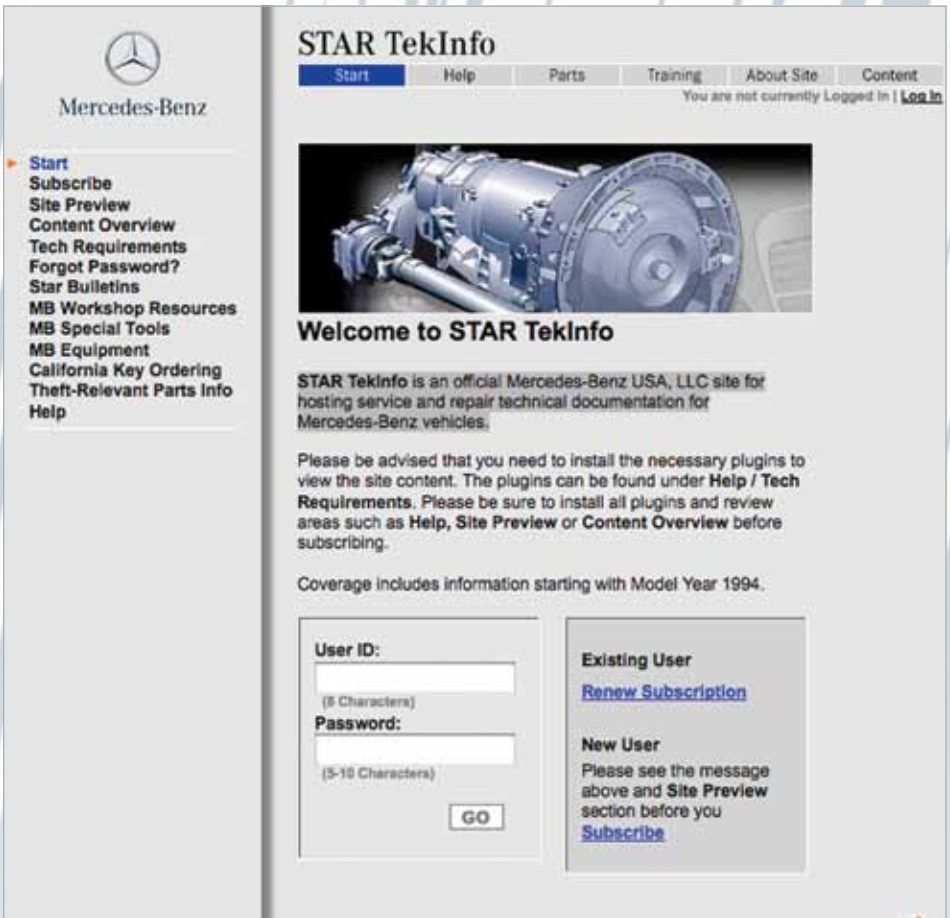
Chip Foose has been wowing enthusiasts for years with his innovative color solutions. BASF has been doing the same with its unique color management system, led by COLOR-MAX®, the industry's most precise color matching tool. The paint-sprayed chips of COLOR-MAX ensure a perfect match the first time, every time, reducing comebacks and increasing productivity. And BASF Refinish coatings are approved by Mercedes-Benz and most major OEMs across North America.

Beautiful color. Speedy matches. It's why Chip Foose sprays only BASF in his shop and has for over ten years. To learn more, visit **www.basfrefinish.com** or call **1-800-825-3000**.

Scan Tools

An Essential Part Of Collision Repair

Is your choice of diagnostic tooling in collision repair helping or limiting you?



The STAR Tek Info website is the official Mercedes-Benz USA LLC (MBUSA) site for hosting service and repair technical documentation, bulletins, recommended tools and equipment, training, and other resources for Mercedes-Benz vehicles. Visit www.startekinfo.com for more information.

MBUSA also makes training information available at its Technical Training website. Visit www.mercedestechstore.com for a list of free model-

If you're in the business of repairing Mercedes-Benz vehicles following an accident, you are now in the vehicle diagnostics business — like it or not. Like your mechanical brethren, being repair-ready and competitive in the marketplace today requires it. It's that simple. But that doesn't make it easy.

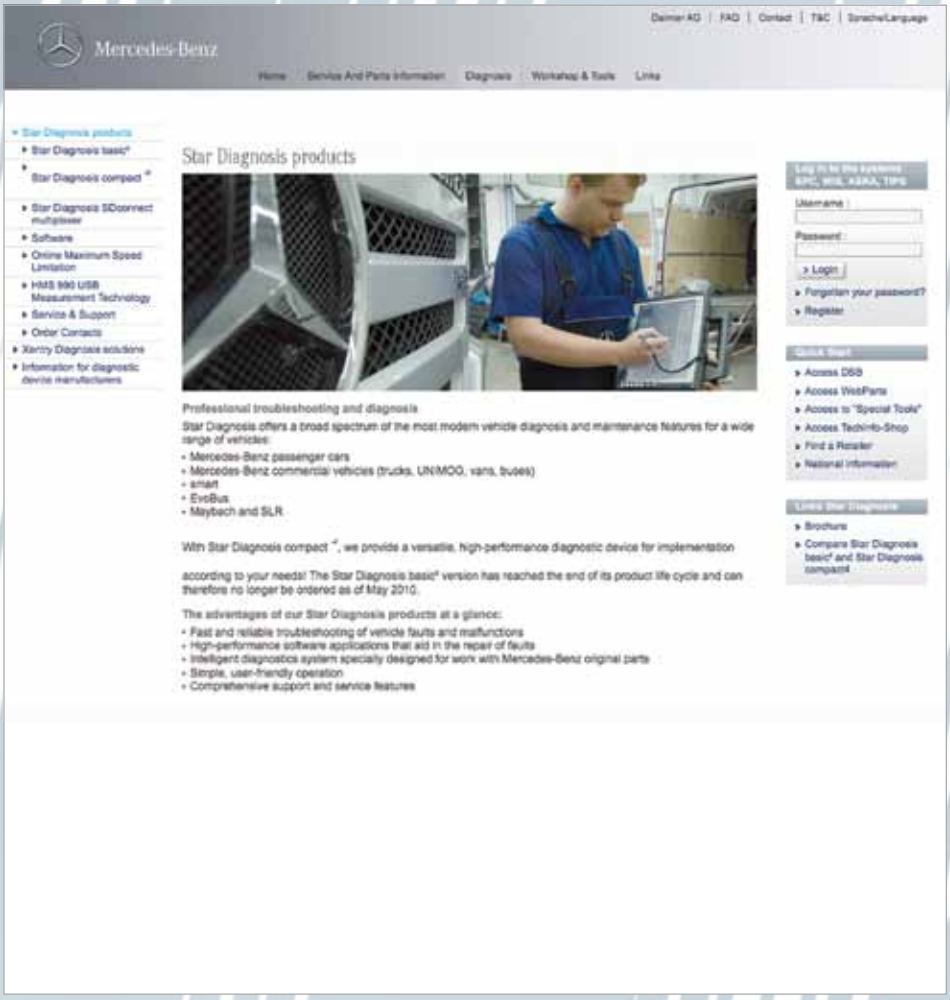
If you are not already using — or relying on someone who is — the M-B Star Diagnostic System (SDS), Xentry Diagnostics subscription-based software, and other factory-approved diagnostic tools during Mercedes-Benz collision repairs, the ability of your facility and technicians to provide customers with a complete job is limited, regardless of your experience and accumulated skillsets. Moreover, post-repair vehicle performance and occupant safety can be seriously compromised.

Let's have a look at diagnostic scan tools basics, some Mercedes-Benz resources available and several case studies specific to the marque that will help collision facilities better understand why proper tooling is critical to their survival and future growth.

Electronic complexity drives scan tools into the collision repair process

Many aspects of modern collision repair of Mercedes-Benz vehicles require access to and the use of genuine resources for service information, training, collision repair procedures, equipment and

specific PDFs or access to the Mercedes-BenzUSA Online Store for model-specific CDs with more detailed information.



The Mercedes-Benz Portal describes various Mercedes-Benz Star Diagnostic System (SDS) hardware and software products, as well as the advantages provided to technicians. Visit http://service-parts.mercedes-benz.com, then click the "Diagnostics" tab to learn more. (Images —Mercedes-BenzUSA LLC)

tools are essential to effect a complete, safe repair. For example, recent changes in the mix of materials used to manufacture vehicle structures (e.g. advanced high-strength metals and carbon fiber-reinforced plastic) have resulted in Mercedes-Benz-specific changes in repair techniques, procedures, tools, and more.

However, accelerating vehicle complexity is not just limited to structure. Vehicles just a decade ago were composed of mostly mild steel; they also contained only a few electronic control units (ECUs) – those computerized modules that control functionality of various vehicle systems. Today, however, it's not uncommon for new Mercedes-Benz vehicles to have 50 or more electronic modules onboard; some high-end luxury models may even exceed 70 units. This proliferation of ECUs, as well as associated sensors, actuators, and other devices is driving the collision industry to join the scan tool revolution.

This trend is also gaining traction. Emerging electronic systems will continue to push the need for scan tools and other diagnostic equipment. Examples include engine management, passive and active safety, electrified drivetrains, electronic power steering, alignment, sophisticated communication networks, and other vehicle systems that may be damaged in an accident. Because these vehicle systems are interconnected, their proper operation and performance post-repair requires an early and accurate diagnosis for collision-induced damage to these systems.

But unlike replacing a structural part, even if an electronic part is properly diagnosed as being faulty, replaced, and properly positioned it will often require initialization, reprogramming, or some other specified procedure to complete the repair. This requires proper diagnostic equipment and software.

What's in your scan tool?

A recent survey by the Equipment and Tool Institute (ETI) reported that approximately two-thirds of all collision facilities own and use at least one scan tool. For those who don't know ETI, it is the industry organization that communicates with Mercedes-Benz and other automakers to acquire and archive scan tool data – algorithms, protocol documents, parameter identifier matrices, diagnostic trouble codes, etc.

Aftermarket tool and equipment manufacturers pay a licensing fee or annual dues to ETI to use selected data to develop and build aftermarket electronic test equipment and other tools used for diagnostics and repair. When genuine gaps in scan tool information are discerned,

The Mercedes-Benz STAR Diagnostic System (SDS) Compact4 scan tool (above) along with SDS Flash subscriptions are essential to providing a complete collision repair. The Compact4 uses a vehicle's VIN to register and verify vehicle-specific hardware and software data into Mercedes-Benz's server, so that Mercedes-Benz knows exactly the configuration of each vehicle. This is crucial, since there are often various recall-based issues that require such knowledge and the company requires it of all electronic modules to provide recalibration, reprogramming, and other services. *(Image – Continental Imports)*

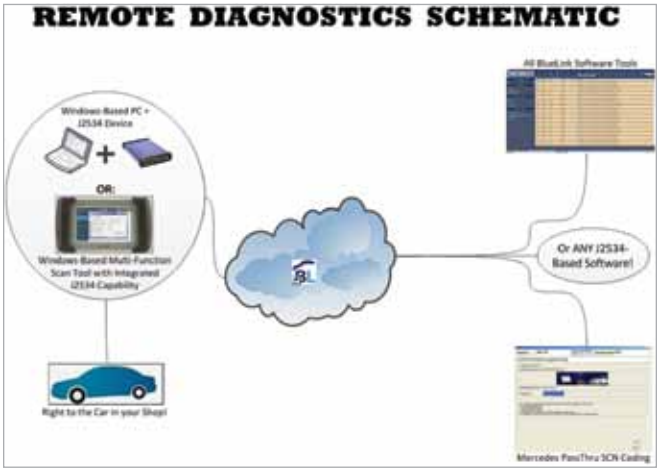
ETI works with Mercedes-Benz, as it does with other automakers, to gather the data and pass it on.

"Be it Mercedes-Benz or any other OEM, factory scan tools are the most expensive diagnostic tools available, but they also have the most diagnostic and repair functionality for any automaker's vehicles," explains Charlie Gorman, ETI executive director. "In the case of Mercedes-Benz and some other automakers, subscription-based diagnostic software is also required in addition to the scan tool hardware. It's often the software that needs to be fixed during a repair – whether by reinitializing, reprogramming or recalibrating functionality.

"With the advent of more ECUs on vehicles, the provision of scan tool information by automakers to the aftermarket has become a greater focus of what ETI does," Gorman adds. "In the case of diagnostic scan tools, we're talking about the computer data that needs to be integrated into an aftermarket scan tool so that technicians can talk to the vehicle and emulate an automaker's factory tool.

It's important that facilities and technicians understand that scan tool functionality is almost always the result of choices made by aftermarket manufacturers, not the lack of data being available from automakers," he notes. "On rare occasions when bona fide data gaps are identified, ETI works with Mercedes-Benz to resolve them for everyone's benefit.

"While aftermarket scan tool manufacturers all get access to the same data streams as the



Diagnostics at a Fraction of the Cost

Body shops and collision technicians can get bogged down by a lack of knowledge, technical resources, the time clock, and the customer. Typically, problematic vehicles are sent to a dealer or a mobile diagnostic service provider is called in. Both can add time and cost to the collision repair.

"Remote diagnostics" is a new alternative that might be the right fit for collision facilities seeking to recapture the time and revenue lost by sending vehicles out to dealers or waiting for a mobile diagnostician to arrive. Robert Beckman, CEO of Blue Link Diagnostic Solutions Inc. says the "just in time" solution, developed in conjunction with IBM:

- *Leverages J-2534 interface devices, which Mercedes-Benz supports, to connect Mercedes-Benz vehicles in your body shop digitally to Mercedes-Benz diagnostic tools, software and equipment at a remote location, at a fraction of the capital costs that tooling up to factory level capability would entail.*
- *Allows vehicles in a body shop to be diagnosed and repaired immediately onsite.*
- *Provides affordable access to genuine Mercedes-Benz service information and other resources.*
- *Utilizes the expertise of highly specialized technicians who have a thorough understanding of and experience using Mercedes-Benz service diagnostics.*

More information about this service can be found at www.bluelinkdiag.com. *(Images – BlueLink Diagnostic Solutions Inc.)*

The Advantages of Genuine Mercedes-Benz Reman

Quality, Reliability and Value

Reman A/C Compressors are not rebuilt or refurbished, they are brought back to the exact Mercedes-Benz approved specifications and tolerances, thus ensuring optimal performance.

Additionally, these units come preassembled with the clutch attached, so a technician can get right to installing the entire assembly, saving time and money.

By using Genuine Mercedes-Benz Remanufactured Compressors, you could save 40% or more when compared to the cost of new. And like all of our remanufactured parts, it's covered by the Mercedes-Benz limited parts warranty.

Genuine Remanufactured installed.
Problem solved!

For more information, visit **www.mbwholesaleparts.com**.

GENUINE MERCEDES-BENZ REMAN A/C COMPRESSORS

MODEL YEAR	VEHICLE MODEL	REMAN PART NUMBER
1984-1992	190D2.2	A000230121180
1984-2002	260E, 190D2.5, 300TD, 300D, 300CE, SL500	A000230241180
1986-1991	420SEL, 560SEC/SEL, 560SL	A000230251180
1986-1995	190/300 series, E300D	A000230111180
1986-2002	300E, 300CE, 600SL, SL600	A000230051180
1990-2002	500SL, SL500	A000230061180
1992-1993	500SEL	A119230111180
1992-1995	400SE, 400SEL, 500SEC, S420, S500	A119230001180
1992-1999	600SEL, S320, S600, 300SEL	A000230171180
1992-1999	300SE, 600SEC, S600, S320, CL600	A000230221180
1992-2004	CL500, 300/400/500 series, S/SLK/C/CLK/ E-Class	A000230701180
1994-2000	C220, C280, C36 AMG	A000230131180
1998-2005	ML320, ML430, ML55 AMG	A000230681180
1998-2010	ML500, ML350	A001230281180
1998-2010	ML350, ML500, E500, SL500, C/CL/S/G-Class	A000230901180

MODEL YEAR	VEHICLE MODEL	REMAN PART NUMBER
2000-2006	CL600, CL65 AMG, S65 AMG, S600	A001230011180
2000-2009	E320, S350	A000230911180
2002-2007	C32 AMG	A000230781180
2002-2007	C230 CL 1.8	A000230971180
2002-2010	CLK-Class, C55 AMG, SLK55 AMG	A001230191180
2003-2009	CLK500	A001230161180
2003-2010	SL55 AMG	A001230021180
2003-2010	E55 AMG, E320, E500, CLS500	A001230121180
2003-2010	E-Class, CLS55 AMG, CLS550	A001230141180
2003-2010	SL550	A001230551180
2005-2010	SLK280, SLK300, SLK350	A001230541180
2006-2010	R350, R500, ML350, ML500, ML550, GL450, GL550	A001230871180
2006-2010	R350, R500, ML350, ML500, ML550, GL450, GL550	A002230521180
2009-2010	C300, C350	A001230501180
2010	GLK350	A002230311180
2010	E350, E550	A002230381180

*Made with the same OE components as original factory parts

*Assembled to original Mercedes-Benz specifications

*Results: Mercedes-Benz Quality, Reliability and Value

Remanufactured for Mercedes-Benz by

DENSO

Available only through your local Mercedes-Benz Dealer

Mercedes-Benz factory tool uses, they cannot effectively replicate the full Mercedes-Benz tool and still be price-competitive. Instead, each manufacturer makes its own marketing decisions about what features, data, and functionality goes in their tools and what doesn't – based on niche, price point, and other factors," says Gorman.

"For example, some companies will build a generic scan tool that covers a wide range of OEMs for the most common fixes; some may offer slightly more comprehensive functionality for a narrower specific group of OEMs (European, Asian or domestic automakers); some will concentrate on a specific automaker and provide greater, although not complete, functionality; and others will focus on specific functions such as diagnostic tools for alignment or tire pressure monitoring systems."

What's a body shop to do?

While a Mercedes-Benz factory scan tool and subscription-based software provide the most complete functionality for electronic-related collision repairs, not every facility can afford them. Given the high cost of factory versus aftermarket tooling, the purchase of a scan tool by a collision facility needs to fit the body shop's business model. The challenge is for a collision facility to use the best scan tool strategy it can afford, then fill any collision service gaps with sources that have Mercedes-Benz factory diagnostic tools and software and the expertise to use them.

With respect to scan tools and diagnostics, collision facility scan tool practices generally fall into one of five broad categories. A body shop may:

- Own no scan tools, electing to farm all related work out to a nearby independent shops or dealers with the access to service information, tooling, training, and expertise.
- Own aftermarket scan tools only, but be unaware that certain functionality is missing, thus limiting the ability to make a complete repair.
- Own aftermarket scan tools only, but be aware of what specific functionality is lacking, and rely on "expert" mobile or remote diagnostic service providers to assist with more complex diagnostics and software programming. This enables a complete repair, but doesn't provide a facility with direct control of its time or destiny.
- Own Mercedes-Benz tooling and software, but may not have mastered the full capability of the tools yet. Training from Mercedes-Benz can help grow expertise.
- Own Mercedes-Benz tooling and software, and acquired the expertise through Mercedes-Benz training to use the tooling to its full capability.

These scenarios prompt three questions. First, does a collision facility know what necessary functionality its aftermarket scan tool does not have before making repairs? Second, if an outside source for Mercedes-Benz tooling is used, does that source have the understanding, expertise, and access to software updates to make full use of the tools? Third, if no Mercedes-Benz tooling is used, either directly or indirectly, what hasn't a collision facility fully repaired?

There is also a caveat to keep in mind: Using stop-gap measures may work for the short-term. However, in addition to giving up direct control, it does not diminish the full responsibility for a complete repair. In addition, because diagnostic-related repairs are not readily visible during the estimating stage, supplemental approvals for work and parts beyond the original estimate may be necessary, which may mean a delay in total repair time. For collision facilities and their technicians, it's becoming increasingly critical to be able to not just make all structural repairs, but all electronic repairs as well.

"Radical change began in 1981 when the computer came onboard on every vehicle," one senior trainer tells us. "Yet only 10 percent of body shops that I have surveyed recently actually use OEM factory tools; and just five percent of shops own and use a J-2534 interface tool to reflash electronic modules."

While the cost of Mercedes-Benz tooling is a serious consideration, the opportunities lost and

the assumed risks of choosing not to invest in such tools to be fully competent and in direct control of one's expertise should not be neglected, either. For example, outsourced expertise must be invoiced at face value, without any up-charge, But with in-house diagnostics, body shops can charge for diagnostic time and equipment, which can increase revenue.

The challenge for collision facilities is clear: Each must strive to be capable of providing customers with a complete and safe repair by employing the highest level of tools and expertise possible. And they must strive to gain more direct control and diagnostic expertise.

"Today and going forward, body shops and technicians are in for a really rough ride if they don't embrace vehicle electronics and electrification as realities today, and then tool and train properly," the trainer cautions. "Many aftermarket independent repair facilities are increasingly less productive today because they continue to farm out too many opportunities, rather than tool and train to manage change. Like a slippery slope, the refusal by some of these facilities to recognize, embrace, adapt, and prepare will ultimately seal their fate and pre-empt a sustainable, profitable future."

A few body shop examples

There are many examples of repairs in which Mercedes-Benz factory tooling and software capability, along with the expertise to use them, are essential to providing a full, safe collision repair. We talked with two expert technicians to provide a few examples to demonstrate this. They are:

- Robert Beckmann, who is the CEO of BlueLink Diagnostic Solutions, Inc. He also provides training in diagnosing and repairing Mercedes-Benz vehicles at various industry events and is well-versed in Mercedes-Benz diagnostics methodology and equipment for both regular and theft-related parts.

- Steve Brotherton, who owns Continental Imports, an independent shop located in Gainesville, Fla., that specializes in servicing Mercedes-Benz vehicles and several other brands. He owns OEM factory diagnostic tools and purchases service information subscriptions for each automaker that he services. In addition, he requires his Mercedes-Benz team of four technicians to complete Mercedes-Benz training and to use the Star Diagnostics System (SDS) Compact 4 diagnostic scan tool (above), software, and other Mercedes-Benz-approved tools. Besides his mechanical-based business, Continental Imports works with nearby collision facilities that recognize when they need the expertise his shop can provide.

"Mercedes-Benz has some of the most advanced safety equipment in the world, which makes the

Configuring the deployment characteristics of new airbags installed during collision repair requires the use of WSS equipment, an SDS scanner and subscription-based diagnostic software. *(Image – Continental Imports)*

use of the company's diagnostic equipment an essential part of most collision-related repairs today," Beckmann says. "For example, many ECUs associated with vehicle safety systems are coded and configured to very specific applications. These include components such as seat weight sensing systems (WSS), electrically operated reversible seat belt tensioners, airbag control units, and others, all of which need programming after deployment or replacement."

"Collision professionals must be aware that these and other Mercedes-Benz safety-related components – especially if part of a vehicle's Supplemental Restraint System (SRS) – need to be properly programmed and configured after deployment or replacement for them to operate correctly. Because they are part of most collision-related repairs today, the failure to do so may cause unsafe or unpredictable operation post-repair."

Beckmann cites a number of reasons why tooling and proper software programming is essential for safe predictable operation post-repair. Among others, these include the following:

- Many ECUs are VIN-locked (vehicle identification number) within the SRS system. Aftermarket scan tools simply cannot do all that the Mercedes-Benz scan tool can.
- Mercedes-Benz diagnostic equipment maintains log files and provides traceability into how things were programmed and coded.
- Accountability is provided by a login system that identifies who did the programming of any ECU.
- The information provided by Mercedes-Benz resources that support factory diagnostic tooling includes guidance that enables a level of repair aftermarket tools may not be able to provide.

"For example, PDFs are available from STARTek Info that provide schematic diagrams and configuration instructions for the restraint and other safety systems," Beckmann tells us. "In particular, these resources denote the data for items that need coding. The use of Mercedes-Benz scan tools and software is essential to taking advantage of this data to properly configure Supplemental Restraint Systems (SRS) and other safety systems. It's part of performing a complete collision repair for your customers."

The Romess electronic inclinometer is a Mercedes-Benz-approved tool used to perform wheel alignments. (Image – Continental Imports)

"The WSS is used to continuously monitor the passenger seat for the size and weight of the occupant and then configure the deployment characteristics of the airbag in the event of an accident," notes Brotherton. "The WSS involves three weights and requires a calibration process that can only be done completely using the SDS scan tool and subscription-based diagnostic software."

"When a wheel alignment needs to be performed as part of a collision repair, Mercedes-Benz requires the use of a certain approved tools and procedures," Brotherton explains. "Any Mercedes-Benz model, but especially those with Airmatic and Active Body Control (ABC) systems, requires the use of the approved Romess tool, which is an electronic inclinometer."

"The concept of the tool is to gauge and calibrate ride height," Brotherton continues. "Romess data is used to establish proper alignment specs. In the case of Airmatic or ABC, the suspension height must be calibrated before the alignment is performed. This is done by first adjusting the height with the SDS scan tool until it is the right Romess angle specification, and then entering those numbers (representing each corner of vehicle) to set the calibration.

"Mercedes-Benz also employs SCN coding when servicing modules," Brotherton says. "The concept of SCN is for the tech to program a module and then hook to the Mercedes-Benz server located in Germany. The VIN, hardware and software numbers are verified and basically a calibration ID is performed. It also registers new software and hardware into the server for the car so the company knows exactly the configuration of each. In addition, there could be various recall-based issues that require such knowledge, and Mercedes-Benz requires it of all modules that get programming. The complete function by its very nature makes a Mercedes-Benz tool and SDS Flash subscription necessary, if a collision facility truly wants to be able to provide complete repairs.

Clearly, it is neither easy nor cheap to tool-up for diagnostic service as part of a collision repair. Improving vehicle serviceability means that OEMs and the aftermarket need to collaborate meaningfully. Mercedes-Benz does that, notably through its involvement with ETI, the National Automotive Service Task Force, and other organizations. That cooperation helps tool and equipment makers build the stuff that technicians want to use.

But collision facilities must be cognizant that when factory-level diagnostics are needed, nothing beats OEM diagnostic tooling. At the end of the day, it is the shop owners, technicians, and service advisors who customers identify as the human interface when it comes to collision repair. So, ask yourself one acid-test question: "Is my choice of diagnostic tooling in collision repair helping me or limiting me in growing my business?" |

Diagnosis Assistance System — Copyright 1999 Daimler AG

VIN WDBTJ65J1 — Model series/model designation 209.365

Order number — License plate

Documentation for repair order WDBTJ65J14F0

Control unit programming was completed successfully.
The SCN coding sequence has been completed successfully.

All input fields must be filled out.
Print log with function key F11 via menu item 'Printout of test step'.
A printout of the log with the repair order number entered must always be filed along with the repair documents for any potential check of warranty and goodwill claims by the MPC.
The order log is no longer available after exiting this screen.

Repair order number	
Name of tester	Steve Brotherton
Dealer number	708-0
User identifier	C ROT
Date	2010-06-20 09:26 (09:26 am)
DAS data version	03/2010(2010-02-11) + AddOn: 1333,1391,1397,1403,1406,1409,1408,1397,1412,14-15,1417,1419,1428,1426,1435,1440,1443,1404,1445,1455,1463
STAR DIAGNOSIS	SDCompactHscr
System number	STAR3(8
Vehicle ident no. VIN	WDBTJ65J14F09
Version Control module programming:	03/2010(2010-02-04)

Motor electronics 2.8

Performed: Control module programming
Control unit identification:
MB object number 1121536579
HW version 35/02 SW version 3D/05 Diagnosis version 1/11 Supplier Bosch Date of manufacture 10/08
Version (internal) M112_oFPV_F9 , ME28 , ME28
Control unit software:
Control unit programming was completed successfully.
Original control unit software version: 1121536479
Performed control unit programming: 00544605022_001
Current control unit software version: 1121536579
SCN coding:
The SCN coding sequence has been completed successfully.
Part number queried 1121536579
SCN 1121536579-1-5-0026

Filename: F:\Programme\Das\trees\pkw\flashen\zentral\inbetriebnahme.s

Cell co-ordinate: 35 , 41

Mercedes-Benz requires SCN coding whenever ECUs are serviced. The coding provides the automaker, technicians, and vehicle owners with a secure means to identify, verify, and update the calibration and programming when servicing electronic modules. *(Image – Continental Imports)*

Mercedes-Benz Mobil1

Product Name	Part Number	Quantity	Product Description	Recommended Consumer Applications
Mercedes-Benz SPEC.				
Mobil 1 Formula M 5W-40	BtQ 1 09 0144	Bulk - No Equipment	Fully synthetic formulas designed specifically for gasoline passenger cars	Low SPAsh. Available at most MB dealers
	BQ 1 09 0162	6/1 Quart Cases		
	BQ 1 09 0151	55 Gallon Drum		
Mobil 1 0W-40	BQ 1 09 0010	Bulk - No Equipment	Fully synthetic formulation designed to meet the requirements of many European vehicles	Porsche A40. Many European vehicles. HT/TS applications.
	BQ 1 09 0015	6/1 Quart Cases		
	BQ 1 09 0016	55 Gallon Drum		
Mobil 1 ESP Formula M 5W-40	BQ 1 09 0135	Bulk - No Equipment	Advanced full synthetic formulas designed specifically for diesel passenger cars that have particulate filters	Low SPAsh. Available at most MB dealers
	BQ 1 09 0142	6/1 Quart Cases		
	BQ 1 09 0143	55 Gallon Drum		
Mobil 1 5W-50	BQ 1 09 0133	16 Gallon Keg	Higher viscosity, advanced full synthetic formula designed for performance vehicles	Porsche A40. HT/HS applications.
	BQ 1 09 0134	6/1 Quart Cases		
Mobil ATF 134	BQ 1 09 0166	55 Gallon Drum	Extra high performance automatic transmission fluid formulated with selected HVI base oils	Recommended for use in Mercedes-Benz automatic gearboxes
Mobil 1 ESP Formula MB 5W-30	BQ 1 09 0165	12x1 Liter Cases	Advanced full synthetic formulas designed specifically for passenger car diesels that have particulate filters	Low SPAsh. Available at many Chrysler dealers
AdBlue® ½ Gal.	A 000 583 0107	1/2 Gallon Bottle	Non-toxic solution that transforms harmful Nitrogen Oxide (NOx) emissions from diesel-powered vehicles into harmless water vapor and nitrogen	Recommended for use in Mercedes-Benz, Volkswagen + BMW AdBlue® (DEF) applications
Diesel Exhaust Fluid 55 Gal	BQ 1 47 0002	55 Gallon Drum		
Mobil 1 5W-30	BQ 1 09 0017	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many domestic, including GM, and imported vehicles	Vehicles that require 5W-30. Corvette approved.
	BQ 1 09 0018	55 Gallon Drum		
Mobil 1 10W-30	BQ 1 09 0019	6/1 Quart Cases	Advanced full synthetic formula designed for domestics and imports	Vehicles that require 5W-30 or 10W-30
	BQ 1 09 0020	16 Gallon Keg		
	BQ 1 09 0021	55 Gallon Drum		
Mobil 1 5W-20	BQ 1 09 0083	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many newer vehicles including Hondas, Fords, Chryslers, and newer Toyotas	Vehicles that require 5W-20
	BQ 1 09 0084	55 Gallon Drum		
Mobil 1 0W-20 AFE	BQ 1 09 0169	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 0W-20 (newer Toyotas and Hondas), 5W-20 and certain hybrids
	BQ 1 09 0168	55 Gallon Drum		
Mobil 1 0W-30 AFE	BQ 1 09 0174	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 5W-30 or 10W-30
Mobil 1 Synthetic ATF	BQ 1 09 0164	6/1 Quart Cases	Multi-vehicle, fully synthetic fluid designed to meet the demanding requirements of modern passenger vehicles	Vehicles that require Dexron III, Ford Mercon and Mercon V performance levels
	BQ 1 09 0163	55 Gallon Drum		
Mobil 1 15W-50	BQ 1 09 0023	55 Gallon Drum	Boosted, higher viscosity, advanced full synthetic formula designed for performance vehicles	HT/HS applications. Racing and Flat tappet applications
Mobil 1 Gear Oil (Mobil 1 Gear Lube 75W-90)	BQ 1 09 0085	12/1 Quart Cases	Exceeds the most severe service requirements in both conventional and limited slip applications	SUITABLE for use in modern high performance automobiles like SUV's, Vans and Light duty trucks requiring API GL-5 level performance
Mobil Special 5W-30	BQ 1 09 002464	Bulk - No Equipment	Formulated from quality base stocks combined with modern performance additives to give the engine the expected protection and performance under a wide variety of operating conditions	Recommended for gasoline fueled automobiles and light duty trucks requiring an API SN/SM/SL/SJ
	BQ 1 09 0171	12/1 Quart Cases		
	BQ 1 09 003064	55 Gallon Drum		

Mercedes-Benz automobiles are designed to perform on the most challenging roads and conditions. Shouldn't the oil used in Mercedes-Benz engines do the same? We think so.

That's why Mercedes-Benz and Mobil 1 have partnered to offer an unbeatable combination of total engine performance and driving luxury.

Please have a look at our oil portfolio which is available through your local Mercedes-Benz dealer. Our dealers are able to offer you a wide variety of oil grades at competitive prices.

Product Name	Part Number	Quantity	Product Description	Recommended Consumer Applications
Mercedes-Benz SPEC.				
Mobil Special 10W-30	BQ 1 09 003164	Bulk - No Equipment	Formulated from quality base stocks combined with modern performance additives to give the engine the expected protection and performance under a wide variety of operating conditions	Recommended for gasoline fueled automobiles and light duty trucks requiring an API SN/SM/SL/SJ
	BQ 1 09 0172	12/1 Quart Cases		
	BQ 1 09 003764	55 Gallon Drum		
Mobil Special 10W-40	BQ 1 09 003864	Bulk - No Equipment	Formulated from quality base stocks combined with modern performance additives to give the engine the expected protection and performance under a wide variety of operating conditions	Recommended for gasoline fueled automobiles and light duty trucks where a higher viscosity API SN/SMSL/SJ oil is preferred or recommended
	BQ 1 09 0173	12/1 Quart Cases		
	BQ 1 09 004464	55 Gallon Drum		
Mobil Special 5W-20	BQ 1 09 012464	Bulk - No Equipment	Formulated from quality base stocks combined with modern performance additives to give the engine the expected protection and performance under a wide variety of operating conditions	Recommended for gasoline fueled automobiles and light duty trucks requiring an API SN/SM/SL/SJ
	BQ 1 09 0170	12/1 Quart Cases		
	BQ 1 09 013264	55 Gallon Drum		
Mobil Special 20W-50	BQ 1 09 004664	55 Gallon Drum	Formulated from quality base stocks combined with modern performance additives to give the engine the expected protection and performance under a wide variety of operating conditions	Recommended for gasoline fueled automobiles and light duty trucks where a higher viscosity API SN/SMSL/SJ oil is preferred or recommended
Delvac 1300 Super 15W40	BQ 1 09 0053	Bulk - No Equipment	Extra high performance diesel engine oils that help extend engine life in the most severe on and off-highway applications while delivering outstanding performance in modern, high-output, low-emission engines including those with Exhaust Gas Recirculation (EGR) and Aftertreatment Systems with Diesel Particulate Filters (DPFs) and Diesel Oxidation Catalysts (DOCs)	Specifically recommended for the latest low-emissions, high performance diesel applications equipped with aftertreatment systems using Diesel Particulate Filter (DPF) and Diesel Oxidation Catalyst (DOC) technologies
	BQ 1 09 0058	12/1 Quart Cases		
	BQ 1 09 0059	4/1 Gallon Cases		
	BQ 1 09 0060	55 Gallon Drum		
Delvac 1300 Super 10W30	BQ 1 09 0086	Bulk - No Equipment		
Delvac 1 5W40	BQ 1 09 0051	4/1 Gallon Cases	Fully synthetic supreme performance heavy duty diesel engine oil that helps extend engine life while providing long drain capability and fuel economy for modern diesel engines operating in severe applications	Recommended for use in all super high performance diesel applications, including modern low emission engine designs with Exhaust Gas Recirculation (EGR)
	BQ 1 09 0052	55 Gallon Drum		
Mobil Grease XHP 222	BQ 1 09 0078	60/14 oz Cartridge	Formulated to provide excellent high temperature performance with superb adhesion, structural stability and resistance to water contamination	Recommended for industrial and marine applications, chassis components and farm equipment
	BQ 1 09 0079	120 lb Keg		
	BQ 1 09 0080	400 lb Drum		
	BQ 1 09 0098	40/14 oz Cartridge		
Mobil Lube HD Plus 80W90	BQ 1 09 0096	120 lb Keg	Extra high performance, automotive lubricant formulated from select base oils and an advanced additive system specifically for limited-slip differentials	Recommended for use in limited-slip differentials, axles, and final drives requiring API GL-5 level performance
	BQ 1 09 0097	400 lb Drum		

Second Time Around

Secondary air systems are designed to help the catalytic converter get up to operating temperature faster. When the system develops a problem, the ME control unit is capable of defining the fault. It's our job to figure out the cause.

The internal combustion engine has been with us for a very long time, and although electric motors are being designed into more and more vehicles battery technology needs to improve before the buying public is convinced. This means hybrids are a more viable choice, but they still need a generator. A gasoline engine can be used to generate electricity and also provide power directly to propel the vehicle down the road. But neither is anywhere near 100% efficient. Much of the energy produced by combustion is still lost as heat, which is why we have a cooling system. We have the same problem with combustion itself. Atmospheric pressure fills the cylinders and we inject fuel to create a burnable mixture. This is then compressed until it is on the verge of igniting. We then add a spark at the proper time and the combustion process begins. As the gases expand, they push down on a piston that turns a crankshaft and power is produced. This process is not perfect, however.

We Can Only Strive for Perfection

In an ideal world, the internal combustion engine would convert the air/fuel charge into carbon dioxide (CO2), oxides of nitrogen (NOx), and water (H20) as a result of the combustion process. This

Vehicle	209.365	Control Unit	ME-SFI 2.8
Actuations			
Y32 (Air pump switchover valve), M33 (electric air pump) (USA, EURO 3, EURO 4, D4)			
Y62 (Fuel injectors)			
M16/6 (Throttle valve actuator)			
M3 (Fuel pump)			
Y58/1 (Purge control valve)			
Y58/4 (Activated charcoal canister shut-off valve) (USA)			
Y31/1 (EGR vacuum transducer)			
Mixture adaptation			
Electric suction fan for engine or air conditioning Fuel tank leak test (USA)			
Ignition circuit shutoff T1/x (ignition coil(s))			
Y22/6 (variable intake manifold switchover valve)			

With an SDS, you can enter the engine control unit and command the secondary air injection test. Here, all of the hard work is done for you. The air pump and air injection solenoid are activated and fuel trim information is displayed so you can see if the system is functioning properly.

is not an ideal world. Hydrocarbons (HC) are not completely burned, and carbon monoxide (CO) is formed from incomplete combustion. These gases are toxic. As a result of the Clean Air Act of 1970, and its later manifestations, greater and greater efforts had to be made to reduce these harmful emissions that came out of the increasing number of cars on the road.

Various anti-pollution devices were fitted to vehicles. Fuel vapors (HC) have to go somewhere, preferably not into the atmosphere, so we got the evaporative emissions system (EVAP) with its charcoal canister to store these vapors until they were burned in the cylinders. But something needed to be done about the byproducts of inefficient combustion exiting the tailpipe.

In 1975, automobiles sold in the U.S. were required to have a catalytic converter fitted in the exhaust system. This converted raw HC and partially-burned CO into CO2, NOx, and H20, significantly reducing harmful exhaust. Early catalytic converters were only two-stage (HC and CO), but about 30 years ago, the three-stage type appeared in an effort to control NOx emissions. Lean mixtures lead to high combustion chamber temperatures, which increase the formation of NOx. EGR (Exhaust Gas Recirculation) recycles inert exhaust gases into the intake manifold, diluting the mixture and cooling the fire to cut NOx production, but it couldn't do enough. The three-way catalytic converter has a reduction section upstream of the oxidation section, which when combined with a closed-loop fuel system, breaks NOx down very efficiently. We should mention right here that the washcoat on the ceramic honeycomb contains precious metals such as cerium, rhodium, palladium, and platinum. This is why high-quality OEM replacement converters are so expensive. Cheaper aftermarket replacements do not contain the proper quantities of these precious metals, so do not work as effectively, or for very long.

Cleaning Up the Air

The function of a catalytic converter is not limitless. You cannot have an extremely rich mixture in your exhaust and expect the converter to clean up all of the exhaust gas. The NOx reduction section of a modern catalytic converter is designed to work with a 14.7:1 "stoichiometric" air/fuel ratio. In the days of carburetors, mixtures were set by means of adjustments, or relatively crude jet sizes. When fuel injection with feedback appeared, it became possible to achieve and maintain this ideal blend.

One of the important characteristics of a catalytic converter is its ability to store oxygen. During

The modern secondary air pump on this 112/113 engine is mounted in front of the intake manifold so heat will evaporate any moisture that has condensed in the lines. It also makes manual testing easy. To the left of the pump is the air injection solenoid, and on the upper left and right are the air injection valves.

lean conditions there is excess oxygen in the exhaust stream. This is stored on the surface of the substrate. In the exhaust stream the oxygen sensor reads this lean condition and switches to a slightly richer condition. During this rich condition, the converter gives off the oxygen it has stored to oxidize the HC and CO passing by.

The oxidizing process requires plenty of heat, and a catalytic converter needs to be in its optimum temperature range to function properly. This means oxidation doesn't occur immediately after the engine is started -- it takes a certain amount of time for the exhaust to heat the catalytic converter up to operating temperature. During this warm-up period, the exhaust stream contains the highest quantity of harmful emissions. Stricter and stricter regulations are being implemented by the government every year, so manufacturers must come up with ways to meet these guidelines. This includes reducing the harmful emissions released during the converter's warm-up period. Although it has been around since the '70s, air injection is still one way to reduce HC and CO while the converter is reaching operating temperature. Oxygen-rich fresh air is pumped into the exhaust stream to help burn HC and CO. Early air pumps were belt-driven off the engine, but modern Mercedes-Benz vehicles use an electric pump. The pump only comes on for the first few minutes after the engine is started, and serves no real purpose during the rest of the drive cycle.

Injecting Air into the Equation

In this system, the fresh air is aimed at exhaust ports as close as possible to the combustion chamber to start the oxidizing process. Even though the rest of the engine and the converter are still cold, the exhaust gases are instantly hot and adding oxygen at this point helps complete the combustion process of HC and CO. The extra heat generated in the exhaust stream helps to rapidly raise the temperature of the catalytic converter to its operating temperature.

The electric air pump is only turned on in two instances. The first is when the engine is in the warm-up phase, and the second is when the ME control unit wants to check the system. It activates the air pump and the secondary air valve solenoid while the engine is fully warmed up. At this point, the oxygen sensors are working to control the mixture. By pumping in fresh air, the ME can monitor the oxygen sensors and verify that they indicate a lean condition while the secondary air is flowing.

Whenever you pump air, you compress it. This condenses the moisture in the air. This can work its way in to the air pump motor causing it to fail prematurely. For this reason, Mercedes-Benz has chosen to install the air pump in a hot environment, which helps the moisture to evaporate while the pump is not being used. Typically, pumps are mounted on the front of the engine, just in front of the intake manifold, or on the passenger side of the block, toward the front of the engine.

Mercedes-Benz pumps are supplied voltage directly by a secondary air pump relay. They draw in the range of 25 to 30 amps, so it is important to verify that you have a good relay. Voltage drop across relay contacts can reduce available voltage, thereby increasing the amp draw. This can lead to blown fuses or premature pump failure. If you need to replace a pump, you should always replace the relay as well.

Controlling The Flow

When the pump is working, it supplies air through tubes to the secondary air injection valves. These vacuum-controlled valves allow the air into the ports cast into the cylinder head that lead to the exhaust ports. A secondary air injection

You should measure the amperage draw of the pump if you have found a blown fuse for the system. Normal draw is between 25 and 30 amps. Higher than that and the pump may be seizing. Any lower and the pump may be worn and not be producing enough air flow.

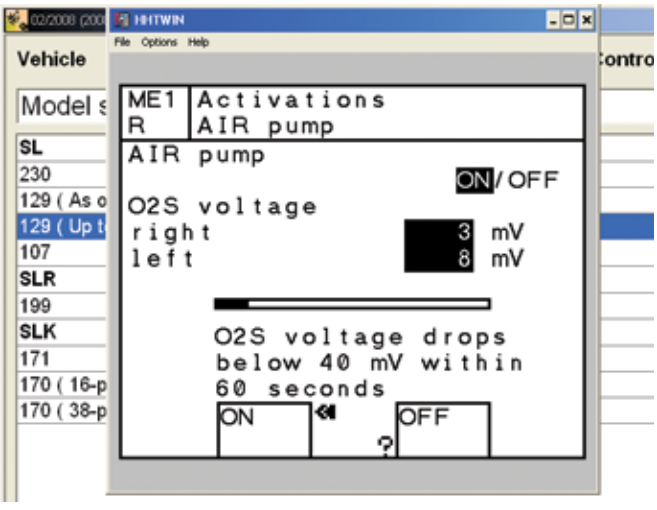
solenoid is switched on by the ME control unit. The solenoid supplies vacuum to the air injection valves to open them. There is also a reed valve mounted underneath the air injection valve. The pumped air can push the reed valves open to allow the air to continue on to the exhaust ports. Once the pump stops, the reed valves close, preventing hot exhaust gases from backing up into the air injection control valves. Also, the ME control unit de-energizes the air injection solenoid. This blocks vacuum to the control valves allowing them to close. This further prevents exhaust from getting into the pump. When the system is working properly, you will notice the air pump come on after a few minutes and run for up to two minutes. You may also notice the system check itself after an extended idle.

To test the system, the ME control unit monitors the oxygen sensor signal voltage. With the air injection system pumping fresh air into the exhaust ports, the O2 sensor reads the false lean condition. The ME control unit will try to compensate for this by increasing injector pulse width. The fuel trim readings will indicate this increase in fuel injector on-time. If you watch the fuel trims while the test is happening, you will see the additive fuel trim go up to 25%. If the fuel trim does not increase enough, the ME will set a code P0410. It is your job to determine which part of the system is not functioning properly. You can access a wiring diagram with a paid subscription to www.startekinfo.com. If you have invested in a Star SDS system, you can test the system dynamically. You can monitor the data while the SDS puts the ME control unit into the secondary air test. Watch the Additive fuel trim readings while in the test and verify they increase over 25%.

The air injection solenoid supplies the vacuum it gets from the intake manifold to the air injection valves. It is only energized when the engine is in the warm-up phase and when the monitor runs. If the solenoid malfunctions, the valves will not open and pumped air will not make it to the ports.

If You Have Manual Control

If you have to perform the test manually, there are a few steps you need to do before you can complete the test. First, you have to activate the secondary air pump. You can do this by locating the pump relay, then you can either apply a ground to the relay, or simply jump past the switched contacts. These are always terminal 30 (DIN for constant power) and 87 (DIN for relay output). You should hear the air pump come on and feel air being pumped out toward the air injection valve. You should also measure the voltage to the pump and its amperage draw. As mentioned earlier, poor relay contacts will drop the available voltage supply to the pump. With low voltage to the pump, the amperage draw has to increase, which can electrically overheat



On older vehicles, the HHTWIN system can allow you to dynamically test the secondary air system. Here the pump and solenoid are activated and the SDS displays the oxygen sensor signal voltage to verify that pumped air is making it into the exhaust stream and creating a false lean condition.

a pump until the fuse for the relay blows. If you get the pump to run, you now have to activate the secondary air injection solenoid. You can back-probe the ground side of the solenoid and apply a temporary ground. You should now measure vacuum to the secondary air injection valves.

The valves should be open at this point. If you remove the air injection supply hose, you should not feel exhaust gas coming out of the open end of the valve. The reed valve mentioned earlier should be held closed blocking exhaust gas from coming through the valve backwards. If you feel exhaust gases, you will need to remove the secondary air valve and inspect the reed valve to see if it is damaged. While you have the valve removed, you can apply vacuum to it with a hand pump and see if the valve opens mechanically. With the air valve and reed valve removed, the secondary air injection ports are exposed. If you run the engine you should feel exhaust gas flowing out of the ports in the cylinder head. If you do not, the ports in the cylinder head are blocked. The proper repair for this problem is to remove the cylinder heads and clean out the secondary air ports, although there may be alternative means. At this point, you have checked the operation of the air pump, injection solenoids, injection valves, reed valves, and cylinder head exhaust ports. If everything is in order, you can check the system dynamically.

Working On Your Own

You can use a generic scan tool to monitor the short-term fuel trim while the engine is running. If you have a Star SDS, you should monitor the additive fuel trim. Now, activate the pump and secondary air solenoid and watch the fuel trim readings or watch the oxygen sensor signal voltages. The O2 sensors should drop to under 100 millivolts indicating the lean condition. The short-term fuel trim should increase to 20 to 25% while the pump is running. If the percentage is not changing enough, you will need to determine if the passages are clogged or the air pump output is too weak.

A properly functioning system should have an easy time passing the OBD II monitor providing the oxygen sensor monitor has already run. If you've performed diagnosis and repair properly, you have provided the level of service your customer expects from you. You have helped reduce harmful emissions from the engine exhaust and helped assure that the vehicle will pass state or local emissions inspection. That should lead to a happy customer. |

Here we are manually applying vacuum to the secondary air valve. The valve should hold vacuum. If not, the valve's diaphragm is torn and the valve needs to be replaced. You should activate the solenoid and verify vacuum is making it to the valve as well.

TPC

The Pressure is Controlled

In an effort to increase the safety of the driving public, Tire Pressure Monitoring Systems (TPMS, Mercedes-Benz TPC) warn the driver when tire pressure is low and may cause tire failure. When the system needs maintenance, it's our responsibility to repair this important safety tool. In this feature, we cover the Beru system that first appeared in model year 2006, and will cover the newer Tire Pressure Monitoring Systems in the November issue.

Mercedes-Benz has always been an innovator when it comes to safety systems. In almost every chassis, high-strength alloys are used to protect the passengers in the event of a collision. Electronically-controlled driver's aids help maintain traction when the tires are about to lose their grip on the road. These systems are designed to work at their peak efficiency with proper tire size, tread depth, and inflation pressure. If any of these characteristics does not meet the necessary standards, optimal performance will not be available. Tire size is important and owners should stick to the same size replacement tire to maintain the road-holding ability they are used to. Tread depth becomes vitally important with rain and snow. Tread design channels water out of the way of the rubber meeting the road. A good snow tire will keep the channels clean, but the sidewalls have to flex properly for the tread to conform to the road surface. Proper pressure is necessary to assure all these characteristics. In the case of under-inflation, there is also the danger of the tire overheating from excessive flexing, which can lead to tread separation and catastrophic failure. A blowout at Interstate speeds can easily result in a serious accident.

In 2000, recognition of these factors led the Clinton administration to push through the TREAD Act (Transportation Recall Enhancement and

Documentation). This required that all vehicles built for the 2008 model year have a tire pressure monitoring system as an early warning to drivers that the air pressure in one or more tires is low. Besides leading to unsafe driving conditions, under-inflation reduces fuel efficiency. While this doesn't amount to a large percentage of an individual vehicle's overall MPG, on the national level it becomes significant.

In the Beginning

Tire inflation can be monitored two ways. The first is the direct method. This uses a pressure sensor mounted inside the tire that reads the psi and transmits a radio signal to a control unit. Tire pressure can also be monitored by the indirect method. Since air pressure supports the weight of the car, any reduction in it will reduce the circumference of the tire. ABS and the traction control system already monitor and compare tires speeds in order to perform their functions. A tire with a smaller diameter will put out a different number of pulses over a given distance. If the difference is significant, the control unit can infer that that tire must be underinflated. This system relies on the wheel speed signals of the other three tires to help make the determination, and uneven tread wear can throw it off. Direct measurement, which all Mercedes-Benz vehicles use, is more inherently accurate, but brings the added complication of needing batteries for the sensors/transmitters. Even the advanced lithium-ion batteries used will only function reliably for about seven years. Of course, that is longer than the recommended safe life of a tire, so the sensors can be renewed during tire replacement.

To find the recommended tire pressures, look at the placard either mounted in the driver's side door jamb, glove box, or inside the fuel filler door. These are the settings you can see with your SDS if you look in Actual Values.

What Kind of Pressure are We Under?

Under TPMS guidelines, sensors must transmit either a 433MHz, or a 315MHz signal. The Mercedes-Benz TPC system uses 315MHz on North American vehicles, and 433MHz for European. The signal is not sent continuously because that would drain the internal battery prematurely. Instead, the sensor reads the pressure every three seconds, and transmits the reading every 55 seconds while the vehicle is being driven. If inflation drops by three psi, the sensor will begin transmitting this information every .8 of a second. So, driving with chronic low tire pressures causes signal transmission roughly once a second instead of once a minute, which will shorten battery life significantly.

Explain to your customers that when they see the tire

Vehicle	220.175	Control unit	RDK	
Tire pressure actual values , Tire pressure set values , Tire temperature				
No.	Name	Actual values	Unit	
024	Front left wheel assignment has been found.	YES/NO		
001	Tire pressure of left front wheel	2475	mbar	
140	Set value of tire pressure at left front wheel	2100	mbar	
014	Tire temperature of left front wheel	73	°F	
023	Front right wheel assignment has been found.	YES/NO		
010	Tire pressure of right front wheel	2450	mbar	
150	Set value of tire pressure at right front wheel	2075	mbar	
015	Tire temperature of right front wheel	72	°F	
022	Rear left wheel assignment has been found.	YES/NO		
011	Tire pressure of left rear wheel	2375	mbar	
151	Set value of tire pressure at left rear wheel	2250	mbar	
016	Tire temperature of left rear wheel	66	°F	
021	Rear right wheel assignment has been found.	YES/NO		
012	Tire pressure of right rear wheel	2375	mbar	
152	Set value of tire pressure at right rear wheel	2200	mbar	
017	Tire temperature of right rear wheel	68	°F	

You can use your SDS to read the sensor identification, tire pressure and tire temperature. You can also see the proper tire pressure settings. This is a quick way to make sure the TPC control unit can read all the sensors.

You can reactivate the TPC system though the instrument cluster. Use the folder keys to get to mph, then the arrow keys to choose TPC reactivation, and use the + or – keys to toggle to "Yes." Then you have to drive the car for about 20 minutes over 20 mph.

pressure warning light come on, they should correct the tire pressure as soon as possible not only for safety concerns, but also to extending the life of the sensor batteries. After inflation is corrected, the instrument cluster will instruct the driver to reactivate the TPC (a.k.a. RDK) system to check the new pressures. This does not require a scan tool, but can be done through the instrument cluster. Consult the owner's manual to find the specific procedure for the vehicle at hand, but essentially you will be using the folder keys to scroll through until vehicle speed is displayed. Then, use the arrow buttons until a question referring to reactivating tire pressure is displayed. Hold down the reset button for a few seconds and you will be asked if you want to activate the TPC system for the new pressure measurements. Using the "+" or "-" keys, scroll to highlight "Yes" and wait. The message in the cluster should indicate that tire pressure is now being monitored. Drive the vehicle over 20 mph for about 20 minutes. The instrument cluster will then display a pictogram of the vehicle and the individual tire pressures (one Bar =14.7psi), and the warning message should go off.

Warning the Driver

If a failure occurs in the system, a warning message will be displayed instead of the tire pressures. If it is in red lettering, it means there is an actual problem with a loss of air pressure in one of the tires. Immediately stop the vehicle and manually check and correct inflation. You can then return to your shop if the tires maintain pressure. If not, have the vehicle towed in. If the warning message is in white lettering, it means there is a problem in one of the three major components of the TPC system. With the system being mandated in 2008 (Mercedes-Benz started using this system much earlier), the sensors could be getting low on battery life. There is also the possibility of damage to the antenna in the wheel well that receives the signals and passes them on to the TPC control unit. The control unit sends any warning messages through CAN-B to the instrument cluster to warn the driver. With an SDS Star diagnostic system,

Here, the bead is being broken at the three o'clock position with the valve stem at the nine o'clock position. This prevents damage to the sensor when the bead makes it over the safety lip of the rim.

you can interrogate the TPC control unit, pull diagnostic trouble codes, look at live data, and perform service procedures.

Tire Service with Sensors

The presence of the sensors requires extra care during tire service. When breaking the bead, always have the tire stem 180 degrees from the anvil of the tire machine to prevent sensor damage. Also, when removing the tire, make sure the sensor is just in front of the anvil. This way the sensor rotates clockwise away from the anvil and the tire should not come in contact with the sensor while being removed.

You should follow a few simple rules when servicing tires and the TPC system. First, replace any sensor that is over five years old. Next, inspect the underside of the sensor. There is a white filter that covers the sensor element. If the filter is dirty, broken, or contaminated with tire sealant, replace the sensor. A damaged filter will shorten the service life of the sensor and/or give incorrect readings. The sensor sends a signal indicating battery condition with every transmission of tire pressure. This battery life reading can be called up with the SDS system. This allows you to accurately inform the customer about which sensors should be replaced along with the tires.

Replacing the Sensor

When installing a new sensor, you should order a new valve kit to go along with it. An aluminum valve stem is used with a lock nut. New sealing washers will come in the kit to prevent any valve stem leaks. The nut for the valve stem needs to be tightened down to 4 NM to form a proper seal. The new sensor also gets mounted to the inside of the vale stem with a special hollow screw, which also needs to be torqued to 4 NM. Always be sure to fit the plastic valve cap to complete the installation. This prevents corrosion in the Schrader valve. Inform your customers not to use metal valve caps as different metals will eventually react with the aluminum threads and become very difficult to remove. You should record the sensor's ID number and the wheel it is being installed in. This will be important if you need to manually enter the sensor's position in the TPC control unit. Your Mercedes-Benz parts department supplies an external sticker

Whenever you replace a sensor, record the identification number pictured here vertically on the right. The number reads 600279933 on this sensor. The mounting screw should be tightened to 4NM.

with the ID number printed on it, which you can tape to the wheel for future reference.

If the sensor does need to be replaced, there are still a few service procedures that need to be performed to speed up the reactivation process and prevent a customer from returning and complaining that the TPC warning message is still displayed in the cluster. Each sensor has its own electronic identification signal it transmits along with those for battery life and tire pressure. This information can be pulled up with most TPMS tools. You may need to activate the sensor before it will transmit while the vehicle is standing still. Simply remove five psi from each tire you want to test, and the sensor will transmit the new information. Remember to correct the pressure after taking the reading for each tire. When you drive the vehicle, the sensors will transmit their ID numbers, battery life, and actual tire pressure. The TPC control unit will eventually learn the wheel position of each sensor. This will be followed by the tire pressure. This process may take a while, hence the customer's possible return. With the SDS, you can manually enter the ID number for each sensor into the TPC control unit. Now that the wheel positions have been learned, the learning of tire pressure will happen much faster.

The SDS has its Advantages

Using your SDS, enter the TPC (Tire Pressure Monitor) system where you will have the options to retrieve diagnostic trouble codes, look at event history, actual values, actuations, initial startup,

control unit adaptations, etc.. By choosing either initial start-up with manual entering of information, or control unit adaptations, and then selecting settings, you can enter the TPC sensor directly for each wheel. This speeds up the tire pressure learning process since wheel position is known. It can also be a valuable tool in your diagnostic process. If you suspect that a bad wheel sensor or antenna is not transmitting information, you can simply change the position of the wheel on the vehicle, then reactivate the system and see if the problem moves to a new wheel location or stays in the same wheel, which would indicate a bad TPC antenna. Other external characteristics can affect how the TPC control unit reactivates. If you live in a hot climate, air temperature inside the tire can go above 120 C. This will cause the sensor to stop transmitting information. Also, if tire pressure is three psi above specifications, the system will not finish the reactivation process.

The activation process must be performed any time components have been replaced, and new air pressure values need to be read. With the initial start up of a new TPC control unit, you can automatically retrieve car information, or manually enter the data. As an example of what information is necessary, you should know that the TPC control unit is usually powered up by the Rear SAM.

Additional weight in the vehicle has an effect on tire pressure. The central gateway gives vehicle-specific information and country code to the TPC control unit. The Front SAM sends charging system voltage and ambient temperature readings. Tire temperatures are affected by ambient and road surface temperatures as well. Look for the placard either in the fuel door, glove box, or driver's side door jamb. These are cold inflation pressures, so the tire pressure needs to be checked before driving the vehicle and not after a long trip. These pressure settings can be changed if different tires are fitted and the tire manufacturer recommends it, but Mercedes-Benz strongly recommends that only the original tire construction and size be used to work with the other electronic systems in the vehicle such as ESP, ASR, and ABS.

The TPC system is not without its limitations. It cannot report on a sudden loss of air pressure (a blowout), so you will still need to carefully inspect the integrity of the tire with each service. With a working knowledge of the TPC system you can do more than just keep that warning message off. You can also provide your customers with the confidence of knowing their vehicles' safety systems are ready to work as designed. It's that confidence and trust in you that keeps them coming back. |

When you order a new wheel speed sensor, you should always replace the tire valve. The sticker taped to the sensor has the ID number on it. You can tape this to the rim to identify the sensor number if you are going to manually enter it.

Vehicle	220.184	Control unit	RDK
Write wheel electronics identification number.			
Wheel electronics identification number of left front wheel			0600350357
The wheel electronics identification number is printed on component A69/1 (left front tire pressure monitor sensor).			
Wheel electronics identification number of right front wheel			0600348488
The wheel electronics identification number is printed on component A69/2 (right front tire pressure monitor sensor).			
Wheel electronics identification number of left rear wheel			0600279933
The wheel electronics identification number is printed on component A69/3 (left rear tire pressure monitor sensor).			
Wheel electronics identificaiton number of right rear wheel			0600262161
The wheel electronics identification number is printed on component A69/4 (rear right tire pressure control wheel).			

Using your SDS, you can enter "Control Unit Adaptations," then select "Settings" followed by "Write Wheel Electronics Identification Numbers," then you can manually enter the ID numbers to speed up the air pressure learning process.

the NET

Sourcing Mercedes-Benz Repair and Parts Information

Extensive information on Genuine Mercedes-Benz **Service Parts** such as Brakes, Wipers, Filters, Batteries and Oil

Revamped **WebParts** overview page and refreshed manuals on WebParts and the **EPC**

Genuine Mercedes-Benz **Remanufactured Parts** Catalog and Core Return Policy, as well as current price updates

StarTuned magazine section with archive search functionality and downloadable articles

www.mbwholesaleparts.com

Mercedes-Benz


Don’t dent your rep.
Trust only Genuine Mercedes-Benz Parts.
When Mercedes-Benz owners depend on you for quality collision repair work, using or recommending non-genuine parts can damage your credibility.
With readily-available Genuine Mercedes-Benz Parts, manufactured precisely to original model specifications, you can meet the superior standards your customers expect.
So, avoid making any risky moves and instead rely on Genuine Mercedes-Benz Collision Parts to get the job done right.
Contact your local Mercedes-Benz dealer or learn more at mbwholesaleparts.com.
Unsurpassed quality • Competitive price
Factory built & tested • Precision fit
Limited warranty • Proven reliability
Mercedes-Benz
©2012 Mercedes-Benz USA, LLC