

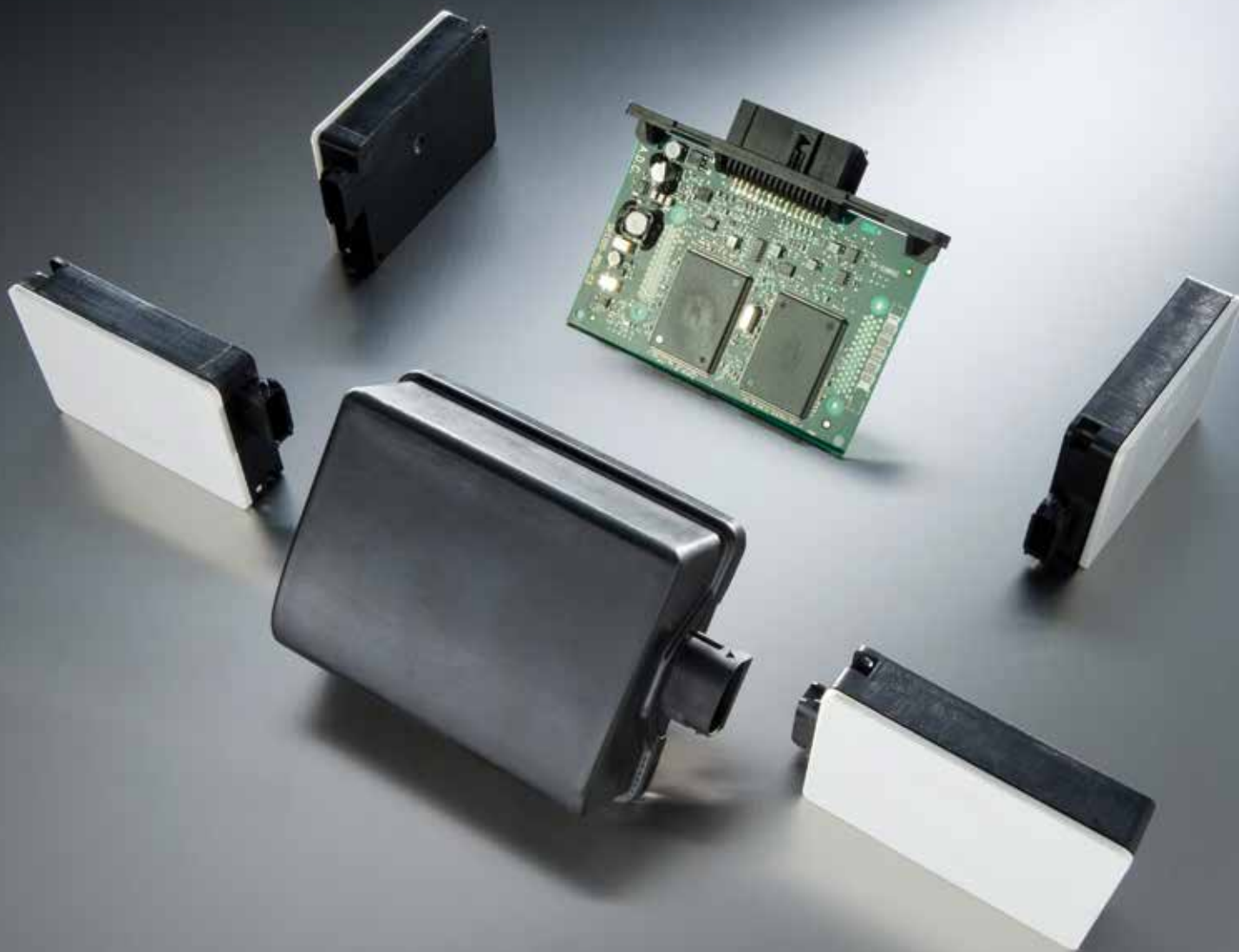
STARTUNED®

Information for the Independent Mercedes-Benz Service Professional

December 2017

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INSIDE:

COOLING FAN CIRCUITS

CONTROL UNIT PROGRAMMING NOW!

HARNESS REPAIRS 2017

RECALIBRATION OF DRIVER-ASSIST TECHNOLOGIES

Mercedes-Benz



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STARTUNED®

December 2017

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

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

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

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

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

Send your suggestions, questions or comments to us at:

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Mercedes-Benz

The best or nothing.



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Cooling Fan Circuits

Does the fan come on at odd times, maybe not at all, or runs continuously? Here's an overview of the functionality of engine cooling fans and their circuitry.



Engine cooling fans have been in operation on most production cars for well over a century. Circulation of water or coolant through a heat exchanger (radiator) has been the traditional method of keeping waste heat from destroying the engine. When the vehicle is at cruising speed, there is enough air flow through the fins of the radiator to facilitate the proper exchange of



The electronically-controlled fan clutch went a long way in increasing efficiency and keeping the fan from spinning when it's not needed.

Opposite page: Here's an older design of a dual electric fan system on a 140 model.

heat. When the vehicle is idling or moving slowly through traffic, however, there's a crucial need to move additional air through the cooling fins. Hence the introduction of the cooling fan.

Early models simply had a fan with two or more blades attached to a drive pulley, often on the water pump shaft. As vehicle design became more concerned with maximizing power and efficiency, engineers saw this as an area of wasted energy. The first attempts at mitigating this waste was the introduction of the fan clutch, a thermostatic engine cooling fan that can freewheel at low temperatures when cooling is not needed, allowing the engine to warm up faster, and relieving unnecessary load on the engine. As temperatures increase, the clutch engages so that the fan is driven by engine power and moves air to cool the engine. Most fan clutches are viscous or fluid couplings, coupled with a bi-metallic sensor system similar to that in a thermostat. These are still in use today.

Some attempts to further enhance the efficiency of the fan included electronic controls, which regulate the level of engagement depending on any number of inputs. Common controlling factors might include engine oil temperature, transmission oil temperature, coolant temperature, A/C system pressures, and ambient air temperature.

As automobiles added air conditioning and other accessories the need for more efficient engine cooling became evident. Enter the electric cooling fan.

Early electric cooling fans

The addition of air conditioning was probably the most influential factor in the need to engineer a better method of moving air through the radiator. The addition of the condenser restricted the air flow somewhat in addition to heating the flow. These took the form of one or more fans mounted in front of the radiator and condenser that "push" more air through the two units.

The earliest designs had fairly simple circuitry controlling the fans. Engine cooling fans are big consumers of electricity, so there's always been a need for some special considerations in circuit design. How much current do they draw? There are a lot of factors that determine this, and the amount of amperage the motor requires is only one of them. Amperage and airflow are related, but you must also consider the pitch of the fan blades, the diameter of the fan, the shape of the fan shroud, and also what it is that you are trying to move the air through. For example, is the fan trying to move air through an oil cooler that is only $\frac{3}{4}$ -inch thick, or is it trying to pull the air through a five-core radiator that has an air conditioning condenser and charge-air-cooler stacked in front of



it? All manufacturers rate their fans by cubic feet per minute (CFM) of airflow at zero inches static pressure. This is the amount of air the fan moves without anything in front of it. A typical two-core radiator will create about 0.5 inches of static pressure in front of the fan. The factors that determine the CFM rating of a fan are the motor itself, the fan speed (rpm), fan-blade design pitch, number of blades, diameter, area and design of the fan shroud it is built into, and static pressure.

Amperage

Amperage normally measures how much load an electrical device draws when in operation. Automotive fans are rated at 13.5 volts, and the rating is after the motor is at operating rpm. The initial startup of the fan will have an amperage spike of up to 60%, which lasts only a millisecond.

Compare the factors that shape the CFM rating of a fan to these items that affect the amperage draw of an electric fan motor: efficiency of the motor, weight of the fan blades, resistance of the electrical components, mechanical resistance of fan rotation (bearings and bearing tolerances), and the amount of airflow (CFM) through the fan. That said, in typical automotive installations you will see anywhere from 15-amp to up 60-amp draws in fan motors. You'll need a heavy gauge wire to drive the fan, and to switch it on you have to have a relay in the circuit unless you want to put in a switch the size of the one in your living room wall that controls the lights.

From this simple circuitry, we have evolved into more and more complex fan controls. In the 140 model and similar systems, the auxiliary

fans are switched on with infinite speed adjustment depending on the refrigerant pressure and or/ coolant temperature. The pushbutton control module receives coolant temperature data from the A\C coolant temperature sensor and the refrigerant pressure from the refrigerant pressure sensor. This input information is transferred to the auxiliary fan control module by the pushbutton control module. The auxiliary fan control module processes this information and compares it with stored values. The resulting request is then transferred to the auxiliary fan.

Newer systems

With the introduction of the W211 and similar models, a more complex system was designed, which requires more detailed diagnostic procedures as well as a strong understanding of system operation. Any attempt to provide the details of all the cooling fan circuits found in Mercedes-Benz automobiles would require volumes of writing. For the sake of brevity, we will describe some of the basic systems you'll find on most of the vehicles you service. It is most important to note that in attempting to solve any cooling fan faults, you should have access to the factory workshop manual wiring diagram (think StarTekInfo and WIS). Trying to solve any faults without a thorough knowledge of how the system was designed to operate will be futile at best.

Here are some details of the individual components involved:

- Refrigerant pressure sensor – the pressure

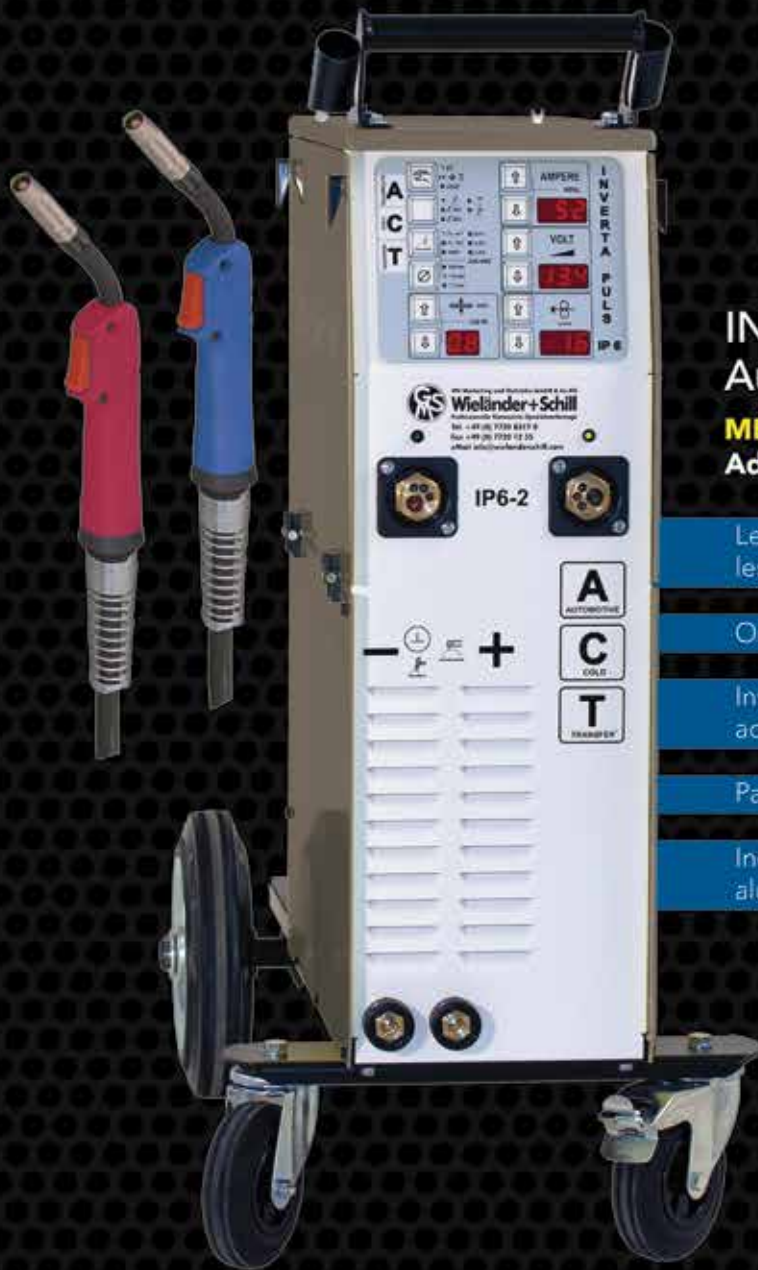
measured by the refrigerant pressure sensor is compared with a value stored in the pushbutton control module. When the following values are present the fan is adjusted infinitely:

- Refrigerant pressure > 16 bar = fan low speed
- Refrigerant pressure > 20 bar = fan maximum speed
- Pushbutton control module – controls the AIR (fan) control module with a minimum of 3mA and a maximum of 10mA. The fan control module compares these with stored values and switches on the auxiliary fan under the following conditions:
 - Outdoor temperature > 5 C
 - Refrigerant pressure ≥ 13 bar
 - Coolant temperature ≥ 103 C

With complaints of a cooling fan that runs continuously, the workflow would be something like this:



The refrigerant pressure sensor is usually located between the compressor and the condenser.



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Be sure to check for corrosion on connectors.

1. Check all fuses. Inspect connections on the Engine Coolant Temperature (ECT) sensor and the A/C pressure sensor on the receiver-dryer. Pay particular attention to corrosion on the connectors as extra resistance can cause faults
2. Connect a Mercedes-Benz fully-functional and compatible scan tool to retrieve/record/clear DTCs in the Engine Control Module (ECM), Signal/Activation Module (SAM), Automatic Air Conditioning (AAC), and Instrument Cluster Module (ICM).
3. Attempt to access the activations menu in the scan tool under the PCM. Use the scan tool to activate and control the engine cooling fan. If the fan is not controlled, check voltage signals at the Fan Control Module (FCM) (N76) located under the left front headlight behind the bumper. Check your workshop manual for locations on other models.
4. Use a Digital Multimeter (DMM) for voltage testing at the connector on N76. Pin 3 Red/Black (RD/BK) should be battery voltage (B+) at all times. Pin 6 Black/Red (BK/RD) should be B+ with the key in the "On" position (#2). Pin 2 Brown (BN) should be constant ground. Pin

5 Yellow/Blue (YE/BL) should be the control signal from the PCM. Depending on the control signal from the PCM, the voltage will vary between 2V (low speed) and 11V (high speed). If voltage is high (above 10V all the time), open the connector to eliminate the possibility of feedback voltage from the N76 module and recheck command voltage on pin 5.

5. Check the version-coding of the Electronic Ignition Switch control module (EIS), the left front Signal Activation Module (SAM), the PCM, and the Climate Control Pushbutton Control Unit. Newer versions are introduced from time to time and may be necessary for completing the repair process.

Some cooling fan complaints may not be caused by a faulty part at all, but have been remedied by a software update as in the case of models with ME97 or ME97 AMG control units. It is very important to check TSBs for any updates. For example:

- 2237 Coolant temperature sensor 1 has a malfunction. The fault can occur at high-temperature differentials (outside temperature/coolant temperature), as may occur after driving out of an air-conditioned garage into high ambient temperatures.
- Cause: High temperature differences can lead to this DTC being set in the ME control unit. This DTC is set due to the programmed temperature limit data in the ME9.7 engine control unit.
- Remedy: If a customer complaint exists, please reflash the ME control unit. Vehicles from MY2012 should be flashed

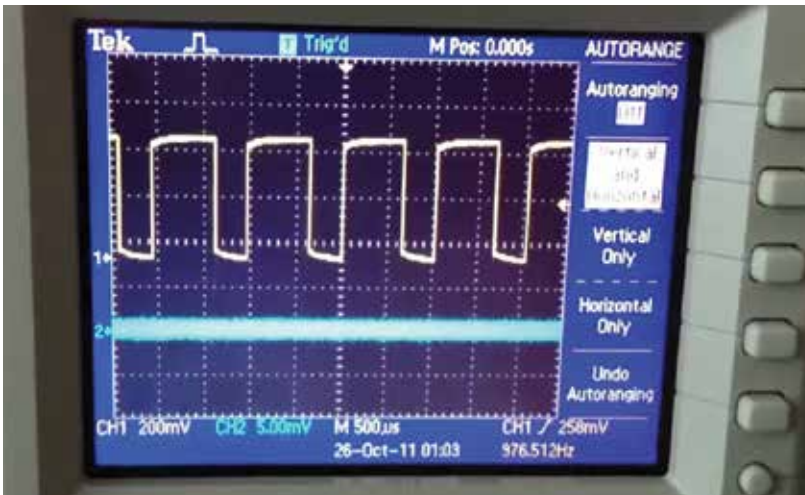


A typical later-model cooling fan and integrated suction fan control module.

using add-on 4067 (XENTRY release 09/2014). Vehicles up to MY2012 should be flashed using 09/2014 XENTRY release (no add-on necessary).

Here is another possible scenario:

- Complaint: Radiator fan starts up without obvious cause although the ignition has been off for longer than 30 minutes. Radiator fan changes to limp-home mode (100% output) while driving, with display message (cooling system) in instrument cluster. Battery discharged.
- Cause: The electric radiator fan may start up by itself with ignition "Off" due to moisture ingress.
- In "Behavior of no-load current" menu, read out the five stored data records. If at least one of the data records contains a no-load current entry of >10A, and if the kilometer reading stated there agrees with the actual kilometer reading at which the vehicle battery was discharged, the radiator fan may have been the cause of the fault.



Here's a typical pattern for a known-good pulse-width-modulated signal.

It is important to note at this juncture that you may have received the following complaint:

- Complaint: Electric radiator fan runs, stays on for too long after ignition is switched off.
- Cause: A delayed fan switch-off after ignition is turned off is dependent on many factors.
 1. Engine coolant and transmission oil temperature.
 2. A/C demand and pressure in A/C system.
 3. In vehicles with a diesel particulate filter, after an aborted regeneration of the DPF, even if the engine is not yet at operating temperature.

During run-on, the fan runs at two speeds – up to a maximum of 50% of the fan speed, the radiator fan may run on for up to six minutes. If another fan is starting up and circuit 15 is switched on, the radiator fan may intentionally be in limp-home mode. If the coolant temperature signal is absent, the engine control unit actuates the radiator fan at maximum speed. If a PWM signal line is defective, the radiator fan likewise switches to limp-home mode.

- Remedy: The radiator fan run-on is intentional. Do not replace any components. This is a normal programming design and you will need to be able to educate the customer to that effect.

If the radiator fan is in limp-home mode due to defective actuation lines or pins in the connectors, a fault code is logged in the control unit (codes vary according to model series). In these cases, the wiring harness must be repaired.

In 164 models and later, the ME-SFI or CDI control units (depending on which engine configuration you're working on) indirectly actuate the fan through the engine or A/C electric suction fan control unit. The fan specified speed is transmitted by the ME control unit to the engine and/or A/C electric suction fan control unit by means of a pulse-width-modulated signal. The on/off ratio is 10 to 90%, which translates to the following:

- 10% electric suction fan OFF
- 20% electric suction fan ON, minimum speed
- 90% electric suction fan ON, maximum speed

The status of the air conditioning or automatic air conditioning is transmitted from the instrument cluster via the CAN to the ME. The fan specified speed is dependent on this status. The engine and A/C electric suction fan with integrated control (M4/7) is located behind the radiator on most models, but consult your workshop manual.

The fan (fans) are powered by the red-fused (in this case 100A) wire, which is hot at all times, and also a pink wire, which is fused and energized when engine circuit relay 87 is on (ignition on). Ground on the suction fan control unit is a brown wire and typically secured at the right front wheel well. Be sure to do a voltage drop test on this for possible faults when diagnosing fan complaints. The final wire is the control wire from the engine control unit to the suction fan control unit, which sets the fan speed. This is the pulse-width-modulated signal we spoke of earlier. This line is best tested by using a lab scope.

Knowing the system you are working on will be your best asset in diagnosing cooling fan and cooling fan circuit problems for your customers. Consult the workshop manual and wiring diagrams available through StarTekInfo.com or other sources. A thorough inspection of the mechanical components of the system should be part of your diagnostic workflow. What is the condition of the fan itself – are the fan blades okay? Check for cracks and other signs of fatigue and stress. Look at the fan shroud, and check for obstructions, dirt, etc. Lastly, be sure to inspect all of the related harnesses and connectors for signs of damage from chafing, oil or water intrusion, and rodent damage. |

Control Unit Programming Now!

Reflashing, recalibrating, and marrying are now essentials of the auto service business. You need XENTRY!



Xentry Diagnosis Machine.

Cars are getting more complex every year, and as a technology leader, Mercedes-Benz's vehicles are no exception. Time was, you could bolt in a new control unit and it worked. These days, that's only half the job: Initialization, adaptation and updates are needed for almost every control unit there is.

First, the bad news: If you don't have a XENTRY Diagnostics machine, you're mostly out of luck. Although there are aftermarket products that can absolutely communicate with some of the control units (particularly those related to emissions), the real problem is getting the software for the control unit, and for that you need access to Daimler's update servers in Europe.

Then, the good news: Mercedes-Benz USA has offered the XENTRY Diagnostics machine for years now to anyone who wanted one, and it includes access to those update servers. Because the market for these machines is relatively small – we speculate that there are under 2,500 in the United States – the cost of the machine itself (a ruggedized touchscreen tablet) added to the costs to develop and maintain the software (cars as old as the 1990s are still supported) make the system seem expensive.

We say seem, because when you add up all the benefits, it turns out that even a small shop can make a good profit by buying one. Included with

access to the update servers and the diagnosis machine itself (plus its accessories), you get three years of semi-monthly diagnosis software updates and fairly complete access to StarTekInfo, worth a bit over \$9,000. But we're not here today to sell you on the virtues of boatloads of genuine Mercedes-Benz information systems, we're just trying to explain that, without all that, your role as a complete automotive repair shop will quickly shift to a role of a mechanical parts installer, which unfortunately will not be enough to make your customers happy with you.

Think of it this way: In the 1960s, a carburetor adjustment could be done with some skill, but really needed little equipment aside from a flat-blade screwdriver. Fast-forward 20 years, and how many 1980s models used carburetors? Well, we're almost 40 years past the 1980s: How long do you really think you can continue as you are? We're reminded of the famous line from the movie *Father of the Bride*, where Frank (Martin Short) tells Steve Martin in the title role, "Welcome to the '90s Mr. Banks."

Okay, on to the actual purpose of this article, reflashing, recalibrating, and marrying. We'll start with some definitions.

Reflashing is when we update the software in a control unit, whether the unit is new or has been in service for years. Daimler AG, the manufacturer of Mercedes-Benz

vehicles, may periodically release new operating software for control units, available only through an online data connection. These updates are intended to tweak or improve performance, address a market concern, correct unintended operation, and so on. In many cases, unless there is a customer complaint, the software that's already in the control unit is just fine and doesn't need to be re-flashed. But a brand new control unit might not have software installed, or an older control unit might have a problem that's been solved that the customer has complained about, or should be installed even if the customer has not yet noticed the problem, and for these the software needs to be updated.

Recalibrating is when a system simply needs to be reset and adjusted for optimal performance. This might be needed if there is a customer complaint, or, again, when a part is being replaced. A mechanical analogy is wheel alignment: Sometimes you need to realign the vehicle, for instance if tire wear patterns indicate a need, and if you replace a key component like a tie rod or control arm.

Marrying is when we link the component to the specific vehicle into which it is installed. We've had to do this for keys and engine control units since the development of the immobilizer and Drive Authorization Systems, but in 2018 we continue to see more and more



systems that need to be married into the vehicle. In general, once married, there is no divorce: The control unit cannot be used in a different vehicle without problems.

There is also a fourth type of update (aside from XENTRY Diagnostics updates) we should consider, at least briefly: **Firmware** updates. Software refers to purely electronic data storage, while firmware means there is a hardware component involved. The typical example is a COMAND system, which uses a special workshop-only optical disk to update its operating software. This doesn't mean a map data update for the navigation system, but the actual COMAND operating system itself. While you don't need XENTRY Diagnostics for these kinds of updates, you do need the special workshop disk. Note that these disks are included with a XENTRY subscription and they come out every two months or so.

Lastly, don't confuse any of this with the need for system Configuration. In these cases, we are only adjusting parameters within the control unit's software to make sure it operates as it is supposed to in the vehicle it is installed in. A perfect example is a front power seat control unit: The exact same part is used for both the driver side and passenger side seat, so someone has to tell it which side it is installed on. If you don't, it will not work correctly. You'll need XENTRY for configuration, but unlike marrying if you later install the part into a different car you can change the configuration as needed.

Let's start with the easy one: reflashing to solve a problem. Your customer says that something isn't working quite right, and you've found an LI Document on StarTekInfo that explains that the solution is to install new software. Here, we go into the control module's Adaptations tab in XENTRY Diagnostics and select "Control Unit Programming." The software leads you through the process.

A few comments on that process, so you not only know what to expect, but don't accidentally "brick" the control unit (this refers to the effect of a faulty programming process: The control unit becomes as useful as a brick). The first point is that you really, really need to guarantee a good electrical power supply during the process. Not just a battery charger, but a good battery maintainer capable of several tens of amps, without the possibility of over-voltage. The next is to pay attention – really read and pay attention – to all the warnings and conditions that the software displays. So many times we've seen experienced technicians

just click past the conditions and warnings page only to learn the hard way that they should've paid heed.

Once you start the process, you see a conditions page as we just mentioned – it might be spread over two pages. First, you have to log on to the update server using your assigned user ID and password. A page that is essentially asking "are you sure?" appears, and if you click "Continue," the programming starts. The programming process can take several seconds to several minutes, depending on exactly which control unit you are programming. You'll get a confirmation of success, or in rare cases, an error screen, with information on what you should do about it.

The process of programming a new control unit goes mostly the same, but you first pull all the programming from the original control unit if possible. This preserves any configuration settings and speeds up the process considerably. In this case, the menu selection is Initial



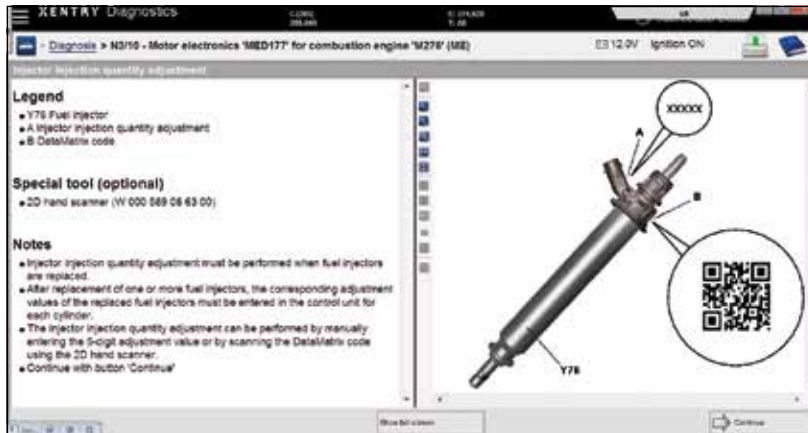
Initialization, adaptation and firmware updates are needed for almost every control unit in a modern Mercedes-Benz vehicle.

Startup, and you usually have two choices: Transfer settings from the old control unit, or manually enter the settings. The latter is used when the old control unit is completely dead or cannot establish communications.

If you do go with the automatic transfer of settings, remember that you can't shut down or otherwise interrupt the diagnosis session once you have pulled the data from the old control unit, since if you do that information gets lost. If this does happen, just install the old unit, start

from the beginning again, and learn the lesson.

Marrying control units is only needed in certain systems. In every case, when you get to the Adaptations tab in XENTRY Diagnostics for that control unit, you will see a menu entry for the process. If you start with the procedure listed first, and work your way down the list, you will always perform all the processes needed by that control unit. The designers of XENTRY, logical as they tend to be, did this exactly because these



Programming isn't just limited to software updates: Modern fuel injectors need to be married to the engine control unit in order to work right. For this you need the special 2D code scanner as well as XENTRY.



STAR TekInfo remains as your best resource for the best possible repair and troubleshooting information available. Virtually anything you could ever need to do to a Mercedes-Benz is explained here...except software updates. For that, you'll need XENTRY.

Wholesale Website www.mbwholesaleparts.com

The wholesale website was designed as the ultimate information resource for ISPs and Collision Shops who are in the business of servicing and repairing Mercedes-Benz vehicles. The website features detailed information and links to parts knowledge, parts ordering and technical support for Genuine Mercedes-Benz Parts and Accessories. It also features a separate PartsPro section with the ability to look up a PartsPro dealer.

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processes might be new to someone, and so they wanted to make it as easy as possible to do everything correctly, and in the correct order, every time.

The caveat for marriage – in control units as well as in life – is to be sure you’re okay with the situation becoming permanent. Before marriage, you can verify that the new control unit really does fix the problem, but in general only for a limited number of times. If you find the problem isn’t fixed, you can remove the control unit before making it permanent, which usually means you are able to install it in a different car. But once you’ve confirmed the marriage, the control unit is permanently and irrevocably tied to that specific VIN, and cannot be unmarried for use in a different car.

It always amazes us to see used control units that require marriage up for sale on those online market websites. A used engine control unit, just like a used key, is only worth the scrap value of its materials. It is not possible to erase its programming and use it in your car. That being said, some online companies claim they can reset the programming.

Recalibrating control units or sensors is a different kind of process – two processes, actually. One is simply version-coding the control unit so it knows what kind of car it is in. The other is actually recalibrating a system or sensor so it can operate properly. Mercedes-Benz has a list of various control units and their recalibration needs, which we’ve reproduced here. We have been cautioned that it is a moving target, and so the table might be incomplete, particularly for very new and very old models, but by and large it is a good

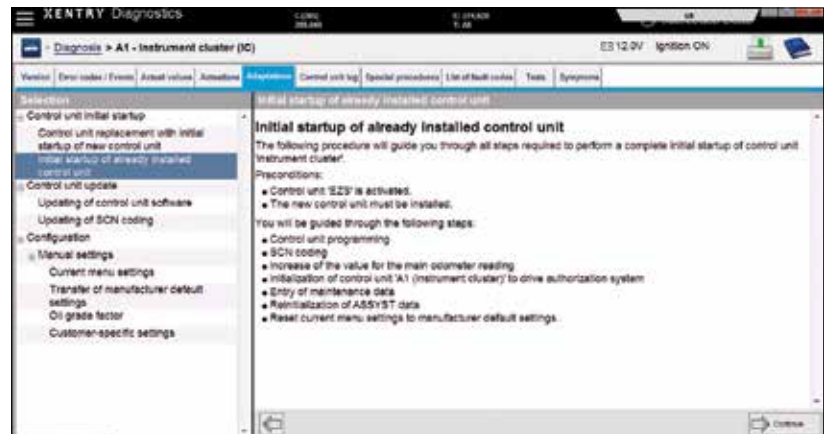
quick reference to see if you need to do something to finalize the repair. Just because there are no MILs lit doesn’t mean every system is happy.

For version-coding, you go in with XENTRY and just follow the menu to set all the settings. Most of the answers are straightforward, such as if the car has automatic transmission or is left-hand drive. In some cases you may need to refer to the data card to see if the car has a particular option code or not.

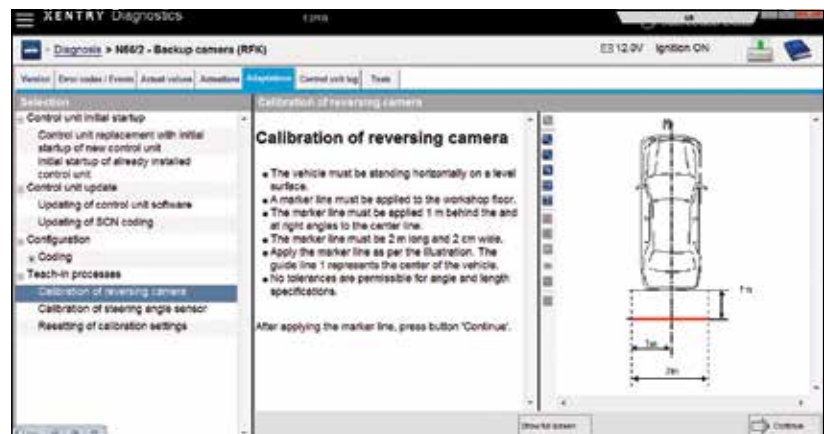
In some cases, particularly the emissions-relevant systems, you

use a Software Calibration Number, or SCN. These SCNs are built to prevent tampering with the settings. For these, you once again have to log on to the servers, which transfer the data behind the scenes. Many systems can have their software updated but if they don’t have a valid SCN, it won’t work. Transferring the SCN from the old control unit to a brand new one saves time by (usually) eliminating the need to log on to the update server.

The Calibration procedures for the many systems and sensors



The initial startup instruction screen for an Instrument Cluster. After fulfilling the preconditions, the system guides you through the seven steps required to correctly install this new cluster in the car. The programming and SCN coding requires an online connection to the Daimler servers. Note the other programming possibilities at the left: Besides initial startup, there’s a software update, SCN coding, and manual configuration.



Not all calibrations need special equipment. Here we see the XENTRY instructions for reversing camera calibration: A line of tape carefully placed behind the rear bumper.



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vary wildly. Some may only require that the technician perform some simple actions – the calibration of AIRMATIC has you press buttons on a XENTRY screen until the indicator for each wheel strut turns green – or may have you use a special tool such as a camera calibration target.

Almost all cameras need a calibration target, the exceptions being some of the older rear-view cameras. The surround-view (360-degree) cameras, the mono and stereo multi-function cameras, and newer rear-view cameras in systems that display guidance lines all need target-based calibration. In each case, the XENTRY system guides you through the process, giving you the part number of the target, where it is to be positioned, and what to do with the XENTRY system to set the calibration. Failing to perform the calibration means the system will either not work at all, or will work improperly. We can't stress this enough: Be sure to calibrate when needed, for your customer's safety and your own liability.

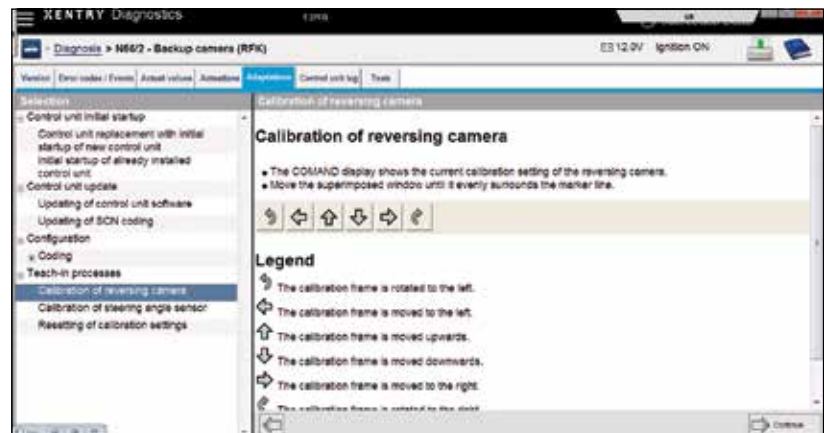
Most of these targets are relatively inexpensive, but even \$100 is a lot if you only use it once a year. Because we buy a lot of parts from our local dealer – not to mention we're all old friends – we have a good relationship with them, and can borrow or rent almost any tool they have. And be aware that Mercedes-Benz requires dealers to have all these calibration tools as a condition of being a dealer.

Just a note for our collision industry friends: This all applies to you, too. If you've replaced the windshield, or removed the radar sensor by the radiator, the system needs to be recalibrated. As we mentioned

before, just because there are no warning lights doesn't mean everything is fine.

We hope this short article was helpful. As the technology in Mercedes-Benz cars advances, so will the demands upon the workshop. Dealers know this and invest tens of thousands each year in new tools and equipment. Soon to be gone are the days when you, as an independent Mercedes-Benz workshop, could get away with not having an OEM diagnostic unit, or skating by with a Chinese knock-off unit of perhaps questionable legality.

More recently, reputable automotive supplier companies have been offering diagnosis tools that claim to do everything the OEM tool does. We're not saying they don't live up to their promises, but we will say that you get what you pay for. If you're considering one of these units, find out what the software updates cost, and if you get access to those critically-important control unit update servers and StarTekinfo. Once you add up all the extra hidden costs, you might find that MBUSA is actually offering a pretty sweet deal. In any case, "times they are a changing," so don't get left in the dust. |



The second step of reversing camera calibration: Use the screen buttons to adjust the image on the COMAND display until it looks right. Not difficult, but impossible without XENTRY.



To calibrate a Night View Assist camera, which uses infrared light to display an image on the instrument cluster display, you need both a headlight aimer and the special calibration target. The XENTRY software walks you through every step of the procedure.

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Your Workshop Resource to Get the Job Done.

- WIS-net (Workshop Information System)
- Wiring Diagrams
- Technical Bulletins
- Mercedes-Benz Special Tools
- Maintenance Sheets
- XENTRY Diagnostics System
- Mercedes-Benz Workshop Equipment

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Harness Repairs 2017

Often, repairing a wiring harness makes more sense than replacing the whole thing. Mercedes-Benz makes it easy to do a high-quality, long-lasting job.



Our customers deserve only the very best, and when we give it to them, they come back for more. As with people, when cars age they come down with maladies rarely seen in youth. Nothing follows this analogy more than wiring harnesses. Replacing a harness due to damage, however, can be awfully expensive, and customers tend to get upset when faced with a large bill. Mercedes-Benz fully understands this, as proven by their extensive efforts to make wiring harness repairs both technically easy and a true value for the customer. In this article we will explore the many facets of wiring harness repairs.

Let's start with the "Why." With just a little thought, you can probably come up with a dozen reasons why a repair might be better than a replacement – reduced costs for the customer, much faster repair times, and savings of all that effort to remove and reinstall a harness that is 99% perfect – but the real question is, "Why should I use Mercedes-Benz's methods and materials to repair a wiring harness?" After all, those tools and connectors are not inexpensive.

The reason goes back to the opening sentence: Our customers deserve only the very best, and when we give it to them, they come back for more. Is there really anyone who thinks twisting two wires together and taping over the "repair" is okay? We certainly hope not. Proper repairs really are not at all difficult, and they work and last at least as well as the original, if not better.

We're going to go through many of the considerations and methods here, but there is simply no way we can cover every detail in a magazine article. Instead, simply read the applicable documents in the Mercedes-Benz Workshop Information System (WIS). There are several hundred(!) of them, covering virtually every possible eventuality.

Shalt and Shalt Not

Most wires found in a vehicle can be repaired. According to WIS document AH00.19-P-1000-08A, we are able to repair normal copper wires smaller than 6 mm², so long as there are not more than 10 wires in a branch being repaired. Certain repairs require

the use of a repair harness, a short (and inexpensive) harness made for specific circumstances, such as airbag/SRS squib connector, the Pyrofuse connector, LED ambient lighting, and contacts on those very tiny 0.13mm² wires.

We are also able to replace plastic connector housings, and individual electrical pins (technically, a male contact is a pin and a female contact is a socket, but here we will call them all "contacts" for simplicity). There is even a special kit for repairing the so-called "flat wire" used in some door panels and headliner assemblies.

The list of prohibited items is a bit longer, but they make a lot of sense. To start with, you should never try to repair any high-voltage cables (such as in electric or hybrid models, 120V AC auxiliary power sockets, or the Magic Sky Roof system, for example). Of course, shielded coaxial cables (often used for antenna and engine sensor signals), D2B/MOST fiber optic cables, aluminum wiring, and high-speed video data lines are generally impossible to repair properly in the workshop. Also include the complete connectors for critical safety systems, such as the airbag and ESP control units, because even a tiny error here can have serious consequences.

The bottom line is, if you're not sure, check in WIS. If you're still uneasy about the repair, defer to the absolute security of a complete

Damage assessment	AH00.19-P-1000-05A
General repair methods for wiring harness	AR00.19-P-0100A
Repair wiring harness as per specified repair method	AR00.19-P-0001A
Replacement part solutions and what can/cannot be repaired	AH00.19-P-1000-08A
Approved repair methods	AH00.19-P-1000-04A
Remove contacts from connectors and plugs	AR00.19-P-0120A
Female and male contacts, overview of Family types	GF00.19-P-7000A

WIS has several hundred documents related to wiring harness repairs. These are the main docs, each leading to the details for each situation and contact family type.



harness repair. As with any repair, the person performing it and his or her employer are generally responsible for any mishaps caused by an improper procedure or part.

Damage Assessment

We start by assessing the damage, a process detailed in WIS document AH00.19-P-1000-05A. Can we be sure of what caused the damage, and prevent a recurrence? No sense in repairing it only to have to fail again. Are we sure we know the full extent of damage? Overheated wires can cause damage hidden in a wire bundle, and far from the most obvious damage. Is the damage repairable? We know that not everything can be safely repaired. Once we know about the damage, we need to pick a repair option, and see which parts are available to support the repair

Wire Repairs

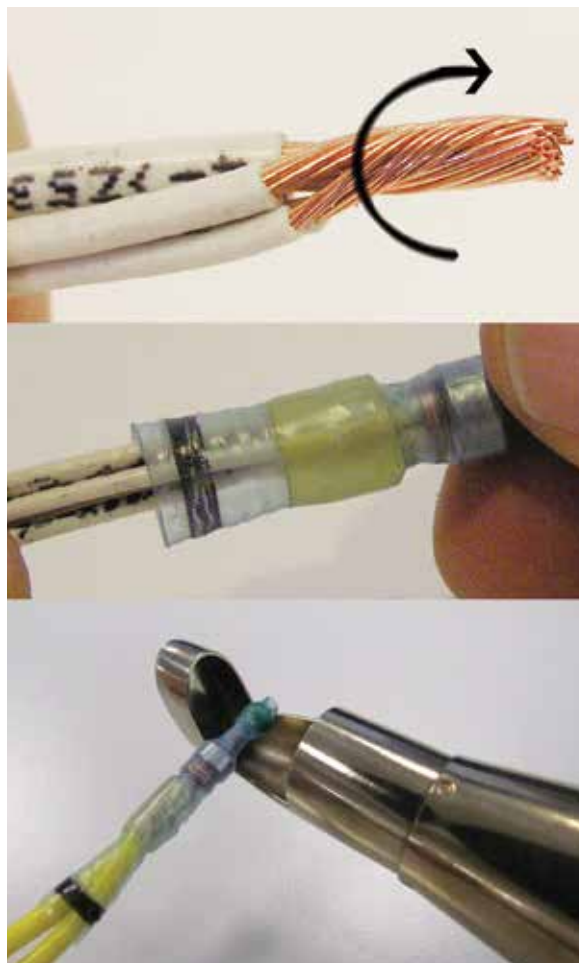
There are three basic kinds of repair: Repairing a wire, an electrical contact, or a connector housing. Let's first discuss wire repairs.

When one or more wires are skinned, cut, melted, or otherwise damaged, we can repair it. If only the outer tubing is damaged, we can cover the area with PVC electrical tape. If the insulation of a wire is damaged, and we have enough slack, we simply

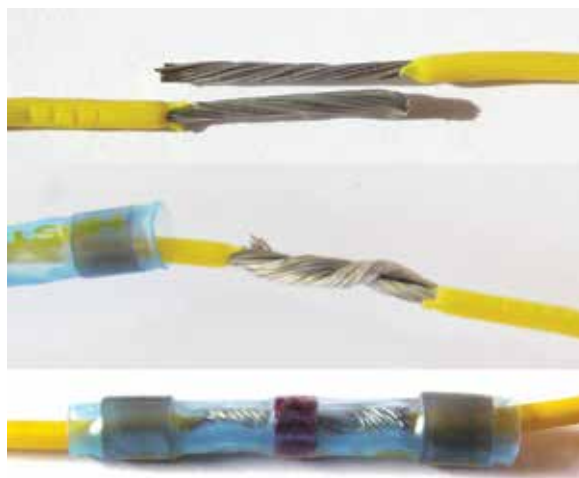
cut the wires to a clean edge, strip the insulation, and reconnect them using a properly-sized Raychem connector. If we don't have enough slack, then a piece of repair wire (of the same cross-section!) can be used. We do have to be careful to not have too many Raychem splices right next to each other, since they do take up some space and can interfere in some cases.

Raychem connectors come in two flavors (Axial and Radial), and in several sizes. The Axial style is often called a butt splice, because the ends of the wires are butted against each other. Axial repairs take up only a small additional space, but can only be used when joining two wire ends together. The Radial style looks something like an electrician's wire nut, and can be used to connect two or more wires together. These are also used to reconnect a Z-splice in a harness if you had to cut it apart for troubleshooting.

Both types of approved Raychem connectors contain solder and soldering flux for a permanent and low-resistance connection, along with a sealant to make the repair waterproof. Thus, these methods can be used outside the passenger compartment where weather might be a factor.



Installing a Radial Raychem connector, which is somewhat like an electrician's wire nut: Strip and twist the wires, twist on the right size connector, and heat it with an air gun equipped with a concentrator shield.



For a Raychem Axial connector, which is only good for two wires, just strip, twist, and heat the connector using the same hot air gun as with a Radial connector. The little solder ring in the middle melts for a permanent connection and the hot-melt sealant keeps it waterproof. The covering shrinks with heat for a tight fit.

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To use a Raychem connector, first pick the correct size based on the wires being connected: The total of all wire cross-sections for the Radial, or the wire size for the Axial type. Strip the wires 15 mm, being careful not to nick the copper strands. Twist the wire ends together (install the axial connector onto one wire first), then position the Raychem. Heat the Raychem with a heat-controlled hot air gun equipped with a concentrator shield, starting at the solder ring. Heat until the solder ring melts (it'll be obvious) and then slide towards the ends until the sealant is melted and the heat-shrink is fully shrunk. Don't try to use a lighter or other flame, you'll just burn the Raychem no matter how careful you think you can be. Wrap some cloth tape around the repair to finalize it.

Mercedes-Benz also approves the use of Rapid Connection Technology (RCT) for two to ten wires in the size range of 0.35 mm² to 0.75 mm². These cannot be used outside the passenger compartment or trunk, because they are not waterproof, nor can they be used for CAN Bus or safety-relevant wiring. To use these, pick the right size connector (2, 4, 6 or 10 wires), cut the wire ends square and even (don't strip them), lay them carefully into the connector and squeeze the connector shut and latched with a pair of pliers. Cover it with some felt tape to prevent rattling.

Rapid Connectors:

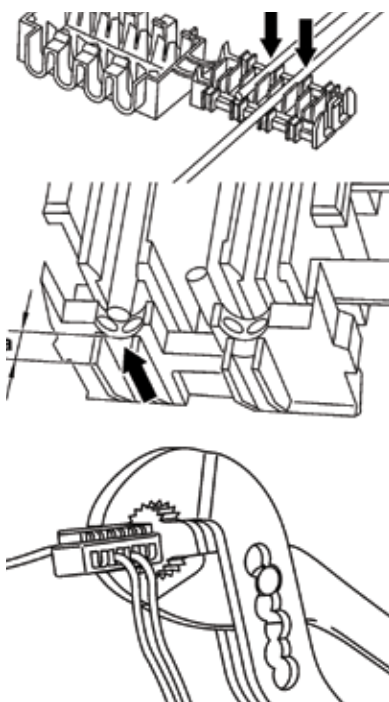
Contacts	Part No
2	A002 546 74 40
4	A003 546 51 40
6	A003 546 52 40
10	A003 546 20 40

Contact Repairs

If an electrical contact is damaged, the first step is to positively identify

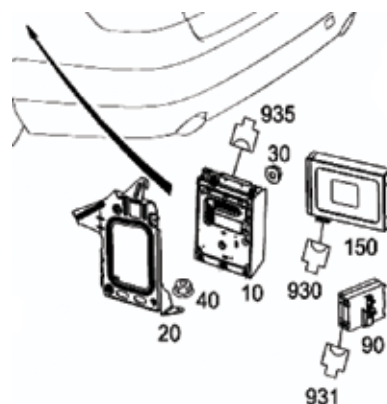
Conductor Wire OD (max)	Insulation OD (max)	Splice No.	Photo
0.5 mm	1.90 mm	A002 546 13 41	
0.8 mm	2.80 mm	A002 546 14 41	
1.3 mm	4.57 mm	A002 546 15 41	
2.0 mm	7.11 mm	A002 546 16 41	

Raychem Axial connectors, as with Radial connectors, come in different sizes. The EPC can help pick out the right size for the wires you're connecting.



Rapid Connectors can be used where moisture isn't a concern. Just lay the wires into the connector (top), with any wire ends about 2 mm (a) from the edge (arrow, center) and close it securely with pliers.

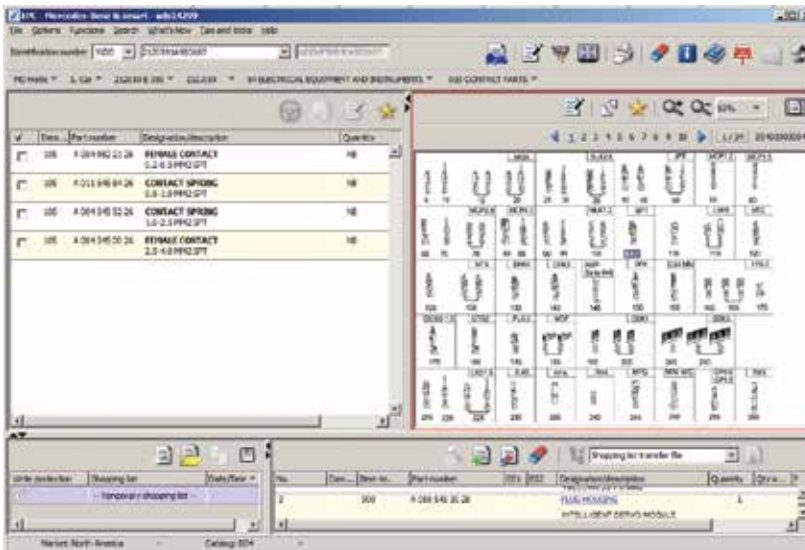
the contact type: Is it a JPT, SPT, MQS, SLK 2.8, MCP 2.8, MLK1.2 or...? Mercedes-Benz uses several dozen different types of contacts, and a correct identification is absolutely crucial to a correct repair. To identify a contact, find



The symbol (such as 935) near the control unit is for the electrical connectors. The description tells us the component designation, connector family and number of pins in the connector body.

the connector in the wiring diagram and make a note of the component designation, such as X138/1 or A80, as well as the number and cross-section of wires.

Next, find the connector in the Electronic Parts Catalog (EPC). Use the search feature (F11) to find the connector or control unit, or navigate to the system or harness images until you find it. The description of the connector in the EPC includes the size (such as 10-pin) and contact family (such as MQS). Note that some connector



The EPC shows the part numbers for the contact in Group 54, subgroup 019. Here we see four SPT contacts, each for a different range of wire cross-section.



A few of the unpinning tools. The handle is universal; the tools themselves fit into the handle. Look closely and you can see that the 220 589 01 99 62 tool is for unpinning the SLK 2.8 family of connectors. Individually, the tools are relatively inexpensive. We have some of the common ones here in the shop, the rest we can borrow from our dealer.

housings have a part number on them, see if you can find that number in the EPC: This works most of the time, but not always.

Once the contact family is identified, go to group 54, subgroup 019 in the EPC to find the part number you will need. Be sure to consider each of these factors: The contact family, the sex of the contact (male or female, pin or socket), the cross-

section of the wire, and whether the connector uses a seal or not (connectors outside the passenger compartment and trunk generally use seals). Note that some contacts are only supplied as “pig-tails,” which are pre-crimped connectors on a piece of wire. These are installed using Raychem connectors. In the end, if you can’t figure out the right contact, your dealer should be able to help. Whenever we place an order for a contact, we buy a few extras just in case.

With the correct part on the way, the second step is to un-pin (remove from the connector body) the existing contact. Unless you want to buy more parts, it is very important that you use the correct unpinning

tool. We’ll talk more about tools later, but just be aware that there is a tool for every connector, and the individual tools are not terribly expensive. We have the MQS and JPT tool in our shop, and we can borrow any of the others from our local dealer when the need arises.

If the contact is on a pigtail, we prepare the ends for the Raychem repair. In the case where the individual metal contact is supplied, we need to have and use the correct crimping set. Again, we’ll discuss tools in a moment, but for now just understand that there is a set of crimping pliers that can accept several different crimping die sets. There is a die set for each contact family, and it is really important that you use the right one.

Some connectors are either ring terminals (often used for grounds), or the old-style 2.5 mm or 4 mm round soldered contacts. Both are the only kind of contacts that need to be soldered. In fact, soldering other contact families (which some may consider instead of using the correct crimp set) is a bad idea because the solder wicks up into the stranded wire and makes it brittle...and brittle wires break when subjected to vibration.

But back to crimping: These tools are relatively expensive, but again, we borrow the correct one from the dealer when we need it. We don’t repair harnesses every day. Using the crimper makes it almost trivial to produce a perfect crimp. Did you know that a properly-crimped contact is superior to a soldered connection? In any case, the crimp die set has a slot to position the contact perfectly, you insert the pre-stripped wire into

the contact and squeeze the handles. A ratchet ensures the correct pressure is applied every time, and out pops a perfect connection. We sadly can't demonstrate the right procedure here, so instead we recommend that you practice it four or five times to get the hang of it before doing it for real. It's not difficult, but a little practice goes a long way. Your local dealer has technicians who have been trained on this, so maybe they can coach you.

To complete the repair, just slide the new contact into place and give it a gentle tug to make sure it is locked in. If you are repairing more than one contact in a connector, we very strongly recommend tackling them one at a time, to be very sure that the wires cannot be installed into the wrong slot. It should be obvious that mixing up the wires is very, very bad.

Connector Body Replacement

The last kind of repair is replacing a plastic connector housing. Some connectors (generally the larger ones) shouldn't be replaced because of the danger of mixing up contact locations, but if you're only replacing the outside part (think of the latching cam on an ME-SFI control unit connector) then you're okay.

The big danger in this kind of repair is mixing up the contacts, so we recommend unpinning one at a time, inserting it into the new housing before starting the next one. Of course, use the correct unpinning tool. Give each wire a gentle tug to verify that it is locked in place.

Most connector housings have a part number on them, and these can be ordered under that number. If the



The Mercedes-Benz crimping tool (bottom) with the crimping die set for the JPT/MCP family of contacts installed. You can also see the automatic stripping tool, a bag of electrical contacts, and some repair wire.

part number isn't available, look up the correct number in the EPC: Sometimes the number on the housing is for just a part of the housing, or is a production number. Almost every connector housing is available as a spare part.

Tools

Mercedes-Benz sells a wiring harness repair kit, and most of the tools are available individually. The Basic Kit (W000 589 13 99 00) comes with a case and several of the basic tools. You will also need the Supplementary Car Kit (W220 589 04 99 00) which contains several crimping die sets and unpinning tools used in cars. You can also get a kit for Flexible Flat Cable (FFC) using part number W211 589 01 99 00, but as this cable type is used only in certain models from around 10 years ago, only a few dealers have made the investment.



This is the basic harness repair kit. It comes with the crimp pliers and several die sets, wire strippers, and several unpinning tools. Also included is a carrying case and about 40 empty boxes to store connector pins. The supplementary car kit includes crimp sets and unpinning tools used in cars.

And an investment it is, since these tool sets are by their nature expensive to manufacture, therefore expensive to buy. We own a few common styles, and can borrow what we need for those once-a-year jobs. But one thing we'll never do is cheat: No paper clips or picks for unpinning, no pliers for crimping: It just isn't worth it. Not only does it result in a poor repair, the liability is simply too great. Oh, and a contact closed with pliers? It usually doesn't even fit inside the housing, so you'll only have to cut it off and do it again, but this time the right way. |



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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		
Genuine Mercedes-Benz Oil MB 229.5 Specification SAE 5W-40	A0009898301USB6	6x1 Quart Cases	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.5 Specification	Mercedes-Benz Engines that require 229.5 Specification Oil
	A0009898301USB8	55 Gallon Drum		
	A0009898301USB9	Bulk - No Equipment		
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		
Genuine Mercedes-Benz Oil MB 229.52 Specification SAE 5W-30	A0019893701USA9	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
	A0019893701USA6	6x1 Quart Cases		
	A0019893701USA8	55 Gallon Drum		
Mobil 1 5W-50	BQ 1 09 0133	16 Gallon Keg	Higher viscosity, advanced full synthetic formula designed for performance vehicles	Porsche A40. HT/HS applications.
	BQ 1 09 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
M-B Genuine ATF 134FE	A0019897703USAB	55 Gallon Drum		
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® 1/2 Gal.	A 000 583 0107	1/2 Gallon Bottle	Non-toxic solution that transforms harmful Nitrogen Oxide (NOx) emissions from diesel-powered vehicles into harmless water vapor and nitrogen	Recommended for use in Mercedes-Benz, Volkswagen + BMW AdBlue® (DEF) applications
Diesel Exhaust Fluid 55 Gal	BQ 1 47 0002	55 Gallon Drum		
Mobil 1 5W-30	BQ 1 09 0017	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many domestic, including GM, and imported vehicles	Vehicles that require 5W-30. Corvette approved.
	BQ 1 09 0018	55 Gallon Drum		
Mobil 1 10W-30	BQ 1 09 0019	6/1 Quart Cases	Advanced full synthetic formula designed for domestics and imports	Vehicles that require 5W-30 or 10W-30
	BQ 1 09 0020	16 Gallon Keg		
	BQ 1 09 0021	55 Gallon Drum		
Mobil 1 5W-20	BQ 1 09 0083	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many newer vehicles including Hondas, Fords, Chryslers, and newer Toyotas	Vehicles that require 5W-20
	BQ 1 09 0084	55 Gallon Drum		
Mobil 1 0W-20 AFE	BQ 1 09 0169	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 0W-20 (newer Toyotas and Hondas), 5W-20 and certain hybrids
	BQ 1 09 0168	55 Gallon Drum		
Mobil 1 0W-30 AFE	BQ 1 09 0174	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 5W-30 or 10W-30
Mobil 1 Synthetic ATF	BQ 1 09 0164	6/1 Quart Cases	Multi-vehicle, fully synthetic fluid designed to meet the demanding requirements of modern passenger vehicles	Vehicles that require Dexron III, Ford Mercon and Mercon V performance levels
	BQ 1 09 0163	55 Gallon Drum		
Mobil 1 15W-50	BQ 1 09 0023	55 Gallon Drum	Boosted, higher viscosity, advanced full synthetic formula designed for performance vehicles	HT/HS applications. Racing and Flat tappet applications
	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

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Product Name	Part Number	Quantity	Product Description	Recommended Consumer App.
Mercedes-Benz SPEC.				
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 15W40	BQ 1 09 0053	Bulk - No Equipment	Extra high performance diesel engine oils that help extend engine life in the most severe on and off-highway applications while delivering outstanding performance in modern, high-output, low-emission engines including those with Exhaust Gas Recirculation (EGR) and After-treatment 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 10W30	BQ 1 09 0086	Bulk - No Equipment		
Mobil Delvac 1 5W40	BQ 1 09 0051	4/1 Gallon Cases	Fully synthetic supreme performance heavy duty diesel engine oil that helps extend engine life while providing long drain capability and fuel economy for modern diesel engines operating in severe applications	Recommended for use in all super high performance diesel applications, including modern low emission engine designs with Exhaust Gas Recirculation (EGR)
	BQ 1 09 0052	55 Gallon Drum		
Mobil Grease XHP 222	BQ 1 09 0078	60/14 oz Cartridge	Formulated to provide excellent high temperature performance with superb adhesion, structural stability and resistance to water contamination	Recommended for industrial and marine applications, chassis components and farm equipment
	BQ 1 09 0079	120 lb Keg		
	BQ 1 09 0080	400 lb Drum		
	BQ 1 09 0098	40/14 oz Cartridge		
Mobil Lube HD Plus 80W90	BQ 1 09 0096	120 lb Keg	Extra high performance, automotive lubricant formulated from select base oils and an advanced additive system specifically for limited-slip differentials	Recommended for use in limited-slip differentials, axles, and final drives requiring API GL-5 level performance
	BQ 1 09 0097	400 lb Drum		

So Sensitive: Recalibration of Driver-assist Technologies

Many Advanced Driver Assistance Systems (ADAS) do not set trouble codes that alert you to the need to calibrate or reset them after repairs. Here are tips to help you catch them before returning the vehicle to your customer.

“It worked fine until after your collision repair.” If you’ve heard that recently, chances are it is because your technician was unaware that he or she must recalibrate the device in question after any event that disconnects power, sometimes even after repair of an unrelated component.

Advanced Driver Assistance Systems (ADAS) from Mercedes-Benz use camera, radar, and sonar sensor technologies to collect information about nearby vehicles, pedestrians, lane markings, and potential obstacles. They measure distance and vehicle trajectory for assessment of potential collision risk. These inputs are also used for control module calculations of the amount and direction of braking required for effective collision avoidance or impact reduction.

Depending upon which and how many of these technologies are on

a given model, there may be dozens of sensors and modules in various locations around the vehicle. ADAS technologies may be mounted on the windshield, embedded in front and rear bumpers, in side mirrors, behind the front grille, in the rear decklid and in other locations around the vehicle.

Mathematical precision

Distance and trajectory data is useless if the camera, radar, sonar, or other sensing device is mounted improperly. If a camera or radar device is mounted in a windshield or bumper just a few degrees offset from its factory specification, the detection area it records two or three hundred yards down the road may be in the wrong lane. For both collision risk assessment and mitigation strategies, all imaging and sensor technologies must be mounted with pinpoint accuracy.

After every repair, you must check that any ADAS or other sensing devices

are functioning properly. Recalibration is simply a way to confirm that these imaging and sensing devices have been mounted with the required mathematical precision.

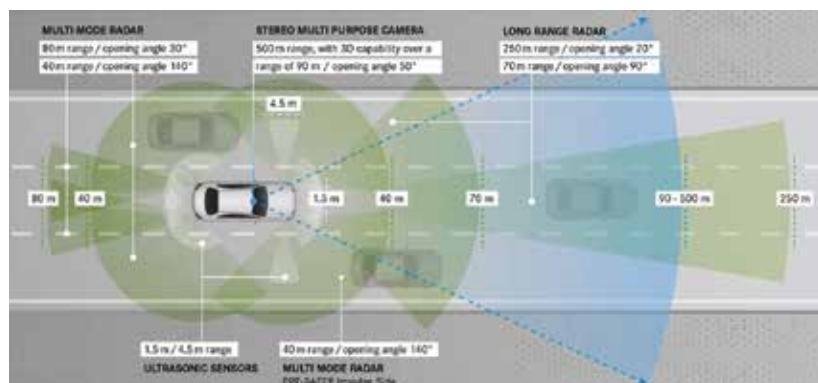
Powerful and vulnerable

The perimeter locations of the imaging and sensing devices for ADAS enhance coverage and expand the area they can “see” ahead, behind and to the sides of the vehicle, but also makes them highly vulnerable to collision impact damage. After repair, you’ll have to reset or calibrate the ADAS component to ensure that it is positioned properly and communicating with its control module.

Similarly, if you remove or replace a bumper, windshield, or other component on which an ADAS device is mounted or embedded, you must at minimum re-calibrate, and depending on whether or not it sustained damage, replace the ADAS device. Disconnecting an ADAS sensor or control module from its power source requires a re-initialization or recalibration, much like a power failure at home requires you to reset the clock on your microwave or other plugged-in digital devices.

Fault detective

Many ADAS devices do not set a trouble code if there is a problem. So, how can you tell which devices are on the vehicle, and whether or not any need repair? First, access the list of what ADAS components may be on the vehicle. In the Mercedes-Benz Workshop Information System



Advanced Driver Assistance Systems (ADAS) on Mercedes-Benz vehicles use a variety of imaging technologies, including regular and infrared cameras, short and long-range radar, and ultrasonic sensors to make drivers aware of potential hazards. These imaging technologies also provide input to control modules that activate braking to slow, stop, or alter the direction of the vehicle to help avoid or reduce the damage of a potential collision.



(WIS), enter the VIN and click on the Datacard icon at the top of the web page. This will open a list of all of the features on the vehicle, including all ADAS components.

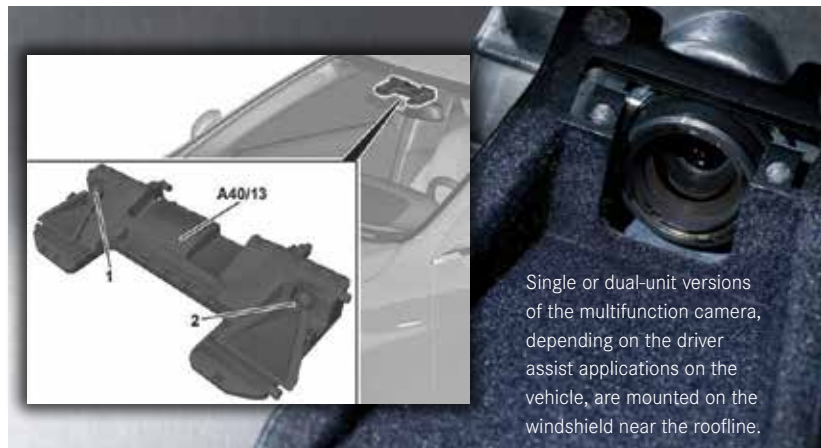
Alternatively, plug your XENTRY STAR DIAGNOSIS tool into the diagnostic connector on the vehicle. In addition to showing a list of the as-built configuration of the vehicle, it will allow you to read any trouble codes that have set, activate sensors, and troubleshoot ADAS or other components. You could try using an advanced aftermarket scan tool, but it will not have the factory as-built information for newer model year vehicles, and there is no guarantee that it will be able to communicate with every sensor or control module needed for troubleshooting ADAS devices.

At minimum, you may now be able to develop a short list of ADAS and other components that you suspect are most likely to have been affected by your repair. This applies to both collision repair and to the side effects of disconnecting or replacing ADAS devices as part of accessing or repairing nearby components. Even changes to the suspension, use of tires of a different diameter than the factory originals, or work on the steering system can have indirect impact on where a camera or other imaging device is pointed, as they may alter suspension level or ride height.

For example, the camera, radar, and sonar devices we've mentioned above must be calibrated after replacement or repair. They are used by multiple ADAS technologies (if so equipped) on the E 350. This includes Cruise Control, Lane Keeping Assist (Code 476) and Active Lane Keeping Assist (Code 238), COLLISION PREVENTION ASSIST and COLLISION PREVENTION ASSIST PLUS (Code 258 up to MY2014), DISTRONIC PLUS (Code 233) and DISTRONIC PLUS Steer Assist (Code 266), Blind Spot Assist (Code 234), Active Blind Spot Assist (Code 237), Brake Assist

PLUS (Code 268), or Brake Assist PLUS cross-traffic (Code 269), PRE-SAFE brake (Code 271 or Code 300), Rear-end PRE-SAFE (Code 253), and Traffic Sign Assist (Code 513).

There are trouble codes that may set for cruise control problems, but not for many of the other ADAS components on the above list. If you see any of these codes on the vehicle data card or in the list, and you replaced or disconnected from power the imaging device related to the code, check that those devices



Single or dual-unit versions of the multifunction camera, depending on the driver assist applications on the vehicle, are mounted on the windshield near the roofline.

System Recalibration/Resetting

Even if the vehicle shows no warning lamps (MILs), systems may need calibration following repairs. This guide is not comprehensive, not guaranteed accurate, and will not be updated: Check the available service literature and tools (e.g., WIS, XENTRY, etc.) for the specific system(s) and vehicle in question. The Option Code list for a specific vehicle can be found in the Vehicle Data Card, available in several online systems, such as VeDoc, EPC, WIS and VMI. System names may vary. "MU" means Model Update.

Option Code	System Name(s)	Recalibration?	Models
218	Rear-view Camera, Reversing Camera	YES	117, 164, 166, 176, 204, 207, 212, 216, 218, 221, 222, 231, 246, 251
219	DISTRONIC	YES	209, 211, 219, 220, 215, 230, 164, 251 as of MY 2011
220	PARKTRONIC	NO	164/251, 166, 171, 172, 197, 203, 204, 207, 209, 211, 212, 215, 216, 218, 219, 220, 221, 230, 231, 245/169, 246/176, 463
230	PARKTRONIC with Parking Guidance	NO	172, 204 MU (not X204), 207, 212, 216 MU, 221 MU
233	Brake Assist System PLUS with Cross-Traffic Assist, with Intersection Assist	YES	207/212 MU, 222
233	Brake Assist System PLUS, PRE-SAFE Brake, DISTRONIC PLUS	YES	166, 172, 204 MU, 207, 212, 216, 218, 221, 222, 231 (on vehicles with DISTRONIC PLUS)

are functioning properly. If any are not performing as specified, check your Mercedes-Benz repair manual to see if there are any calibration, initialization, or activation procedures required after repair or replacement.

Below are a few examples of specific scenarios in which calibration or initialization is required.

Multifunction Camera

A multifunction camera is used on many Mercedes-Benz vehicle models for a variety of driver assist systems, including Active Lane Keeping Assist, DISTRONIC PLUS with Steering Assist, Brake Assist Plus, Adaptive High Beam Assist and Intelligent Light System, and Active

Body Control. The multifunction camera must be recalibrated if you are installing a new camera, control unit, or cable from the camera to its control unit.

It must also be calibrated if the camera has been disconnected or removed. For example, if you are replacing the windshield and either

Option Code	System Name(s)	Recalibration?	Models
234	Blind Spot Assist	NO	117, 164, 166, 172, 176, 197, 204 MU, 207, 212, 218, 216/221 up to MY 2009, 246, 251 MU
235	Active Park Assist, PARKTRONIC	NO	117, 166, 169/245 MU, 176, X204 MU, 207/212 MU, 218, 222, 231, 246
237	Active Blind Spot Assist	NO	166, 204 MU, 207, 212, 216 MU, 218, 221 as of MY 2010, 222, 231
238	Active Lane Keeping Assist	YES	166, 204 MU, 207, 216 MU, 212, 218, 221 MY 2011, 222, 231
239	Adaptive Brake Assist, Active Brake Assist	YES	117, 176, 246, 242, 207/212 MU, 222, 166 (as of MY 2013) (with code 239, 252 or 258)
239	COLLISION PREVENTION ASSIST PLUS, Active Brake Assist	NO	117, 176/242/246 as of MY 2014
252	Adaptive Brake Assist, Active Brake Assist	YES	117, 176, 246, 242, 207/212 MU, 222, 166 (as of MY 2013) (with code 239, 252 or 258)
252	COLLISION PREVENTION ASSIST	NO	246, 176, 166 (as of MY 2013)
253	PRE-SAFE PLUS	Special	207/212 MU, 222
258	Adaptive Brake Assist	YES	117, 176, 246, 242, 207/212 MU, 222, 166 (as of MY 2013) (with code 239, 252 or 258)
258	COLLISION PREVENTION ASSIST	NO	207/212 MU, 222, 117
266	DISTRONIC PLUS with Steer Assist, Distance Pilot DISTRONIC	YES	117, 176, 246, 463 MU (code 239)
269	Brake Assist System PLUS with Cross-Traffic Assist, with Intersection Assist	YES	207/212 MU, 222
476	Lane Keeping Assist	YES	117, 166, 172, 176, 204 MU, 207, 212, 216 MU, 218, 221 MU, 231, 246

Option Code	System Name(s)	Recalibration?	Models
501	360 Camera System	YES	X166, W166 as of MY 2013, X204 MU, 207/212 MU, 222
513	Speed Limit Assist, Traffic Sign Assist, Speed Limit Pilot	YES	117, 166, 172, 176, 204 MU, 207, 212, 213 216 MU, 217, 218, 221 MU, 231, 246 As of MY 2012 207/212 MU, 222
538	ATTENTION ASSIST	NO	117, 166, 172, 176, 204 MU (only with code 442), 207, 212, 216 MU, 218, 221 MU (without S400 Hybrid), 222, 231, 246
608	Adaptive Highbeam Assist	YES	117, 166, 172, 176, 204 MU, 207, 212, 216 MU, 218, 221 MU, 231, 246
610	Night View Assist, Night View Assist PLUS	YES	216, 221 (NVA), 166, 212, 218, 216/221 MU, 222, 231 (NVA+)
628	Adaptive Highbeam Assist PLUS	YES	207/212 MU, 222
233 239	DISTRONIC PLUS	YES	166, 172, 204 MU, 207, 212/218, 221/216, 207/212 MU, 222, 231 (code 233), 117, 176, 246, 463 MU (code 239)
Std	ATTENTION ASSIST	NO	117, 166, 172, 176, 204 MU (only with code 442), 207, 212, 216 MU, 218, 221 MU (without S400 Hybrid), 222, 231, 246
Std	Brake Assist System, BAS	NO	All
Std	Clock	YES	All
Std	ESP	YES	All
Std	Sunroof	YES	All
Std	Tire Pressure Monitoring System	YES	All
Std	Window lifters	YES	All
	Crosswind Stabilization, Crosswind Assist	Special	216,221,217,222, 213
	LED Headlamps	YES	Need scanner tool
	Neck Pro head rests	YES	
	PRE-SAFE Brake with Pedestrian Recognition	YES	205, 207/212 MU, 213, 217, 222

installing a new camera, or reinstalling the existing camera on the new OEM glass, calibration is required.

Backup Camera

You must calibrate the backup (reversing) camera after any of the following events occur:

1. Replacement of the backup camera control unit.
2. Removal of the backup camera.
3. Any collision repair that could potentially alter the camera mounting angle in the trunk lid, as this may have altered the camera viewing angle.
4. Changes to the suspension which influence ride height.
5. Removal or replacement of the steering angle sensor (SAS).

You will need a calibration fixture (stand) and target, a laser, and the XENTRY Connect diagnostic system.

DISTRONIC PLUS

DISTRONIC PLUS (DTR) uses front long- and short-range radar technology to regulate vehicle speed and distance relative to the vehicle immediately ahead. Initialization of the DTR control unit is necessary if the control unit is replaced or disconnected from power during any procedure. Because the DTR uses lateral and longitudinal acceleration data inputs in its calculations, it must also be initialized after replacement of the yaw rate and/or rotational speed sensors.

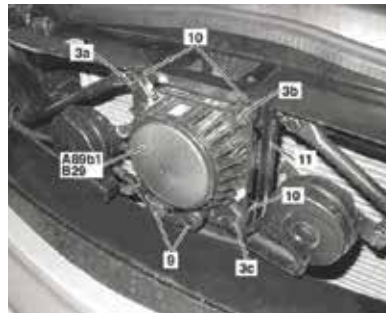
You must adjust the DTR radar sensor after replacement of the DTR control unit, or if the sensor has sustained any mechanical damage. Front collision repair, alterations to camber, track width, caster or alterations of the vehicle height at the front or rear axle, are all additional reasons you must adjust the DTR radar sensor.

Tire Pressure Monitoring System

Were you aware that tire rotation requires you to re-activate the tire pressure monitor (TPM)?

Wheel replacement, installation of a new pressure sensor on a given tire, or simply adding or releasing air to bring a tire within pressure specification limits are all events that require activation of the TPMS.

The TPM must also be re-activated after every tire rotation. The inflation pressure specification is different for

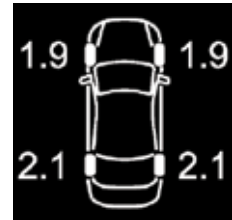


The DTR radar sensor (Code A89b1 in this image, for vehicles with non-arched type radar sensor, B29 for the arched type) is the heart of the DISTRONIC PLUS system. It must be adjusted not only if it has suffered collision or mechanical damage, but also if the vehicle has had suspension alterations that affect ride height.

front and rear tires. For example, if you rotate a left rear tire to the right front, you must adjust the pressure to the appropriate level for each wheel that moved. Without pressure adjustment, the controller sees that the pressure is off for one or more tires, and presents a TPM error warning message in the dash.

Activation is easy, and less costly than throwing parts at the problem.

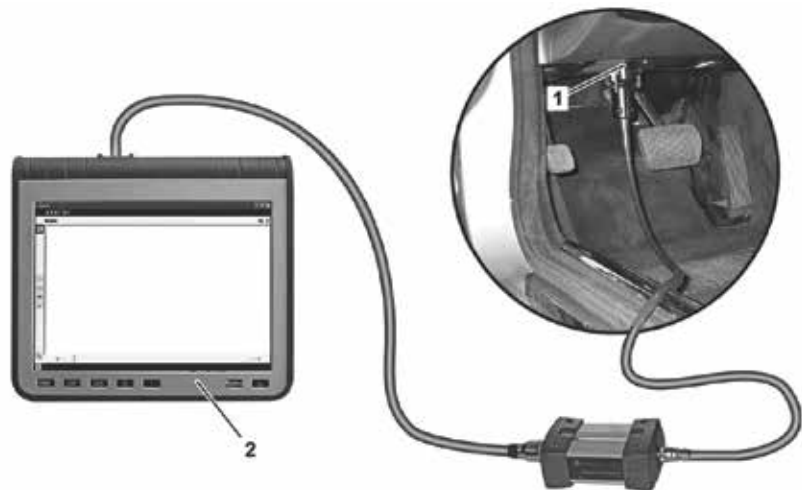
Tire pressure is often different for the front and rear tires. In that case when you rotate them rear-to-front, you'll need to adjust pressures to maintain tire performance within normal parameters, not to mention keeping the TPM happy.



Use current pressures as new reference values

 Confirm with OK

Once you've adjusted tire pressures for each wheel, then tell the TPM control unit to accept the new pressure for a given tire as its baseline value.



Once you start the Mercedes-Benz STAR DIAGNOSIS tool, shown here plugged into the diagnostic connector on the C-Class (chassis series 204), STAR DIAGNOSIS provides step-by-step, menu-assisted test and repair procedures for any faults it identifies on the vehicle.

Ron Resnick

“I Love the Parts Business!”

Once you’ve made the appropriate pressure adjustments, you simply press “OK” to confirm with the TPM control unit that they are the correct values for each tire, and the system is re-activated. However, because TPMS technology has evolved, there are at least three, and possibly more, different activation procedures for Mercedes-Benz models from the early 2000s up to the present. Check in the Mercedes-Benz Workshop Information System (WIS) for the TPM activation procedure that is appropriate to the model you are repairing.

If your repair requires you to disconnect or remove and reinstall components such as the ABS controller or other electronic control units, those devices also must be checked for function after re-assembly. In some cases, a test failure will cause the setting of a trouble code that will indicate the need for initialization or calibration of the device. If no code is set even though the device fails a function test, check your Mercedes-Benz repair information for initialization, calibration, or reset instructions.

After you have completed any required calibration, initialization, or reset procedures, scan again to verify your repair was effective and complete. You can then delete from the diagnostic trouble code memory any stored faults which may have been caused by disconnecting wiring or by simulation during testing. Connect your Mercedes-Benz STAR DIAGNOSIS tool and read out and erase the fault code from memory.

With these hidden calibration requirements taken care of, now you can invite your customer to come and pick up the vehicle. |

Those words are certainly music to the ears of dealership parts departments and independent service providers who deal in parts for Mercedes-Benz vehicles.

Consider the role of Mercedes-Benz Regional Parts Sales Managers. Their job is to provide support to Mercedes-Benz dealership parts departments and the independent auto repair and collision repair shops they serve. What would you expect such managers to do?

Well, you’d expect them to educate and assist dealership parts professionals in using the latest software and ordering procedures in order to obtain parts for wholesale and retail customers as quickly as possible, and assuring that they get exactly the part needed at competitive prices. And that’s exactly what Ron Resnick does.

Ron is Parts Sales Manager for the 115 or so Mercedes-Benz dealerships in 13 southeastern states, and he really does love the parts business. And well he should, as virtually his entire professional career — 40+ years — has been in the parts business, much of it within the Mercedes-Benz family.

His career path has been classic. He started as a parts driver, worked in dealership parts departments and as a national parts director for one of the largest dealer groups in the U.S., served as a Parts Manager/Director for several dealerships before managing three different Mercedes-Benz dealership parts departments. He has facilitated training seminars at the national level for MBUSA and provided training, support, and coaching for dealership parts and service professionals all around the country. Half of his career has been with dealerships and half has been with automotive manufacturers, so he knows the parts business inside out.

These days Ron provides support for dealerships and their wholesale and retail customers throughout the southeast U.S. He counsels on subjects like inventory control, merchandising, marketing and wholesale parts promotional programs. He visits independent service providers in order to constantly monitor their needs and relay those needs to the supporting dealership and MBUSA Headquarters. He also makes extensive use of teleconferencing, which allows him to interact more frequently than in-person visits would allow.

Rather than simply a trainer, Ron considers himself a coach/consultant, working with parts professionals in exploring ways to provide even faster, more accurate, and more affordable solutions for their wholesale and retail customers.

We guess Ron really does love the parts business.... |





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