StarTuned®

Information for the Independent Mercedes-Benz Service Professional

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Inside:

- Energy Management
- Cooling System Work
- Sensotronic Service
- Pre-/Post-scan Calibration

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StarTuned®

September 2019

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, online 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:

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Mercedes-Benz
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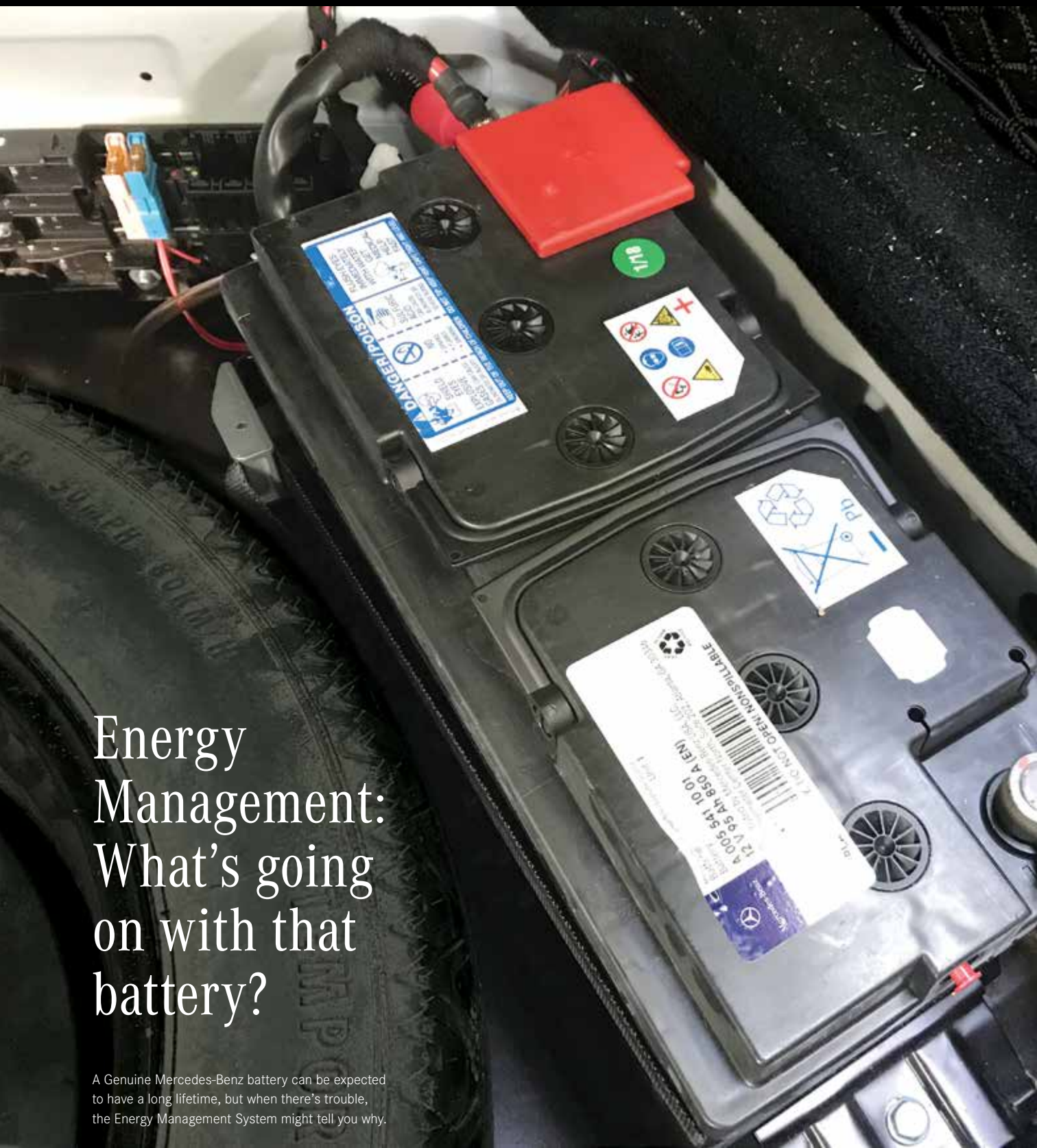


Energy Management: What's going on with that battery?

A Genuine Mercedes-Benz battery can be expected to have a long lifetime, but when there's trouble, the Energy Management System might tell you why.

We've all seen it many times: The customer complains that the battery has died. Your job is to figure out why, so after replacing the battery your customer doesn't come back with the same complaint.

As always, we start by asking the customer for some details: when did this first happen, did you leave something on, has the engine been cranking slowly lately, and so on. Then, we check the battery: How long ago was it installed, does it test good, are the terminals or cables corroded? Lastly, if all else doesn't turn up an obvious cause, is to more carefully diagnose the vehicle and find the actual reason for the problem, and fix that, too.

So let's assume that the customer hasn't noticed a problem and swears they didn't leave their lights on. Uncover the battery and have a look. Are the terminals clean or is there some corrosion? It can't hurt to clean the terminals anyway, either with some sandpaper or a battery brush. Of course, you already know to disconnect the negative terminal first, since having a wrench on the positive terminal and touching ground with it will absolutely ruin your day. While the terminals are disconnected, get out your battery tester.

While we haven't see a Sun VAT-40 in several years, some workshops continue to use a carbon-pile load tester. We load the battery to three times the Amp-hour rating – that would be 300 Amps for a big 100 Ah Mercedes-Benz battery – and check the battery voltage after exactly 15 seconds. A good battery will read over 10.0 volts. While not exactly a bad choice, load testing like this isn't nearly as accurate at showing the battery condition as a modern internal resistance tester.

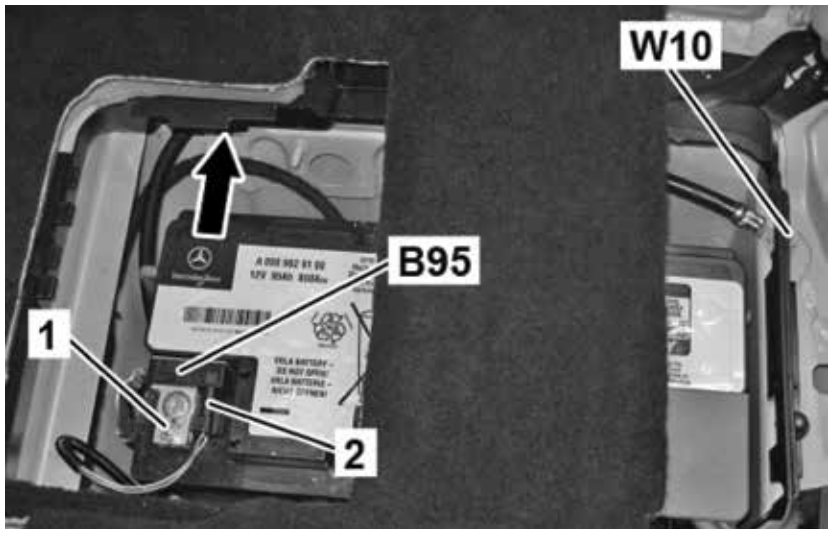
Mercedes-Benz recommends the Midtronics 165-EXP-717 tester and requires it for all dealerships. This tester uses "dynamic conductance battery testing technology," which means it accurately measures the battery's internal resistance to determine its condition. The advantage of this kind of testing is that we don't need to apply a large load – which can be dangerous – and the tester delivers the results in clear, plain language: Good battery, Replace battery, or Charge and Re-test. For dealers, it also delivers a test results code, required for warranty claims. We've found this tester, and its

Don't let it come to this! Battery terminal corrosion can cause more than enough resistance to prevent engine cranking.

immediate predecessor the Micro-717, for sale on the used market at reasonable prices.

A healthy lead-acid starting battery has an internal resistance of just a few milliOhms, or thousandths of an Ohm. Let's say that the battery needs to be able to deliver perhaps 700 Amps for starting. If the internal battery resistance is too high, Ohm's Law dictates that the voltage at the battery terminals will drop too much and not be able to run the starter. If the battery has an internal resistance is just 10 milliOhms, the internal voltage drop at 700 Amps will be 7 volts, meaning it won't start the engine with only about 6 volts at the terminal. In contrast, a healthy battery would be expected to have an internal resistance of 3 to 4 milliOhms.

The Midtronics Micro-717 battery tester we use in the shop. The test results are always perfectly clear.

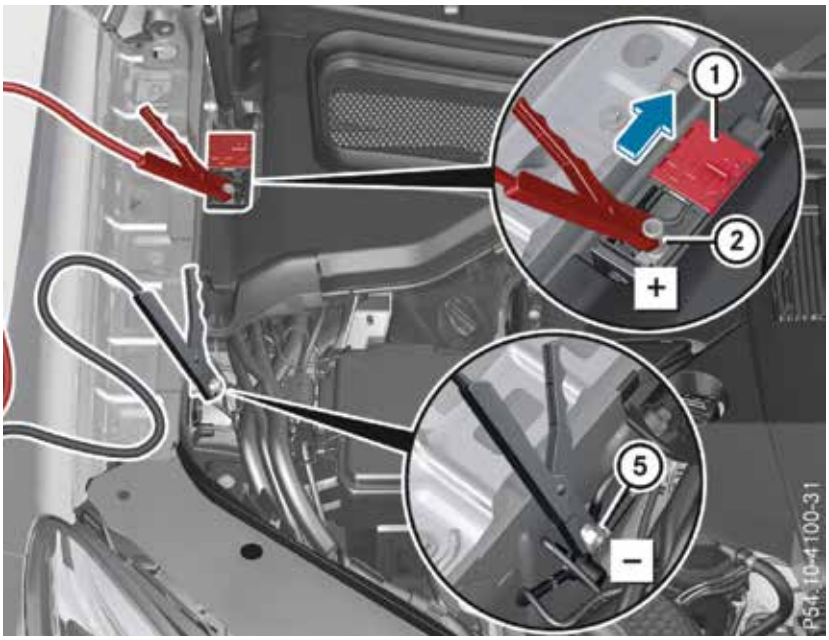


The battery sensor used by the energy management system, B95 in Model 166, is mounted between the battery negative terminal (1) and the ground wire leading to the chassis ground (W10). Vehicles with a battery sensor generally have an energy management system that influences battery state of charge.

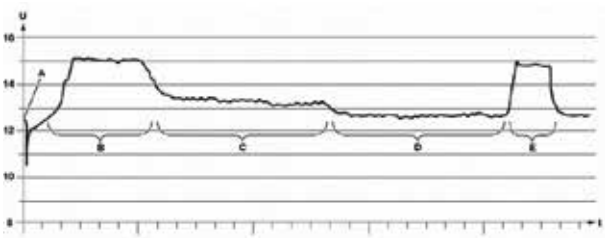
While we're on the topic of milliOhms, if the electrical path between the battery and starter (and back!) has more than a few milliOhms of resistance, you'll still end up with a no-start condition. It doesn't matter where the excessive resistance is (and as odd as it may sound to describe 0.01 Ohms as "excessive"), the result is still a no-start. What this means is that no matter how the battery tests, you need to check the condition of the entire current path from battery to starter and back.

You're looking for corrosion and loose connections, anything that might increase resistance by even just a few thousandths of an Ohm. Be sure to verify that the bolt holding the other end of the battery ground cable really is tight, and the ring terminal and the metal under it are clean and bright. If you haven't cleaned the battery terminals yet, do that now. Don't forget the positive current path as well: check it along the entire length, wiggling wires and terminals since a visual-only inspection might not spot trouble. All this should take just a few minutes.

OK, so the battery, after a recharge, tests good. The current path to the starter is fine. Why'd the battery go dead? In newer Mercedes-Benz models, the Battery Control Module keeps track of charge and discharge current and can offer you some clues. In our shop we consider the real introduction of this diagnosis aid to be with the start of production of the Model 164 M-Class and GL-Class models, although some earlier models had a more rudimentary system. It was installed on all models that were newly introduced starting in Model Year 2006, and later.



In vehicles with an energy management system, always charge the battery using the jump-start terminals in the engine compartment. Bypassing the battery sensor by connecting directly to the battery terminals bypasses the battery sensor, meaning the system can't see the charging effort.



Here we see an example of how alternator management might work. The marked stages in this voltage (U) versus time (t) graph are: A: Engine Start, B: Fast Charging, C: Temperature-based charging, D: Alternator management, E: Charging in deceleration mode.

You can tell if your vehicle has such a system by looking at the negative battery terminal: Is there a battery current sensor? If so, most likely your vehicle is equipped. Here, we will be using the Model 166 (newer M/GL-class, also known as GLE and GLS models) system as our guide, but be aware that virtually all of these systems are quite similar, although there have been some improvements over the years.

Before we get into the details of the system, just a note that we won't be discussing how to isolate excessive parasitic draws here. That was covered in the December 2015 issue of *StarTuned*.

One thing about battery charging: If you recharge the battery by connecting directly to the battery negative terminal, the battery sensor won't be able to 'see' it. You are better off connecting to the other end of the battery ground cable if possible or at least on the non-battery side of the battery sensor. Mercedes-Benz recommends using the jump-start terminals found in the engine compartment for all battery charging, specifically so the battery sensor can do its job.

The battery sensor has a bigger role in the vehicle's energy management system than monitoring battery current draws. The energy management system takes care of the supply and consumption of electrical energy, with a primary goal of ensuring the vehicle can be re-started, along with the goal of ensuring a stable energy supply to all vehicle consumers. This system is made up of several components: The main vehicle battery, the battery sensor, the alternator, the engine control module and the Additional battery. The Additional battery in most vehicles is installed to ensure the shift-by-wire function can always operate, and in vehicles equipped with ECO Start/Stop it also provides the power to run the electrical system for a few seconds as the engine is being restarted (avoiding a 'brown-out').

The entire system is operated by the Signal Acquisition Module (or SAM), known as N10 in Model 166, with two basic functions: The electrical energy balance system, and the engine coordinator which can slightly modify engine running characteristics to support the electrical system.

The electrical energy balance system monitors the vehicle's power supply and can actively intervene when necessary, for example by increasing alternator output and/or shutting off certain electrical consumers. So if the electrical system voltage is starting to sag, and the alternator is already giving all it can, and the engine idle speed is already increased, the system can shut off non-essential consumers like the heated seats to help ensure the rest of the system can continue to function.

The system's most powerful tool is Alternator management. After the battery is discharged by the act of starting the engine, the energy management system

starts out by commanding – via LIN-Bus communication – the alternator to deliver maximum output, also known as Fast Charging. As the battery recovers, the alternator is then switched over to temperature-based charging, which is the most common condition, found during nearly all operating conditions.

The system tells the alternator to reduce charging output (as long as the battery does not need fast charging) during high engine demand, such as during acceleration. This saves a bit on fuel consumption at virtually no cost. Similarly, when the engine is coasting such as a long downhill run, the alternator is asked to boost energy delivery, not only adding to the engine's braking effect but recovering the downhill kinetic energy as electricity for the battery.

Certainly this doesn't count as regenerative braking, but it is just one example of how far modern automotive engineering has gone in pursuit of ever-increasing fuel economy. It also points to some new thinking needed when diagnosing something as simple and well-understood as an alternator. Now that the alternator has gotten 'smart' and can communicate with a control unit, technicians have to keep that all in mind as they try to figure out why their customer's vehicle is acting strangely.

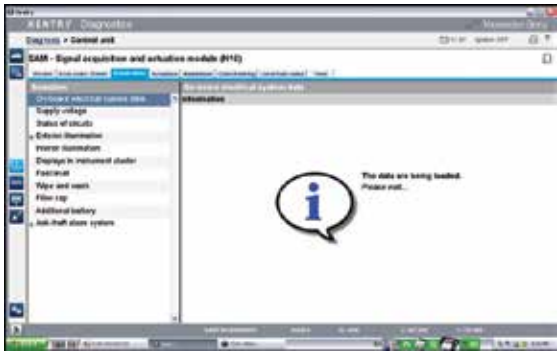
This also makes a case for taking advantage of the highly-advanced diagnostics available in Mercedes-Benz vehicles by getting and using a modern XENTRY Diagnostics System. It certainly is a considerable investment for any small business to get a XENTRY machine, but you need to do the math: How much will this machine cost, and how much will it make? Just like any tool – think of a vehicle lift, air compressor or tire machine – it is an investment in your business and your ability to serve your customers efficiently.

Back to the energy management system: As a side job, it also collects data on the vehicle electrical system and makes it available to us for diagnosis. It also will flag what it calls a "conspicuous" problem, which is anything that the designers thought might be something you should look at. Brings a whole new meaning to the term Conspicuous Consumption.

To get in to the battery monitoring system, start up your XENTRY Diagnostic System and navigate to the SAM control unit. In models having both a Front and Rear SAM, it will usually be the one closest to the main vehicle battery, but of course if it isn't, just try the other one. On the Actual Values tab, select the entry for On-board electrical system data. Give the system a moment to gather the data and format it for display, and the overview screen appears.

On the overview screen, we can see the last 100 "engine off" and "driving" cycles, and how much electrical energy each particular cycle added to or removed from the main vehicle battery. Note that cycle 1 is the newest cycle, and the older cycles have higher numbers.

A XENTRY Diagnostics system, like this older Tab 2 system, will pay for itself in ease of diagnosis and programming if you work on Mercedes-Benz vehicles regularly. Visit www.startekinfo.com for more information.



The energy management system data is found on the Actual Values tab of the SAM control unit. Selecting the On-board electrical system data page starts the process of generating the graphs.

Take a look a Figure A: The black lines show the number of Amp-hours added to or removed from the battery during a driving cycle, and the red lines show the same for a 'stationary' (engine-off) cycle. In the image, you can see that some driving cycles show a negative charge balance, meaning energy was lost, and some stationary cycles show that energy was gained, meaning a battery charger was connected.

Note that a driving cycle begins when the engine is started, but the data for that cycle is not recorded until the engine is switched off. In the same way, a stationary cycle begins when the engine is switched off, but the data is not recorded until the engine is started again. You need to keep that in mind when counting backwards to identify a specific cycle.

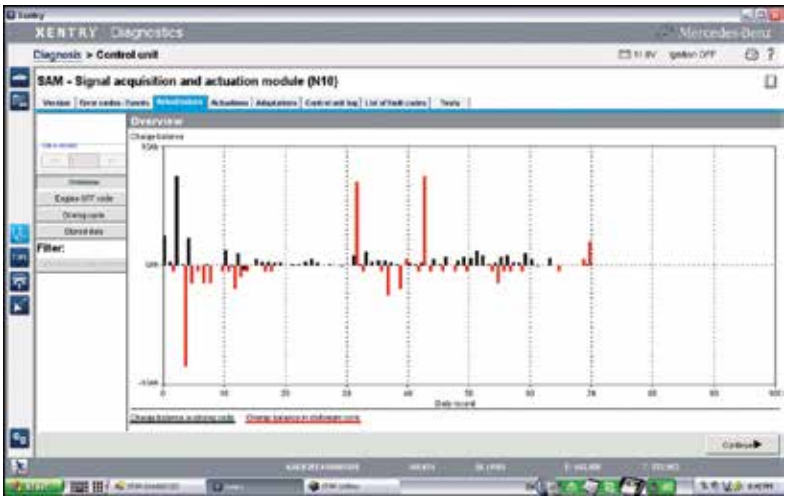


Figure A: The Overview screen shows up to the last 100 driving and engine off cycles, the most recent being #1.

Now take a look at Figure B, which in this example shows the specific details of engine off cycle #4 (see the top left of the image – clicking the arrow buttons goes to the next or previous cycle). You should compare this to cycle 4 in Figure A: it is the longest red line, dropping downwards. This detail screen shows several things: The battery lost 9 Amp-hours (red bar at bottom), a door

was open for about 70 minutes (green bar), the standing (parking) lights were on for about 15 minutes, the CAN Bus was active for about 30 minutes, the battery voltage fell below 12.3 volts for about 10 minutes, and Circuit 15R was on for about 15 minutes. No wonder some energy was lost!

We can see that the odometer reading was 44 km (convert to miles for USA vehicles by multiplying by 0.62) and the vehicle was switched off for 215 minutes before the engine was started again. You can also see the system noting that the charge balance (here, - 9 Ah) is "conspicuous." Using this information, for whichever cycle you wish to examine, can help you figure out what was going on while the vehicle was parked. Finally, note the time and date stamp at the top of the graph: This comes from the COMAND head unit via GPS, so it can be wildly inaccurate if GPS or COMAND isn't functioning.

Figure C shows the next screen, the driving cycle. This is a chart like the engine off cycle, but here we see nothing unusual, and we can see that the battery gained about 8 Amp-hours. The battery was only 69% charged when the engine was started, with a measured internal battery resistance of 3.20 milliOhms. We would expect a state of charge between 70% and 100%, so this is a bit low. We can see that alternator management was active for most of the trip, and engine RPM increase was active for a short while, likely because the system was trying to recharge the battery. In a drive cycle like this, your customer might complain that ECO Start/Stop was not activating, and you can explain that the battery was a bit low at engine start. This example shows how this data might help you explain the vehicle's symptoms to your customer, which would be impossible without it. Note that data is not recorded for driving cycles of less than a minute.

The last screen is the Stored Data screen. Here was can see, as a line graph over a long time, what was going on with the vehicle. The graph shows a variable period of time from as little as 30 minutes to as long as five

Figure B: An Engine OFF cycle graph. Here, we see that the battery lost about 9 Amp-hours, and several consumers were active, including standing lights and a door that was open for over an hour.

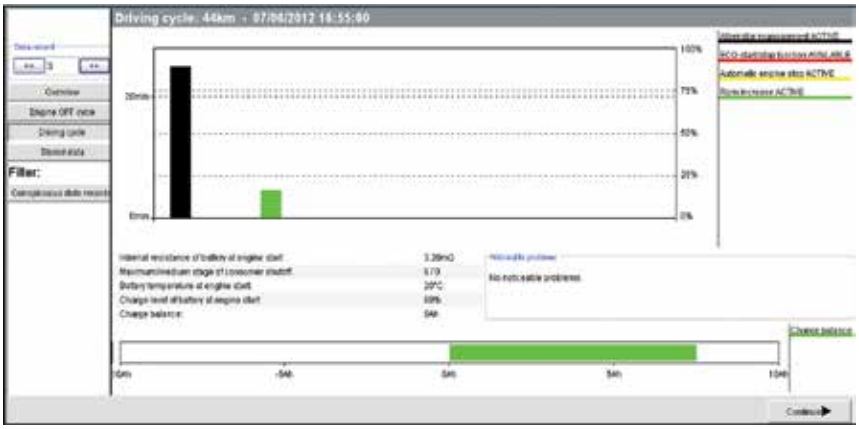


Figure C: A Driving Cycle graph. Alternator management was active most of the drive, probably trying to recharge the battery, which started out at only 69% charged.

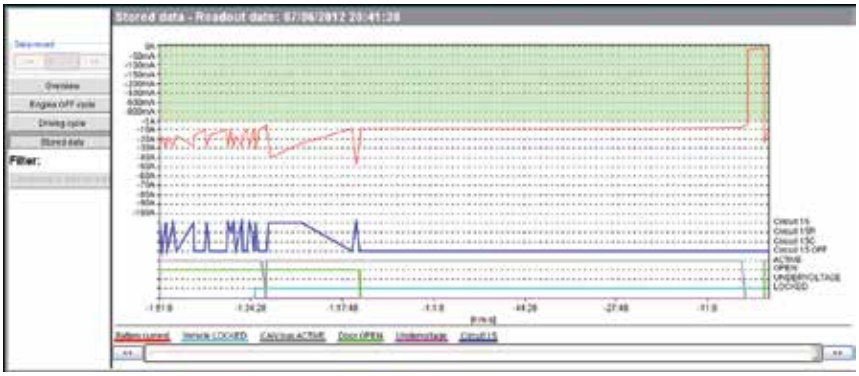


Figure D: The Stored Data screen, showing a long-term picture of several system parameters. Note that sloped lines don't represent a gradual change in the value: See the text for an explanation.

days. The system is constantly storing data, and stores a data point at least every 17 minutes, but if things of interest are happening, it will store data points more frequently. This means that if a large number of changes are recorded, the time period available for display will be shorter, and if only a few changes are recorded the time displayed is longer.

Some important points to note for this graph:

- A sloped line does NOT represent a slow transition between states. The graph software is merely connecting each measurement point with a straight line. So that gradual change in Circuit 15 between about -1:20 and -1:15 just means there are only two data points, one 'on' and the other 'off' at those times – the in-between is unknown.
- By using the slider at the bottom, different periods can be viewed. The time scale automatically adjusts to show data of interest.

So the next time your customer comes in with a dead battery, you can look like a wizard when you show them that they'd left their lights on last night – as long as they ended the Engine-off cycle by starting the engine... |

Takata: Recall Procedure

With the Takata airbag recall in the news for several years, you know that millions of vehicles affecting nearly every manufacturer that used certain airbag inflators manufactured by the former Takata Corporation are subject to a US Federal Recall Campaign, due to the possibility of injury from the type of propellant used in the airbag inflators. Out of an abundance of caution, this recall was increased to encompass approximately 46 million airbags installed in an estimated 34 million vehicles. While the total population compared to other OEMs is significantly smaller, certain Mercedes-Benz vehicles are also affected. What does this mean for you, the independent workshop?

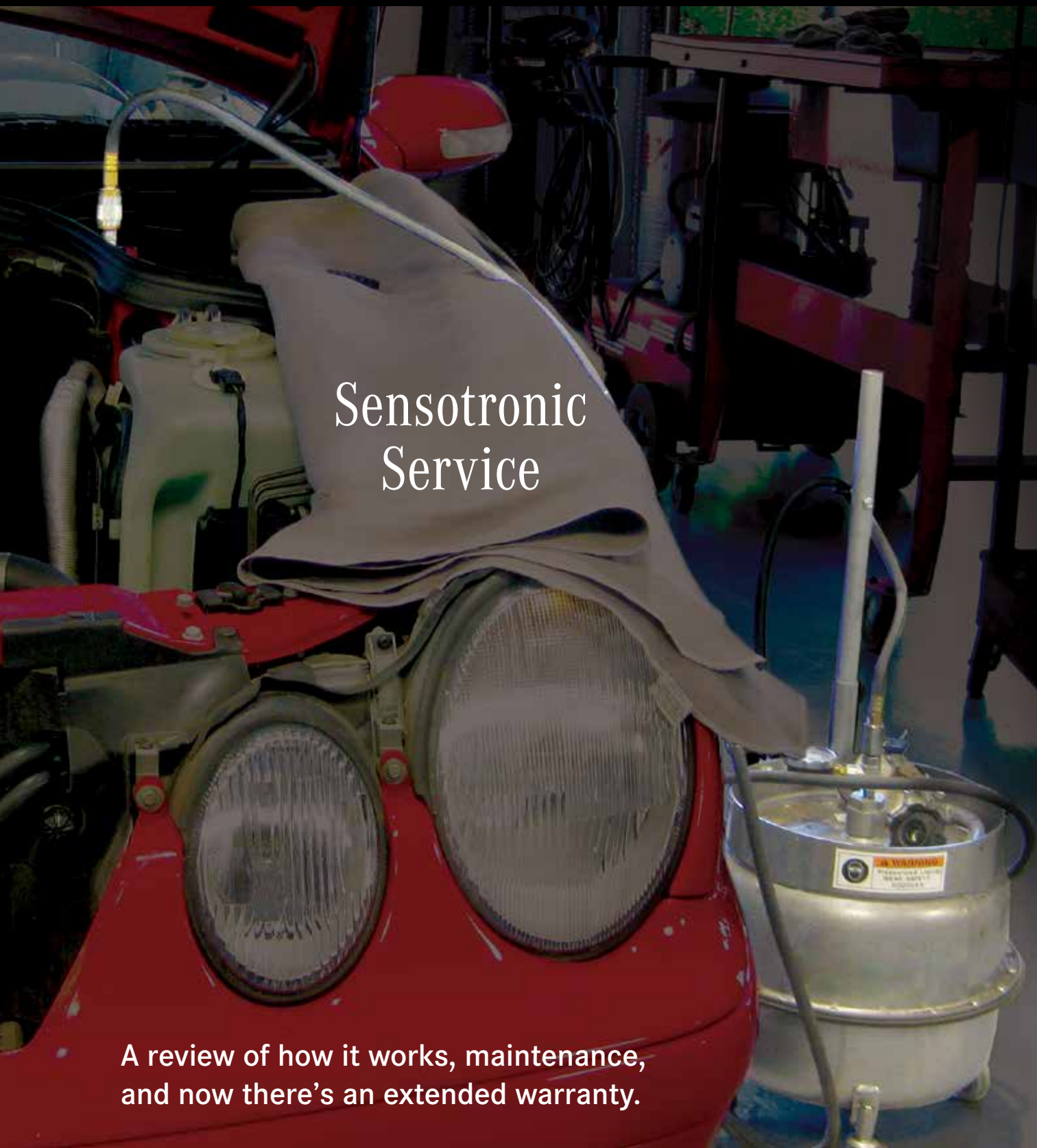
First, you need to be aware and informed of the recall, and only share accurate and clear advice to your customers. This means directing them to their authorized dealer for the repair, MBUSA's VIN Lookup Tool at mbusa.com/recall, the free license plate/VIN Scanner App (Airbagrecall.com), or the website for the National Highway Traffic Safety Administration (NHTSA.gov). Don't venture a guess or speculate on a safety recall, since incorrect information can be a liability to you and your business. What you should do is check each vehicle that comes into your shop to see if it is affected by this (or any) recall campaign. If you are participating in StarRewards, or visit the MBWholesaleParts.com website, you'll see regular updates on this and other topics of interest as well.

Standard practice for dealers is to check the vehicle VIN for open recall campaigns and schedule repairs when necessary. Why should your shop be any different? While there is no legal requirement to do this, you can continue to build a trusting relationship with your customers, knowing that you have their safety and best interest in mind. And we all know that nothing builds repeat and referral business more than customer trust.

For that reason, make it a habit to check every vehicle's VIN through one of the three resources mentioned above. Add a note on the repair order such as "Checked VIN and found no open recalls," or "VIN has an open recall. Visit a dealer as soon as possible." The customer should always contact their dealer to discuss any unrepaired recall campaigns. While the resources do not list any non-safety or service campaigns, your local dealer can see these and, assuming the vehicle has the affected condition, will happily provide repairs to the vehicle under the terms of the voluntary campaign – just another way you and your dealer can partner to take care of all our mutual customers. Not all recalls can be performed Immediately due to parts availability; with the Takata airbag recall campaign the Federal government is prioritizing certain

vehicle and areas of the country for repairs, since the supply chain for airbag inflators cannot keep up with the demand.

In choosing to drive a Mercedes-Benz, your customers have chosen to make safety a priority. In choosing your workshop for their repairs, they have also chosen to make safety a priority. Honor those choices by always keeping your customer's best interests in mind. Stay informed with updates and information on how to better assist your customers via StarRewards and MBWholesaleParts.com. |



Sensotronic Service

A review of how it works, maintenance, and now there's an extended warranty.

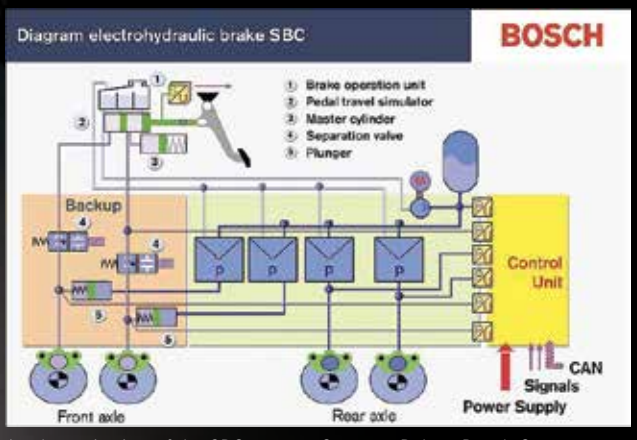
If you work on Mercedes-Benz vehicles then most likely you have encountered the Sensotronic Brake Control (SBC) system in the course of your work. Beginning in 2003 with the W211 E-Class models through the 2011 SL models the Sensotronic system was in production. Mercedes-Benz and Bosch teamed up on this groundbreaking development project which entered into series production at the Stuttgart automobile plant under the name Sensotronic Brake Control.

As a brake-by-wire system, it turns the conventional hydraulic brake system into an even more powerful electro-hydraulic system. Its microcomputer is integrated into the car's data network and processes information from various electronic control units. In this way, electric impulses and sensor signals can be instantly converted into braking commands, providing a significant safety and comfort gain for drivers.

Theory and Operation

We all understand that in a conventional braking system, the driver's foot pressing against the brake pedal generates pressure in the brake master cylinder, which then acts upon the brake calipers, pressing the brake pads against the brake disks, causing friction that slows the vehicle.

Engineers sought to shorten the time involved in this mechanical hydraulic braking application. With Sensotronic Brake Control, the driver's foot pressing against the brake pedal is sensed by a pedal travel sensor. This signal, along with various other signals such as wheel speed, is processed by an electronic control unit that calculates the optimum brake pressure for each wheel. Electrohydraulic valves allow pressure from a high-pressure pump and pressure accumulator to act upon the brake calipers, again pressing the brake pads against the brake disks, causing friction that slows the vehicle. Because of the electronics involved, SBC can offer even greater active safety than conventional brake systems, particularly when braking in a corner, on a slippery surface, or in a panic stop.



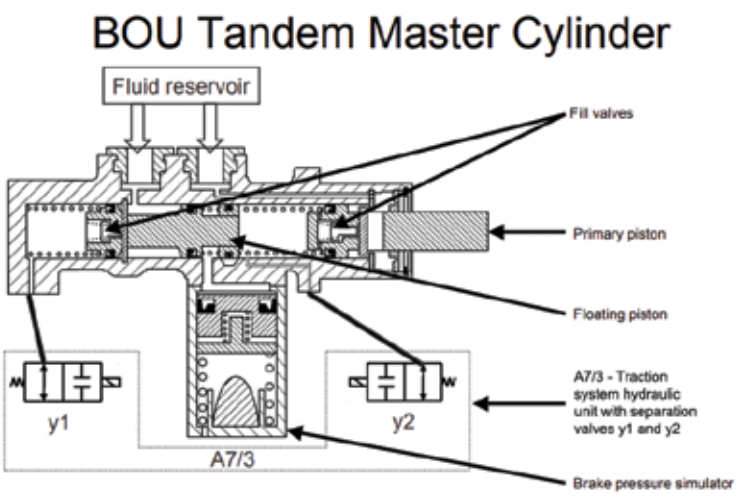
A schematic view of the SBC system. Courtesy Robert Bosch Corp.

The most important performance characteristics of Sensotronic Brake Control include the extremely fast build-up of brake pressure and precise monitoring of driver and vehicle behavior by means of sensors. Brake force control plays a very important role in the overall safety of the vehicle. Keeping this in mind, Mercedes-Benz has programmed the system in such a way that when slowing down from a high speed, the larger part of the brake force continues to act on the front axle which prevents hazardous over-braking of the rear axle. At low speeds or during partial braking the system automatically increases the brake force share at the rear axle to improve brake system response.

During research in Daimler's Berlin driving simulator it had been discovered that almost two-thirds of all drivers are startled when ABS pulsation sets in, or drivers do not apply enough brake force for the situation, lengthening the stopping distance of their vehicle. Sensotronic Brake Control helps eliminate these problems and, as a result, this innovative system offers significant benefits in terms of handling safety.

One example includes emergency braking: SBC recognizes the driver's sudden switch from the accelerator to the brake as an indication of an emergency situation, and is able to react automatically. In this case the system increases the pressure in the brake lines and positions the brake pads against the brake discs so that they can grip with full force the moment the driver actually steps on the brake.

In the case of slippery or wet conditions, through brief regular application of the brakes, SBC ensures that the film of water on the brake discs is stripped away so that the brakes can always operate to full effect. This automatic drying function is activated whenever the windshield wipers have been operating for a certain length of time. The finely-metered brake impulses are not noticeable to the driver.



A cross-section of the Brake Operating Unit (BOU), the master cylinder used with SBC.

An additional support system in some models further ensures greater safety and improved comfort: the Start-Off Assist system, also known as SBC Hold. This feature applies the brakes to hold the vehicle still until disengaged by the driver, relieving driver fatigue from having to press the brake pedal continuously, and is particularly useful when stopping on hills and steep gradients. Once the vehicle has been braked to a stop, a little extra pressure on the brake pedal is enough to activate this function. The vehicle is then held firm by the SBC Hold function, allowing the driver to take their foot from the brake pedal. The letters "SBC H" will light up in the instrument cluster. Pressing either the brake or accelerator pedal releases SBC Hold.

Summary of Advantages of SBC

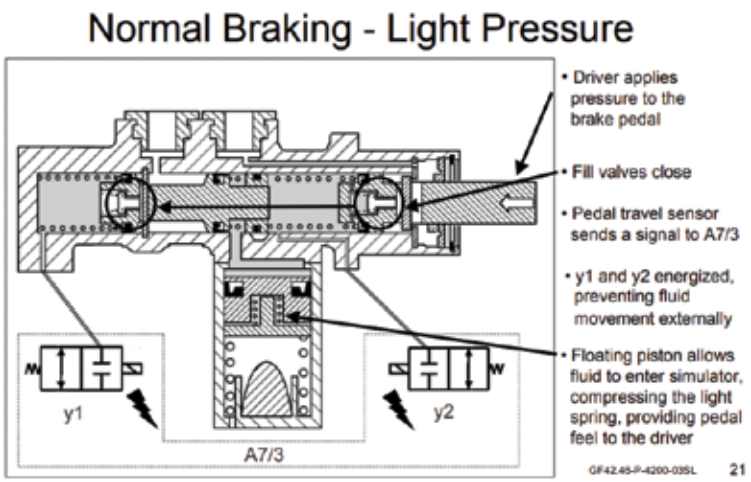
- Improved metering of required brake pressure – each wheel can be precisely controlled independently.
- Improved BAS (Brake Assist System) function – monitors the release of the accelerator pedal and application of the brake. The maximum brake pressure is available immediately. Pre-filling of the system (overcoming play) removes any physical play to ensure fastest brake application by applying a slight pressure to the system when the BAS function is anticipated.
- Electronic Brake Proportioning (EBP) – allows brake proportioning front to back and side to side.
- No pedal vibration during ABS operation – eliminates startling and distraction of the driver during critical moments.
- Improved driving dynamics: ABS, ASR, and ESP – faster response to brake request inputs.
- Pressure reduction at standstill – system pressure is reduced to a level sufficient to hold the vehicle steady, reducing stress on system components.
- Dry braking function – lightly actuates brake pads to keep the brake disks dry. If windshield wipers are in use, as signaled via CAN Bus, brakes are activated approximately every 7 to 14 minutes.

The Brake Operating Unit (BOU) used with SBC looks like a traditional master cylinder, adding a brake pedal position sensor and removing the vacuum booster.

Components

In addition to the components found in a conventional braking system, Sensotronic adds a Brake Operating Unit (BOU), and uses the existing wheel speed sensors and a modified traction system hydraulic unit known as the SBC control module (A7/3).

The BOU, located where a conventional master cylinder with vacuum booster might be found, consists of the brake fluid reservoir, an SBC pedal value sensor (B37/1), a tandem master cylinder, and a brake pressure simulator to provide force feedback via the brake pedal to the driver. There is no vacuum booster in an SBC



Normal Braking: This summarizes the operation of the Brake Operating Unit. Note that valves y1 and y2, which lead directly to the brake calipers, are closed during normal SBC operation. Braking pressure is provided by the SBC control module and hydraulic unit.

A complete SBC unit consists of the electronics (left), hydraulic valve system 9center), high-pressure pump (right front) and pressure reservoir (right rear). The system uses high pressure, so be sure to read and follow all warnings.

system. WIS document GF42.46-P-4210SL has a good explanation of the system's function and operation, and is a worthwhile read.

The pedal value sensor, physically connected to the brake pedal, has two Hall-effect sensors which convert pedal travel to an electrical signal, providing input to the SBC control module A7/3. Take a look at the nearby image labeled 'normal braking' to see how the driver's braking effort and the BOU interact. Note that the valves leading to the brake hydraulic system, y1 and y2, are closed during normal operation: Brake pressure is delivered and controlled by the SBC control module, based on the brake pedal travel.

In case of system failure, the valves y1 and y2 remain open, allowing the driver's brake pedal force to deliver pressure to the brake system as with conventional brakes. However, braking performance is diminished since there is no power assist, and of course a warning is displayed in the instrument cluster.

The SBC traction system hydraulic unit consists of:

- SBC control module (A7/3n1) - This is the brains of the operation and is responsible for the calculations and interpretations of the various input signals. This also operates the ESP and related traction control systems.
- High pressure charge pump (A7/3m1) - Pressurizes the brake fluid to supply the system.
- Pressure reservoir – A pressure accumulator to provide a ready source of instant pressure and dampen pressure fluctuations.

There are 3 pressures stages used for the brake system calipers, similar to those known from the standard ABS function, but these can be applied as needed to any or all wheels. They are:

- Pressure increase
- Pressure hold
- Pressure release

Operation

SBC has a wake-up and a pre-check diagnostic function. The wake-up feature happens when opening a door, operating the central locking system, depressing the brake pedal, turning the key to position 1, or operating the parking brake. The wake up signal comes from the left front SAM. This ensures the pressure reservoir is sufficiently charged.

The Pre-Drive Check (PDC) may be performed after wake-up. Here, pressure is applied to the brake calipers, to check the reservoir pressure, pressure sensors, control valves, sense any leaks, and overall operational checks.

WARNING: Pressure applied to the brake calipers during the PDC will apply the brakes, which can injure or crush body parts, or eject the caliper pistons from the cylinders if the brake pads are removed. Do not perform work on the brake system unless the PDC has been disabled, as explained below.

The PDC self-tests are also conducted regularly during operation, about once every 16 brake applications.

Service and Repair

WARNING: YOU CAN BE HURT! When servicing brake pads or rotors, or with most repairs on the brake system, the system must first be deactivated to prevent the Pre-Drive Check (PDC) from being performed and possibly causing injury or vehicle damage. Deactivating the system will discharge the pressure reservoir and prevent the charge pump from operating.

To deactivate the system, either use XENTRY Diagnostics, or follow the procedure explained in a Video released by Daimler, which is only viewable by Authorized Mercedes-Benz Dealers. You should check with your dealer to see if they have any advice on using this procedure. We repeat those instructions here:

To deactivate the SCB Pre-Drive Check (PDC), start with all wheels completely off the ground, switch off all electrical consumers and open the driver's window. Switch the ignition off and remove the key. Close all doors, centrally lock the vehicle, and wait at least 30 seconds for the system to power down. Once time has passed, unlock the vehicle with the remote key and wait at least 15 seconds. Lock the vehicle again, and the PDC is deactivated. Keep the keys well away from the vehicle, since operation of the key could re-activate the SBC system and cause a safety hazard.

After repair work on the brake system, the SBC system MUST be re-activated BEFORE the engine is started! Failure to activate will prevent proper operation and generate fault codes.

To activate the system, either use XENTRY Diagnostics, or use the procedure from the video we mentioned above.

After performing the necessary work, reactivate SBC: Unlock the vehicle with the remote key. Reaching through the open window, switch the ignition on using the key to Position 2, switch the ignition off for 5 seconds, then switch the ignition on again. On the driver's side, turn the rear wheel forwards at a rate of 1 to 2 revolutions per second for at least 3 seconds. Bring the wheel to a stop, then within 60 seconds, turn the driver's front wheel at a rate of 1 to 2 revolutions per seconds until the wheel stops by itself (the SBC applies the brakes). The tail lights will flash three times to confirm the activation. The brakes will be applied several times at each wheel.

Lower the vehicle and switch the ignition off. Start the engine, pump the brake pedal slowly about 10 times: If no faults are indicated, the activation was successful. If any faults appear, repeat the activation routine. If necessary, check for diagnostic trouble codes using XENTRY Diagnostics. Remember, check the tail lamps for those three flashes.

Activating SBC will re-charge the pressure accumulator, preform a PDC, move the pads towards the rotors and erase the fault memory. Be sure to top up the brake fluid reservoir level.

Keeping the fluid right

In the course of servicing an SBC system you may find yourself having to bleed the system either to remove air or when flushing during routine maintenance. Vehicles with this system will have the same brake fluid change intervals as other conventional mechanical/hydraulic vehicles. Most Mercedes-Benz maintenance schedules call for a fluid change every 20k miles or 2 years, whichever comes first.

Moisture and dirt are the two major offenders when it comes to tripping up a Sensotronic system. A lack of cleanliness when filling or topping a system is one reason brake fluid may appear dirty or contaminated. The more common reason is moisture in the system: Brake fluid is hygroscopic, meaning it absorbs water from the atmosphere. This means that the brake fluid's water content will gradually increase over time, which is why it is absolutely critical to always use only brake fluid from newly-opened containers. Mercedes-Benz generally recommends only DOT 4 brake fluid – avoid using anything else. Of course, check the owners manual to verify the correct brake fluid required.

WARNING:
Failure to follow the procedure described precisely can expose you to risk of serious personal injury or vehicle damage. If unsure, use XENTRY.

Moisture in the brake fluid lowers the fluid's boiling point, which is undesirable. As the brakes get hot during use, some of the heat is transferred into the brake caliper and thus into the hydraulic fluid.

Genuine Mercedes-Benz DOT 4 brake fluid. Always use brake fluid from a new, sealed container.

With SBC, a power bleeder and diagnostic scan tool with bleeding routine are an absolute must!

During strenuous braking, temperatures can become so high that the brake fluid boils, introducing bubbles of gas into the hydraulics. This is bad news since the bubbles of gas increases the overall compressibility of the brake fluid leading to a spongy pedal and, in extreme cases, can lead to significantly reduced brake system effectiveness.

A diagnosis scan tool, such as XENTRY Diagnostics, with a bleeding system menu is needed for this operation. You also need a power brake bleeder and a battery maintainer to ensure battery voltage remains stable. Here is the procedure from the workshop manual:

1. Connect the battery maintainer.
2. Deactivate SBC brake system using XENTRY.
3. Connect the brake fluid changing equipment (power bleeder).
4. Raise vehicle with lift and remove wheels.
5. Carry out bleeding operation using the XENTRY menu.
6. Check brake fluid level in reservoir and correct if necessary.

Trying to service the later model Mercedes-Benz vehicles without the proper equipment and repair information will be futile and will result in many lost hours of work. That 2-year service interval is important. We've seen neglected SBC systems that needed costly repairs because the fluid hadn't been changed often enough. Informing your customers of this need will greatly improve their chances of having no problems in the system down the road.

Extended Warranty

As an independent service workshop, you need to be aware that Mercedes-Benz USA in 2018 extended the Limited Warranty for the SBC control module (including the hydraulic unit) to 25 years with unlimited mileage. Before making repairs, check with your local dealer to see if the warranty applies.

Also be aware that Mercedes-Benz USA has issued in 2005 two Safety Recall campaigns (RC2005110001 and RC2005070007) to address certain system issues in the SBC system. In summary, the Recall campaigns state that a ground wire may become loose, disabling the system and potentially increasing stopping distance.

This means that, first, you should make it a habit to check for open Recall campaigns at NHTSA.gov; if any campaigns are open have your customer visit the Mercedes-Benz dealer to have the campaign fulfilled. Second, if the SBC control unit appears to have a fault, check with your local Mercedes-Benz dealer about possible warranty coverage.

The Future is Here

Mercedes-Benz, based on customer feedback, decided to discontinue its SBC system following a number of problems which has led to vehicle recalls. By 2005 over 2 million vehicles worldwide were recalled.

Like most innovative technology, there are "growing pains." For example, several years ago "drive by wire" was just an engineering vision. Through much testing and refinement the system became the norm, and now almost all production vehicles use some form of electronic throttle control. So it will be with "brake by wire": As technology advances and more safety measures are incorporated, SBC or a future form of it will indeed be the norm in production automobiles.

Mechatronics – a new term gaining popularity within the automotive industry is rapidly developing into a buzz word in a quiet technological revolution. Mechatronics brings together two disciplines which in many cases were thought to be irreconcilable, namely mechanics and electronics.

One such system, Active Body Control, takes the previously unobtainable ideal of being able to vary spring rates and suspension reaction at each individual wheel, during all types of driving and road conditions, and makes it a reality.

In this way, purely mechanical automobile functions will, in the future, likely be controlled by high-performance microcomputers and electronically controllable actuators. These could either replace the conventional mechanical components completely, or enhance their function. The mechatronic interplay therefore opens up what were previously speculative ideas to possibilities which further raise the safety and comfort levels of modern passenger cars.

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With our competitively priced Genuine Remanufactured Parts, you no longer have to settle for anything less than Mercedes-Benz quality. But that's just part of the story. You see, our AIRMATIC® struts, catalytic converters, turbochargers and steering racks all carry a 24-month, no mileage-restriction warranty. So our parts are not only a great deal. They're a great value. And since they're genuine Mercedes-Benz, you can have confidence they'll last, and so will your relationship with your customers.

Mercedes-Benz

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One remanufactured engine pulls the plug on climate-damaging CO_2 and saves 447 days of power for one laptop.

Cooling System Work

Electronic thermostats, multiple coolant circuits, and efficient flushing/filling.

History

Cooling systems in the modern automobile by and large still accomplish the original objective that they were designed to do: cool the engine and maintain it at an optimum temperature. Early systems were only concerned with the former. The internal combustion engine generates enough heat, so much so that if left unchecked it would melt the metal components and seize the engine in a short period of running time.

There have been basically 2 types of cooling systems in the automotive world – air cooled and liquid cooled. Air cooled systems have had a place in much of automotive history with the most iconic examples being the original Volkswagen Beetle, the Porsche 911 and the Chevrolet Corvair.

Automotive air-cooled engines are actually cooled by both air and oil. Basic cooling is provided by generous fins on the cylinders and cylinder heads which expose as much surface area as possible to the cooling air forced across them by an engine-driven fan. Located in the airstream often is some sort of heat exchanger to control the temperature of the engine. Control of the oil temperature was usually done with a type of oil thermostat that would control the flow of oil through a cooler.

This 1886 model was air-cooled, but went to a water-cooled system in 1887.

Opposite Page: This gallon of Genuine Mercedes-Benz coolant, meeting specification sheet 325.0, doesn't really cost much more than the green stuff sold everywhere, but it offers far superior protection and performance.

The earliest prototypes from Mercedes-Benz were developed by pioneering Germans Gottlieb Daimler, Wilhelm Maybach and Karl Benz. Herr Benz originally concentrated on two-stroke industrial engines, while Daimler worked alongside Nikolaus Otto at the Deutz firm that manufactured his engines.

Water has a higher heat capacity than air, and can thus move more heat, more quickly, away from the engine; however it involves more complicated and technically advanced engineering to get it flowing through the engine and regulated properly. Other than some early prototypes, Mercedes-Benz has stuck with the water cooled model for its production models.

Thermostats

As mentioned above, a way to regulate the temperature both to aid in warm up of the engine and control the combustion temperature was with the introduction of the coolant thermostat. The first thermostats used a sealed capsule of an organic liquid with a boiling point just below the desired opening temperature. These capsules were made in the form of a cylindrical bellows. As the liquid inside the capsule boiled, the bellows expanded, opening a sheet brass plug valve within the thermostat. As these thermostats could fail in service, they were designed for easy replacement during servicing, usually by being mounted under the water outlet fitting at the top of the cylinder block. Conveniently this was also the hottest accessible part of the cooling circuit, giving a fast response when warming up.

Today's thermostats are usually located within a metal or plastic housing where the upper radiator hose connects to the engine. Most of today's thermostats utilize the "reverse poppet" design, which opens against the flow of the coolant. These thermostats have a wax filled copper housing or cup that pushes the thermostat open against spring pressure. The wax thermostatic element was invented in 1935 by Sergius Vernet. As the engine's coolant warms up, the increase in heat causes the wax to melt and expand. The wax pushes against a piston inside

a rubber boot. This forces the piston outward to open the thermostat. Within 3 or 4 degrees F of the thermostat's rated temperature, usually marked on the thermostat, the thermostat begins to unseat so coolant can start to circulate through the engine and radiator. It continues to open until engine cooling requirements are satisfied.

The combustion process in a passenger car engine runs optimally at an operating temperature of approximately 230°F. However, in older engines the engine temperature was kept below this ideal temperature level to prevent component damage from the high pressures needed to maintain this temperature without the coolant boiling away.

This is a typical electronically-controlled thermostat. Note the electrical connector for the heater.

Conventional thermostats start to open at an engine temperature of approximately 110°F. It is fully open about 15-20 degrees above its rated temperature. If the temperature of the circulating coolant begins to drop, the wax element contracts, allowing spring tension to close the thermostat, thus decreasing coolant flow through the radiator and regulating coolant temperature.

Better control

Today's engine thermostats play a greater role in increasing engine combustion efficiency and reducing emissions. Supplementing the mechanical function of the wax element, electrically-assisted thermostats incorporate an electric heater. This heater is controlled by the vehicle's engine control unit (ECU), which receives information on the speed and load conditions of the engine. This data allows for precise control of the engine temperature, increasing combustion efficiency while reducing emissions, particularly during warm-up.

The controlling "map" or data set, stored in the ECU, is calculated by the engineers based on theoretical calculations and real-world measurements. Maintaining the engine at the optimal temperature under all conditions is the goal, and the electrically-assisted thermostat allows for this precise temperature control.

Electrically-assisted thermostats are fairly trouble-free, but external factors such as the use of low-grade coolant and failure to regularly service the cooling system can lead to material failure. Other failures may include mechanical sticking, as with a conventional thermostat, or failure of the heating element. The latter will set a diagnostic trouble code, aiding in the diagnosis of any faults. Generally the workshop manual will give a resistance value that can be checked with an ohmmeter.

Replacement

Having determined a fault in the thermostat, replacement of the electrically-assisted thermostat is no different in terms of nuts and bolts than with a conventional one. Following the proper procedure is a standard guideline for this operation. Of course, paramount is using a genuine Mercedes-Benz part, unarguably the perfect match of fit and performance for the application.

Mentioned in the above paragraphs, these thermostats work in conjunction with a mapping component within the ECU. Aftermarket parts can trip you up and cost you time and expense you'll regret in the long run.

Here is a rundown of the replacement procedure from the workshop manual for a 204 model; other models will be similar.

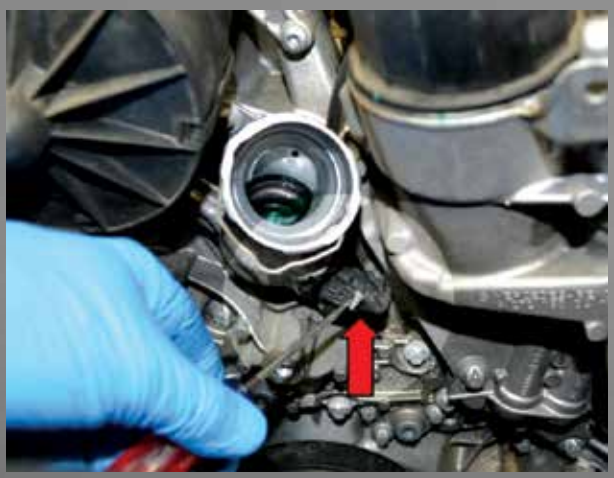
- Drain coolant at radiator.
- Remove left engine intake air duct and front engine cover.
- Remove upper coolant hose from coolant thermostat housing. Note: Be sure to replace the O-ring upon installation.
- Remove the poly-V belt and guide pulley to allow access to the thermostat bolts.
- Release and disconnect the electrical connector on coolant thermostat (see photo).

- Remove 2 bolts and pull coolant thermostat housing with coolant thermostat out of timing case cover.
- As usual, installation is the reverse order. Be sure the gasket surface is clean when installing the new gasket.
- Perform a function test on the coolant thermostat and check the system for leaks.

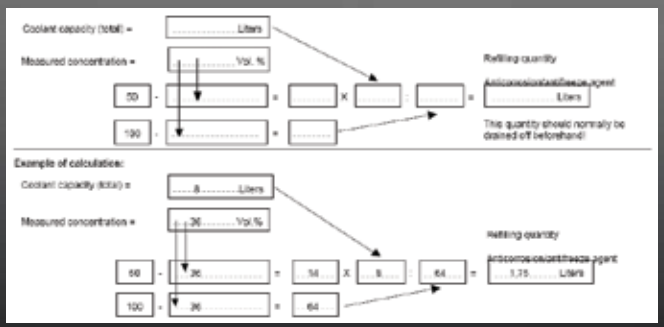
Draining, filling, and flushing

The maintenance interval for changing the antifreeze/coolant will vary depending upon the model year you are working on, but in newer Mercedes-Benz models it is 15 years for the first change, then every 2 years after that. To be sure, consult the maintenance book for the specific vehicle you are working on.

Whenever you are replacing a cooling system component, best practice is to renew the coolant at that time to avoid any contamination. The characteristics of the coolant should be checked at every service and during routine inspections. Mercedes-Benz recommends for passenger vehicles and some commercial applications a mixture of 50% by volume of water and antifreeze/anticorrosion agents, for protection down to temperatures of -37 F.



Releasing the electrical connector on the thermostat housing.



Use this handy chart to calculate how much antifreeze to add to bring the concentration to the recommended level.

Only use coolants that comply with specifications sheets 325.0, 325.2, or 325.3. Premixed coolant meeting specification sheet 326.0 can be used in engines produced up to April 2014. To find a list of approved coolants, visit the MB BeVo web site available from Daimler AG at bevo.mercedes-benz.com/beam.en.html, or search for "MB BeVo" in your favorite internet search engine, or download Daimler's free "Specifications for Operating Fluids" app for iOS and Andriod.

A word about the water (see "Water Watch" *StarTuned*, December 2018): Clean water must always be used, and most drinking water will comply with the given specifications. Water that is too hard (has a high mineral content) is disadvantageous because of the possibility of scale or sludge deposits. Salt content, which is predominately chloride ions, will greatly promote corrosion. If you have no information available on the quality of the water in your tap, play it safe and use distilled or deionized water, or at least commercially-bottled water.

The aforementioned scale and sludge deposits typical when not following the specifications can result in overheating and deterioration of the cooling system. The radiator tubes will form scaly deposits which can block the flow of coolant. No amount of flushing will remove it once it's there, the only remedy being to replace the radiator.

Corrosion of the metal components can wreak havoc as well and lead to serious and expensive repairs. Mercedes-Benz is the only passenger car/SUV manufacturer to build into the cooling system a slow-release protection device that on most late-model vehicles allows for a 15- year, 143,000 or 150,000 mile coolant replacement interval. The protection device - a packet of silica gel in the coolant reservoir - is designed to work with Mercedes-Benz specification coolants, and not others. Note that replacing the coolant reservoir gets you a new protection packet; otherwise, as mentioned previously, after 15 years the interval drops to 2 years.

I know fifteen years/150,000 miles seems like a long time. You might be thinking "That must be one of those new antifreeze products that fits all." Well, despite anything you read about "compatibility," most of those new antifreezes are not approved for use in Mercedes-Benz vehicles, for specific technical reasons. Stick with what's best, or be prepared for the consequences.

If you've been in this business a while, you remember the traditional yellow Mercedes-Benz coolant. That changed to a blue coolant just after the turn of the 21st century, and modern models come with a pink coolant. With this variety of coolant types, Mercedes-Benz cautions the workshops to avoid mixing in coolants of a different specification sheet (color) in volumes greater than needed for topping off, or about 10% maximum. More than that, replace the coolant with all the same product.

Draining and filling is a fairly straight forward process. Here are the steps for the M271, M272, OM642, OM646, and OM651 engines:

- Slowly unscrew cap on coolant expansion reservoir, be careful of residual pressure.
- Remove lower engine compartment panels along with soundproofing.
- Slide drain hose onto drain fitting at radiator and drain coolant into a suitable container.
- Tighten radiator drain plug and detach drain hose from fitting on radiator.
- Remove coolant hose on coolant inlet fitting for coolant pump. This step is to help air enter the system to help drain the crankcase. You may be able to skip this step if having the cap off the expansion tank is enough
- Push drain hose on crankcase drain screw and loosen screw. (Not all engines have this.)
- Detach hose and tighten drain screw.
- Reinstall coolant hose on coolant inlet fitting if removed.
- Fill and bleed system. Use a vacuum bleeder/filler to avoid air entrapment, and speed up the process as well.
- Replace any removed panels.

Mercedes-Benz offers a special tool for vacuum filling under part number W285 589 00 21 00, although there are many similar tools available on the market.

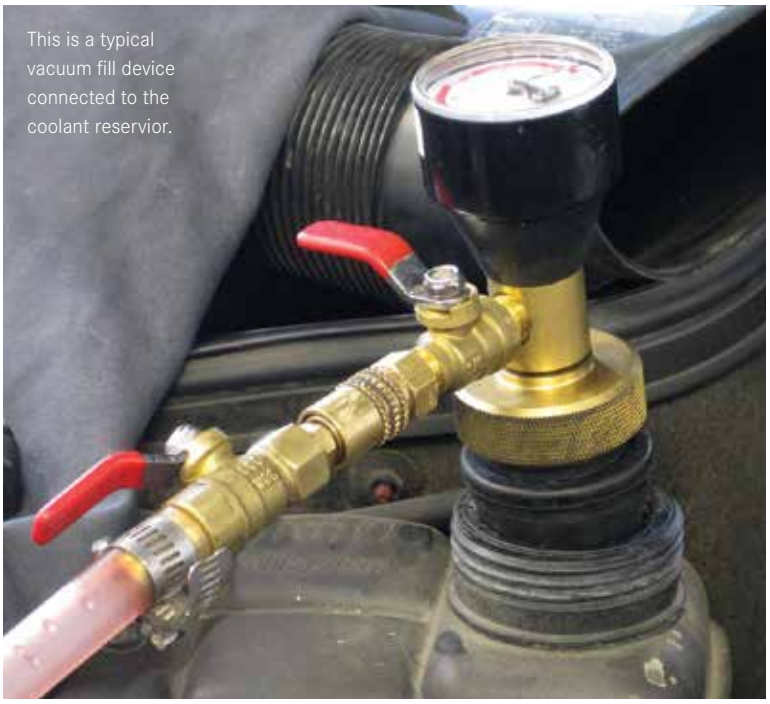
Vacuum Filling and Bleeding

A vacuum filler is highly advantageous when filling a cooling system, as they pull the entire system down to a vacuum, and this vacuum will pull your coolant into the system, quicker than pouring it in and without adding unwanted air. While the system is at vacuum you can check the vacuum gauge to be sure there are no obvious leaks. Many a technician has started to fill a system, having left a hose off or a clamp undone, only to waste expensive coolant onto the ground.

While the corrosion in this water pump housing is just getting started, in a short time it will grow and eventually impede the coolant flow. Genuine Mercedes-Benz antifreeze/anticorrosion protects against this.

One manufacturer claims to be the first and only tester developed specifically to run complete cooling system diagnostics with the engine running and at normal operating temperature and pressure. New patent-pending technology combines testing and monitoring of pressure, vacuum and temperature simultaneously, to provide real-time data far beyond the capabilities of a simple pressure tester. This combination of features ensures the most extensive, accurate cooling system diagnosis possible. The vacuum filling operation is fairly simple, most devices have similar steps:

1. Attach the system valve and adapter to the expansion tank or radiator.
2. Connect a shop air hose to the valve – make sure the valve is in the off position for this step. The valve uses a venturi to get vacuum from compressed air.
3. Insert the suction hose into a premixed coolant container – have plenty of coolant ready to fill the system. The Mercedes-Benz tool has a large reservoir, big enough to accommodate most any cooling system without having to pause while swapping containers.
4. Open the valve and pull a vacuum on the system. Observing the gauge, bring the vacuum down to about 25 inches. Most gages will have a marking to indicate the recommended vacuum level for testing and filling.
5. Allow the system to rest, with the vacuum valve off, for 5 minutes while observing the gauge; this step will tell you if the system is tight. If not, disconnect and recheck your work.



This is a typical vacuum fill device connected to the coolant reservior.

6. After vacuum has held for the proper time, open the valve on the suction hose and pull in the coolant mixture. Filling will stop when the system is full.
7. Now either disconnect and check your system, or continue to use the tool to pressure and temperature test your work.
8. Connect a suitable scan tool after you've filled the system and check for codes and proper temperatures during warmup. You may need to top off the system with a little coolant after your test drive.

Remember that several newer models have more than one cooling system. In addition to the conventional high-temperature cooling system, some models have one or more low-temperature cooling systems, for temperature control in systems not generating the kind of heat emitted by the engine. Vacuum bleeding ensures these systems fill properly, so don't cut corners here.

Flushing Machines

The majority of flushing machines on the market today work under a similar principle, whether it is forward flushing or "back" flushing: a pump pushes the coolant mixture through the system until clean or full. The problem with most of these is they work on a principle of pushing the coolant against the thermostat spring to open it and then through the system. This principle works ok on conventional thermostats but is not practical on the newer electronically-assisted thermostats.

This product is safe to use in Mercedes-Benz cooling systems.

If you find yourself with a system that is contaminated and needs to be thoroughly flushed (as opposed to a drain and fill) then it is best to manually flush the individual components with a garden hose and clean water. You can drain the system in severe cases and add a descaler or flushing compound and then run the engine. To remove scale and sludge, or even engine oil in the case of a failed head gasket, use Mercedes-Benz cooling system cleaner A000 989 10 25 11, which is a citric acid-based product that is safe for all Mercedes-Benz vehicles.

After using the cooling system cleaner, you must completely drain all the cleaner and completely flush the system. Remove the upper and lower hoses from the radiator and run clean water through it, backwards and forwards, until the water runs clear. Do the same with the heater hoses.

The engine block will be more complicated because the thermostat will not allow you to push cool water through it. You will need to remove the thermostat and run clean water through the cylinder head and block until it runs clear.

Afterwards, completely drain the system and fill with the proper mix. A word on the heater core: this is an item that can get plugged due to lack of maintenance or incorrect antifreeze usage. Severe cases will require replacement, but the cooling system cleaner mentioned above, left in the system for a bit longer, and perhaps even repeating the treatment, is what Mercedes-Benz recommends. Flush thoroughly with clean water and hopefully you'll have heater function again.

Proper maintenance, procedures and using the right products are the keys to successful cooling system service.

Mercedes-Benz Mobil 1

Product Name	Part Number	Quantity	Product Description	Recommended Consumer App.
Mercedes-Benz SPEC.				
Mobil 1 Formula M 5W-40	BQ 1 09 0197	Bulk - No Equipment	Fully synthetic formulas designed specifically for gasoline passenger cars	Low SPAsh. Available at most M-B dealers
	BQ 1 09 0195	6/1 Quart Cases		
	BQ 1 09 0196	55 Gallon Drum		
Mercedes-Benz GEO 229.5 5W-40	A000989790211BIFU	Liter	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.5 Specification	Mercedes-Benz Engines that require 229.5 Specification Oil
	A000989790217BIFU	208 Liter		
	A000989790219BIFU	Bulk - No Equipment		
Mercedes-Benz High Performance EO 229.5 0W-40	A000989810211BIBU	Liter 5KG	Fully Synthetic formula specifically designed for Mercedes-Benz AMG engines that require the 229.5 Specification	Mercedes-Benz Engines that require 229.5 Specification Oil
	A000989810217BIBU	208 Liter 15KG		
Mercedes-Benz GEO 229.6 5W-30	A000989820211BJEU	Liter 40KG	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.6 Specification	Mercedes-Benz Engines that require 229.6 Specification Oil
	A000989800217BJEU	208 Liter 20KG		
Mercedes-Benz GEO 229.71 0W-20	A000989830211BNXU	Liter 35KG	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.71 Specification	Mercedes-Benz Engines that require 229.71 Specification Oil
	A000989830217BNXU	208 Liter 15KG		
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 X1 0W-30	BQ 1 09 0184	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 0182	6/1 Quart Cases		
	BQ 1 09 0183	55 Gallon Drum		
Mercedes-Benz GEO 229.52 5W30	A000989800219BMEU	Bulk - No Equipment	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.51 and 229.52 Specification requirements	Mercedes-Benz Engines that require 229.51 Specification Oil
	A000989800211BMEU	Liter 170KG		
	A000989800217BMEU	208 Liter 50KG		
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 0194	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 most MB 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		

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 App.
Mercedes-Benz SPEC.				
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
	BQ 1 09 0022	6/1 Quart Cases		
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		
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
Mobil Delvac 1300 Super 15W-40	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		
	BQ 1 09 0179	6/1 Quart Cases		
Mobil Delvac 1300 Super 10W-30	BQ 1 09 0086	Bulk - No Equipment		
Mobil Delvac 1 5W-40	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 80W-90	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		

Pre- and Post-Repair Scanning
for Restoration to Pre-accident Condition

Use pre- and post-repair scanning to learn which Advanced Driver Assist Systems (ADAS) are on the vehicle, what fault codes have been stored, and how to avoid a few diagnostic rabbit holes.

Networked

In today's cars, everything is connected. Chassis control systems, including vehicle stability control, traction control, and anti-lock braking are networked together to improve safety. What began years ago as separate driver convenience features, such as electronic power steering and cruise control systems, are now combined with chassis control and sophisticated wiring technology to enable advanced driver assistance systems. Known as ADAS, these systems can adjust acceleration, steering, braking, and other functions independently if the driver is not responding to road conditions and outside threats in a timely fashion. Even power seats and windows, adjustable pedals, and power door locks automatically change to positions that improve the safety of vehicle occupants if a potential collision is nearing.

These are just a few of the many systems that are networked together to give the best fuel economy, emissions control, road handling and performance, and safety.

Act, observe, adjust

ADAS relies on a combination of state-of-the-art technologies, sensors to monitor what that hardware is doing, and software that allows computers to adjust the performance of a system or component, in real time, to enhance driver and occupant comfort and safety.

Collision connection

Many chassis control systems rely on inputs from sensors that are located near the vehicle perimeter, where they have a high vulnerability to collision impact damage. Wheel speed, yaw rate, ride height, and vehicle speed sensors all provide data to anti-lock braking, active suspension, stability control, traction control, and other road handling and driving performance systems. Damage to these sensors, their mounting hardware, wiring, and connectors may or may not be readily visible, but often sets fault codes. A pre-scan contributes to a more complete repair.

Thanks to controller area network (CAN) technology, a single sensor can share its data output with multiple vehicle systems almost simultaneously. Similarly, that data can be transmitted to multiple devices over a single wire (in reality, two wires twisted together, called a "twisted pair"). CAN technology and twisted pair wiring together make up the CAN bus network. The CAN bus allows digital signals to be shared quickly with every computer connected to the network.

Consequently, a failing sensor or defective wiring can affect several vehicle systems. If your collision damage assessment catches only one of the affected systems, you may replace a component that is a symptom, not the cause of the problem.

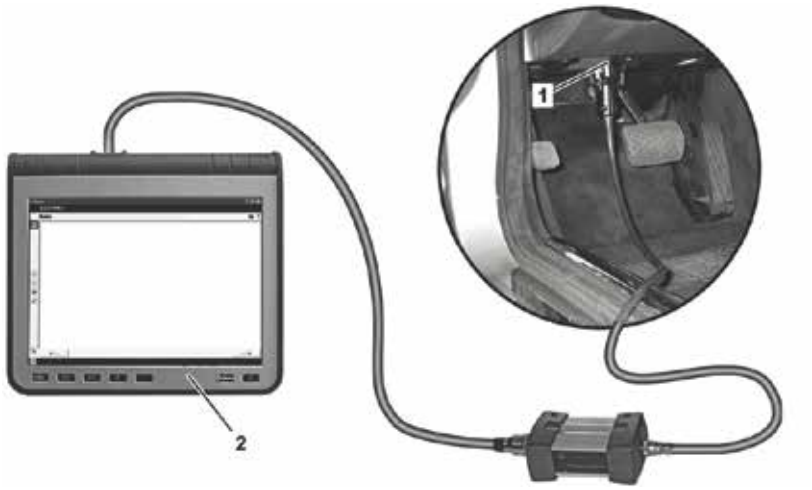
A diagnostic advantage

The CAN bus gives you a diagnostic advantage, if you pre-scan for fault codes before planning your repair. In addition to making it possible to use fewer wires to send sensor data and actuation commands to various vehicle devices, CAN bus wiring enables diagnostic communication.

For example, in addition to turning on the high beams upon driver request, the relevant control computer measures current flowing to headlamps on both sides. If one lamp is weak or burned out, the controller sees lower current and sends a problem identifier code via the CAN bus to all computers in the system. Each computer checks whether or not the identifier code applies to the system or components it controls. If it does not, the computer ignores the identifier message. If the message code does apply to a device that the computer controls, it stores a trouble code that can be retrieved from memory by a scan tool, and may also turn on a warning light in the dash. If multiple systems are affected, CAN bus diagnostics sends problem identifier messages that result in fault codes being set for any devices for which Mercedes-Benz engineers set up protocols for real-time monitoring.

A pre-scan collects and presents fault codes that highlight any systems in which problems exist and are monitored. This gives you a greater likelihood of identifying the cause and reducing the possibility of a comeback.

Of course, a factory scan tool covers far more fault codes than even a high-level aftermarket scanner. Many codes related to ADAS components are OEM-specific and can only be interpreted by a STAR DIAGNOSIS or other Mercedes-Benz diagnostic service tool.

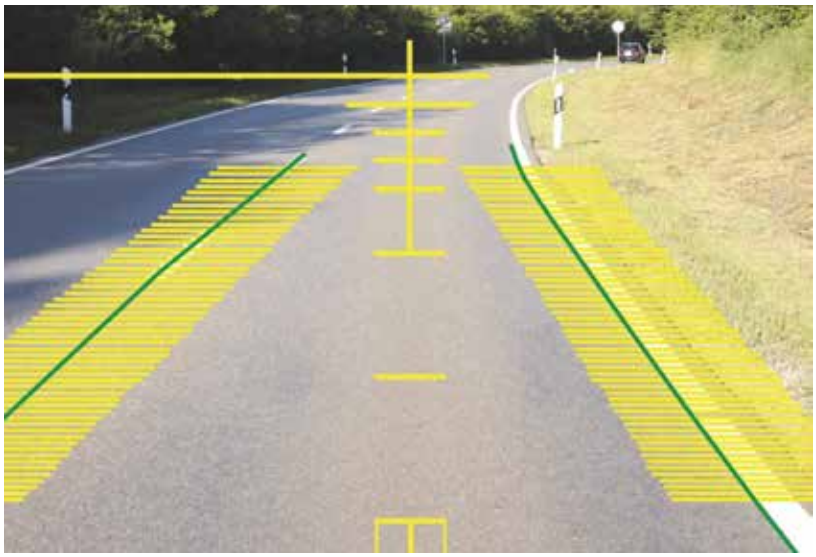


The Mercedes-Benz STAR DIAGNOSIS system allows you to readout factory fault codes that aftermarket scan tools may not be able to access.

A factory scanner also includes build data that an aftermarket tool does not. Build data helps focus your diagnostic efforts by telling you which ADAS technologies are on the Mercedes-Benz model in your bay.

Example: Lane Keeping Assist

Mercedes-Benz Lane Keeping Assist (LKA) systems use real-time video images of where the vehicle is relative to lane markings in the road. When the Active LKA camera sees the vehicle traveling over the lane markings in the road, and warnings being ignored by the driver, the control module sends an actuation signal to another system to nudge the vehicle back on track.



The Mercedes-Benz Lane Keeping Assist (LKA) system uses real-time video images of lane markings to calculate the relative position of the vehicle in the road. The green line in the center of the yellow overlay on each side indicates the borders that the LKA prevents the vehicle from crossing.

Depending on how the model is equipped, the ADAS system may take over the anti-lock brakes (ABS) or electronic power steering system. The ADAS controller instructs the PCM to either command light pressure to the ABS on one side to pull the vehicle back across the line, or take control through the electronic power steering to turn the vehicle back to where it should be headed.

If the LKA camera has been affected by a collision, including damage to wiring, connectors, mounting brackets, or to the camera itself, the damaged part(s) must be repaired or replaced. Cameras that have been replaced or disconnected from power for any reason must be calibrated to ensure that they point in the correct direction. Calibration and re-initialization verifies that the control module can communicate with the camera, and knows its orientation.

Incorrect vehicle ride height, poor alignment, and other chassis control issues affect the accuracy of what the camera sees, and therefore the effectiveness of corrective measures commanded by the PCM. Whether the LKA system takes control through the electronic power steering or the ABS, any collision damage to those parts must also be repaired before full functionality is available.

You'll find some of these potential problems in a visual assessment of damage. A pre-repair scan for fault codes helps catch issues that may be less obvious to the naked eye. If the vehicle is drivable, a test drive can help determine the level of functionality of many ADAS systems.

The multifunction camera used by the LKA system is mounted at the top center of the windshield on many Mercedes-Benz vehicles. If the front windshield is removed and replaced, the camera must be calibrated after installation. Calibration ensures that the camera position is properly accounted for so the system knows exactly where the lens is pointed relative to the vehicle.

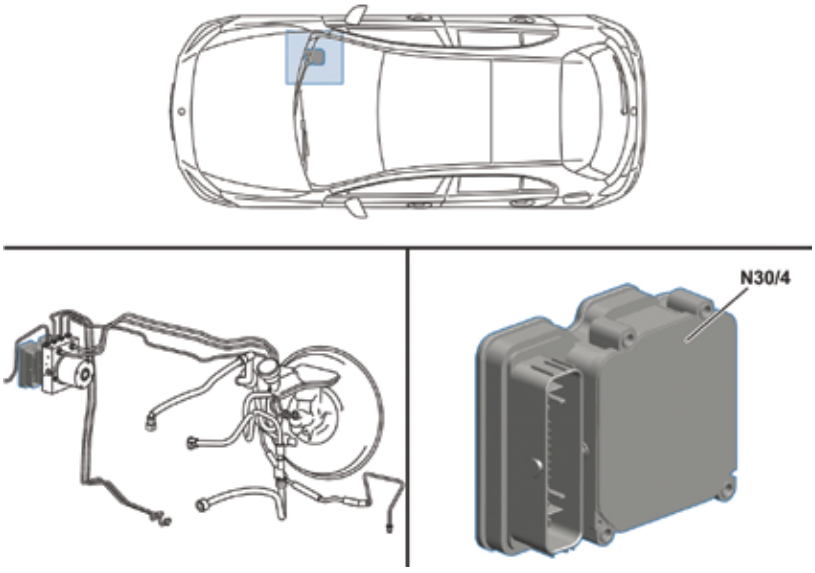
Example: Electronic stability program

The powertrain control unit (PCU) sends commands to the electronic stability program (ESP), electronic brake force distribution (EBD), anti-lock braking (ABS), traction control, brake assist system (BAS), pre-charge brake, and many other systems, depending on the as-built features on the Mercedes-Benz model you are repairing. To do this, the PCU depends on inputs from the electronic stability program. The ESP control unit processes data from rpm sensors on all four axles, the brake vacuum sensor, stop lamp switch, accelerator pedal sensor, and other input sources.

The ESP control unit then transmits actuation signals as needed to the drivetrain control unit, supplemental restraint system (SRS) control unit, brake pedal signal, left and right electric parking brake actuator motors, and the electrical ignition lock control unit. If the PCU sees an out-of-parameter signal from any of the input sensors, or a component not responding within specification to one of the actuation commands, it stores a fault code for the affected sensor, component, or system.

Example: Adaptive damping system

Leaks or obstructions in air tubing, loose or failing height sensors, and damaged air springs are just a few examples of collision damage to air suspension components. But you must also consider the possibility of electrical problems in the control circuit, the compressor or vent solenoids, air spring solenoids, or the compressor relay.



The ESP control unit (shown here on the 2018 and newer A-Class) processes inputs from rpm sensors at each axle, the accelerator pedal sensor, brake vacuum sensor, stop lamp switch, and other sources. It outputs commands to the drivetrain control unit, supplemental restraint system (SRS) control unit, brake pedal signal, and other devices. CAN bus technology networks all components to enable sensors to monitor hardware function, software to compare performance against specifications, and control modules to issue commands to actuate components or store fault codes as needed. This high-level of network connectivity generates a wealth of data. Pre-repair scanning mines this data to help focus diagnostic troubleshooting.

The good news is that some Mercedes-Benz air suspension systems feature self-diagnostic capabilities. A pre-repair scan for fault codes helps narrow the diagnostic path so you don't start replacing air suspension sensors or solenoids prematurely.

Changes to ride height affects caster readings. Out-of-specification caster readings lead to electronic stability control and steering problems. Checking ride height and air suspension dynamics is a good pre-alignment strategy.

Example: Bumper repair

The Parktronic system (PTS) is an ultrasonic measuring technology that detects distance to an obstacle. The PTS assists drivers in parking and backing up at low speed.

Parktronic sensors emit sonic signals that are reflected by nearby obstacles. The PTS monitors the amount of time it takes the reflected signal to return to the sensor and converts that number into a distance calculation.

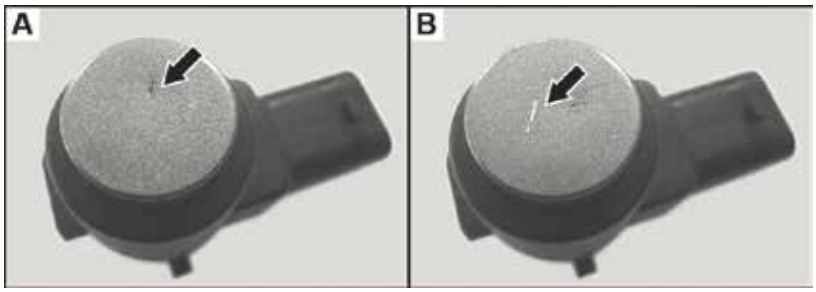
The control module combines the distance calculation with data from wheel speed and steering angle sensors and presents visual and audio alerts to the driver as he or she moves near an obstacle. PTS fault codes may point to problems in receiving signals from these other sensors, damage to wiring, or related network issues instead of a failing Parktronic sensor.

PTS sensors are mounted in front and rear bumper covers on many Mercedes-Benz models. If a sensor is soiled while driving through snow and ice, chipped by flying road debris, or impacted by collision it can suffer reduced functionality.

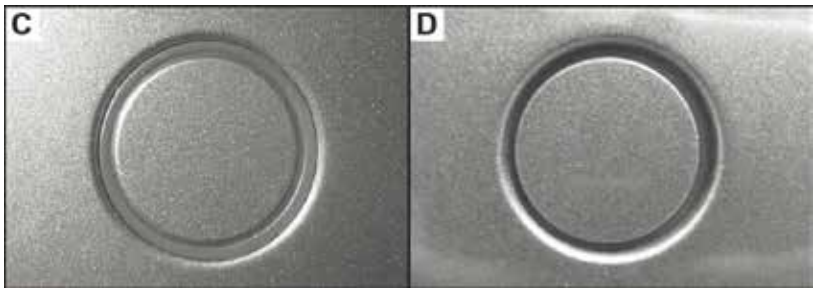
Fault codes, if set, tell you which Parktronic sensor to investigate further. For example, the fault code B1246 indicates that the Parktronic connector #A42b1 (left outer sensor, front bumper) has a problem. You must do further diagnostic testing to determine whether the cause is a loose or corroded connector, damaged wire, or failing sensor.

In some instances the system may not set a fault code. If the PTS does not store a fault code, careful pre-repair visual inspection of the wiring harness and sensor can identify

Damage to the adaptive damping system (shown here from the Mercedes-Benz GLA) affects electronic stability control and steering. Pre-scanning narrows the diagnostic path, and post-repair scans help catch additional work, such as steering angle sensor calibration that you must do before delivering the vehicle to the customer.



Minor stone chip damage (images “A” and “B”) can reduce Parktronic sensor effectiveness.



The decoupling ring that positions the Parktronic sensor looks like image “C” when correctly placed. The Parktronic sensor in image “D” is not centered.

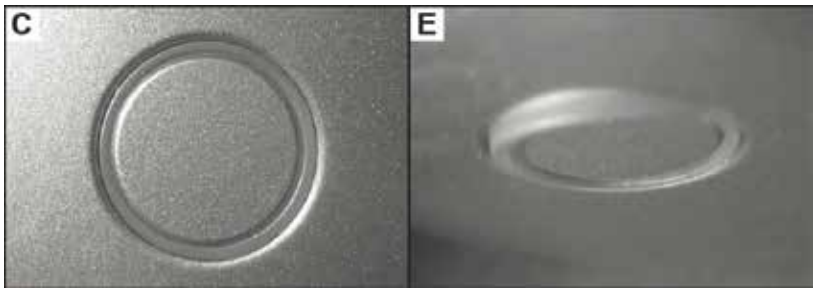


Image “D” shows a Parktronic sensor that is improperly mounted resulting in an offset position that will skew the sensor’s coverage area and reduce the accuracy of the vehicle’s projected position.

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You've chosen your career as an ISP (Independent Service Provider) because you enjoy maintaining, diagnosing, and repairing motor vehicles. One of the most challenging pieces of your business is parts procurement.

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A PartsPro dealer has the tools in place to better meet the needs of their esteemed wholesale customers.

For a dealership to achieve PartsPro Certification, parts department personnel must first undergo intensive "customer-centric" training which teaches personnel how to better help YOU.

There's far more to PartsPro than just customer-service training. The dealership must make specific commitments to provide "Best in Class" service in areas such as logistics, which includes ISP-focused parts availability, regular delivery service, outside sales people to provide you personalized service, as well as a dedicated phone line and "will call" pick up area.

Then there's technical help

On occasion we all need a helping hand. Your PartsPro dealer is there to assist. Whether it means providing diagnostic assistance, information on supplies or special tools, or anything else you may need, your PartsPro dealer is there to assist you in repairing your customers' Mercedes-Benz vehicles and getting them back on the road as fast as possible.

Only those dealerships that meet the stringent certification requirements earn the right to display the "PartsPro" logo. Additionally, they receive ongoing consultation and training to ensure that they are consistently providing the very best support to you, the ISP customer.

We hope you are already receiving industry leading service from your Mercedes-Benz dealer; however, once your dealer is PartsPro Certified, we believe you'll be thrilled with the new "Best in Class" parts-procurement experience!

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damage. Even nicks and scrapes that appear minor can harm Parktronic sensor performance. Use close visual inspection to confirm correct position and angle of each sensor during replacement installation.

Because the PTS uses acoustic technology instead of a camera, painting the sensor surface may be allowed, depending on the vehicle model. Use of filler material over or near the sensors is not permitted. If your pre-scan indicates the presence of Parktronic sensors, check the repair instructions to confirm whether you can paint over them and if so, the coating type and maximum thickness allowed.

LED and other advanced technologies allow this 2019 Mercedes-Benz AMG E-53 to increase brightness from individual subsections of the front headlamps to provide precise directional targeting of the road ahead. The dynamic lamp can simultaneously cast shorter and longer lengths of light from the same headlamp, so the driver can see what is immediately ahead without blinding oncoming traffic up to a half of a mile away. It can throw part of the light straight ahead and another portion in the direction the vehicle is turning, to illuminate the inside of the curve.

Example: Headlamp variations

Don't limit your repair planning to just scanning for fault codes. By looking up build data and searching through the Mercedes-Benz Workshop Information System (WIS) you can identify what ADAS technologies are on the vehicle. You can develop a list of what sensitive components may be located in collision-affected areas.

The identification codes used to catalog various advanced Mercedes-Benz headlamp technologies illustrate the benefit of checking build data. In addition to Static LED headlamps (all models with code 631), selected models have Dynamic headlamp systems (code 641), and Bi-xenon headlamps with integrated curve illumination (codes 615 and 616) as standard or optional equipment. Intelligent Light System (code 621) and Adaptive Highbeam Assist (code 608) are additional variations in headlamp control available on selected Mercedes-Benz models.

Dynamic lamps can also automatically adjust the amount of light based on vehicle speed. In stop-and-go traffic, the headlamps are activated at lower switch-on points to ensure that the cornering lights turn on early enough to cover the shorter turning radius of urban driving.

Dynamic lighting control uses inputs from wheel speed and steering angle sensors, as well as the turn signal function.

Fault code guidance

When pre-repair scan results do show trouble codes, do not automatically assume that an ADAS or other sensor is failing. A trouble code merely indicates that a reading from that sensor does not match the signal output specification expected by the controller. A code that says a signal is too low or high for a given circuit could mean that a sensor if faulty, but it could also be a short to power or ground due to impact damage or wear somewhere in that circuit's wiring.

Physical damage to linkages, cables and hoses throw readings off even though the sensor itself may not be failing. For example, a fault code that reports a ride height sensor signal is a lower or higher value than expected may be the result of a broken mounting bracket.

Connected

Include pre- and post-repair scanning in every collision job. Connect to the information that helps you make complete repairs and return the vehicles you work on to like-new condition.

Service Bulletins

"Ordering a programmed DAS4 key when no keys are present."

In this SI, the "Fallback process" is explained. Vehicles equipped with the DAS4 security system can have a key programmed directly at a dealer, assuming the dealer has the proper authorizations and training. Before a key can be programmed, it must be 'announced' to the online DAS4 security server in Europe, and for this the ignition must be able to be switched on. If all keys are lost, then the Fallback Process must be used to 'announce' the vehicle. This process involves the dealer completing a form and sending it to Daimler for processing. Once Daimler responds, the key can immediately be ordered from the central programming warehouse.

New on STAR TekInfo.

- As of July 2019, the WebETM wiring diagrams for Model 167 (GLE, GLS), along with the STAR Finder images, have been posted to STAR TekInfo.
- Most Model Year 2020 Maintenance Sheets are now posted.
- The Model Year 2020 Model reference Chart is now posted.

"Wind Noises from Exterior Mirrors" Affected: Model 166.0/166.8, From VIN A098xxx to A175xxx.

In the case of wind noises from the outside door mirror frame, fold in the mirror and check for any plastic flashing on the plastic frame of the mirror. If found, trim with a sharp knife. The outside mirror does not need to be replaced. The use of putty or sealing compound to prevent mirror noises is not allowed, although temporary use for diagnosis is permitted.

"Air Conditioning has insufficient cooling output" Affected: All 205, 212 and 222 Hybrid Models.

In cases where the A/C has insufficient output, there is low or no refrigerant in the system, but a leak test cannot identify any leaks, check the refrigerant circuit shutoff valve at the High Voltage battery for a hairline crack at the intake connection, resulting in refrigerant loss. If the leak is traced to this component, replace the HV Battery Refrigerant Shutoff Valve using the repair set as follows: Model 212 (Gen 1): A789 830 00 00. Model 212 (Gen 2): A789 830 02 00. Models 222/205 (Gen 2): A789 830 01 00. Verify these numbers in the parts catalog prior to ordering.

M256 with DTC P031501 "Sensor rotor adaptation not performed". Affected: All models with M256.

In cases where the DTC P031501 appears, which may show as Current after a component replacement or repair, first perform the teach-in procedure with XENTRY Diagnostics. The adaptation values will show "Completed successfully" and the DTC will show as stored, however the DTC may return as Current after the next key cycle. If this occurs after following the XENTRY Teach-in procedure, perform the following activation procedure to clear the DTC: Warm the engine to at least 50 C, set the Driving Mode to Individual and select Manual Gear shifting. Accelerate in gear 3 or higher to 2500 RPM. The minimum speed is 20 km/h, but higher gears and speeds are recommended for best success. Once you reach 2500 RPM, release the throttle completely without braking and coast down until the transmission shifts (minimum speed). Verify that the adaptation was successful; clear the DTC with the ignition on, then cycle the key with an engine start.

M264: Filling engine with oil. Affects: All models with M264.

If filling engine oil with an oil fill gun, be certain that the gun nozzle is inserted straight in to the oil filler opening. If the nozzle is rested on the oil filler neck at an angle, it is possible to fill the crankcase ventilation system with oil. This can result in additional customer complaints and/or engine damage. The crankcase ventilation system tube runs straight off the back of the oil filler neck, take care to avoid pumping oil into this tube.

"Water leak from tailgate seal". Affected: All 166 and 292 models.

Be advised that the tailgate rubber sear installed in production, intended to keep water from leaking past the tailgate door, cannot be re-used due to its construction and the factory installation method. If the tailgate seal is removed, even partially, it must be replaced. The spare parts seal has a different design, allowing it to be installed in a workshop. To replace the seal, all body sealant must be removed from the body flange.

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