

Mercedes-Benz troubleshooters and the ScopeMeter® 199C

**Technology
at Work**

Imagine the visceral, physical feel of being behind the wheel of a machine so well engineered that it reads your commands as if by instinct. A vehicle that has inflamed passions and demanded attention wherever it goes for more than 100 years.

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Each Mercedes passing you on the highway contains thousands of parts, miles of wiring and as many as 50 on-board computers operating with incredible precision.

With a history of German engineering excellence and the satisfaction ratings to prove it, Mercedes values both the loyalty of its customers and their confidence in the reliability of Mercedes vehicles. When, very occasionally, a part of the system displays a temper of its own, Mercedes dealers launch a customer care program designed to get customers out of repair facilities and back on the road.

Service technicians at Mercedes dealerships are highly skilled in all aspects of their vehicles' operations. "We're continually developing our shop foremen and dealership teams," says Mario Haro, Hub Leader at the Mercedes Technical Assistance Center in California. "Our commitment to our dealer workforce is very, very important to Mercedes-Benz."



Hermann Stehling examines fuel control on an AMG engine.

Those occasional malfunctions that leave the dealership technicians scratching their heads are referred to the Technical Assistance Center (TAC), a Mercedes-owned national system of technical support for dealerships, with U.S. hubs in New Jersey, Florida, Chicago and Los Angeles. Most problems can be figured out over the phone, Haro says. When the TAC team runs up against one that can't, it

sends one of 45 highly trained technical specialists to meet the challenge in person.

Technical Specialist Hermann Stehling, one of Mercedes' top specialists, has more than 45 years in the business, almost all with Mercedes. By the time a vehicle operational problem gets to Stehling and his colleagues, it already has outwitted some of the best in the business.

While Mercedes counts on its TAC specialists to solve the most challenging operational problems, Stehling counts on his ScopeMeter test tool.

Stehling's 199C ScopeMeter is a handheld color oscilloscope with greater capabilities and power than most bench scopes — its complex monitoring over time can capture even the most elusive electronic malfunctions, and it's portable. "The ScopeMeter test tool waveform displays and monitoring are the best things to me," Stehling said. "I use it two, three, four times a week, minimum."

When Stehling and his scope arrive at a dealership, they team with on-site technical experts to get to the bottom of the elusive malfunction as efficiently as possible.

Each high-performance car has the equivalent of a complex industrial computer network under the hood, with a similar set of electrical and electronic diagnostic requirements. To make it even more challenging, cars are also subjected to all kinds of vibration, environmental changes and humidity shifts not typically found in stationary applications.

Most signals in a vehicle's computer network operate in the micro-second time domain, sending and receiving information on a local controller area network. Power quality, stray signals and environmental conditions all play havoc with the system and can cause intermittent performance issues that, in Stehling's words, "can be a bear to track down." That's because these glitches typically occur at nanosecond speeds — so fast that the system considers them "noise" and the human eye can't even register them on a typical digital multimeter. With the ScopeMeter test tool, technicians can take a continuous flight recording of these minute readings and use its powerful glitch detection function to determine what's really going on.

"If the engine does something for a second or two, you're not going to be able to catch it," he said. "But with a ScopeMeter test tool monitoring and recording everything, you can scroll back and see it. Before the scope, you were looking at a piece of digital equipment with flashing numbers. Many times you need more information. That's where the scope comes in."

Stehling and Fluke's Corey Glassman, a certified auto technician himself, recalled wrestling with an intermittent power loss problem.

As with any intermittent, the key is being there when the problem actually occurs. So, Glassman added a low current clamp accessory that measures the very low magnetic field surrounding wires as current passes through them. Combined, the clamp and the ScopeMeter test tool allowed him to continuously monitor the vehicle's primary

and branch power system without interrupting the circuit. Using this combination, he determined that one of the car's numerous computers was staying awake when it shouldn't, consuming excessive current and draining power.

Glassman also uses the clamp combo to monitor current ramping of fuel injectors, for accurate fuel control, and to check the internal, hidden connection between the brush sets and the motor's armature on the electric in-tank fuel pump. Best of all, he can do both under dynamic operational load conditions.

In another interesting case, a customer reported that while the car was sitting still with the engine running, the radio volume would continually increase.

As it happens, Mercedes vehicles have an advanced function that compensates for road noise by automatically changing the volume of the sound system according to vehicle speed.



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Under normal operation, a speed sensor at the transmission output generates a signal communicating vehicle speed data to the onboard computer, which then sends volume adjustment commands to the radio.

Glassman hooked up the ScopeMeter test tool to the vehicle speed sensor (VSS) signal input at the powertrain control module (PCM) and found that the signals were contaminated with noise. More specifically, the PCM was misinterpreting electrical noise as an increase in road speed. It turned out that after-market wiring had been incorrectly routed too close to the computer input, causing the excess noise. Rerouting the wiring corrected the problem.

Half the battle in these situations is tracing the problem's source. Is it the computer, the data, or the wiring? By monitoring communications between the different computers, sensors and actuators on the controller area

network, the ScopeMeter test tool gives automotive technicians an invaluable interface into a high-speed network.

"One of the best things about a ScopeMeter test tool is the ability to print out a graph," Stehling said. "You can talk until you're blue in the face, but if you show someone something, they understand it. It takes the guesswork out of things. The signal is either there or it's not."

For example, if a scope reading determines that a component needs to be replaced, the technician can print out before-and-after reports that demonstrate both the need to replace the part and the quality of the new component and its installation. That kind of detail not only makes the technician's diagnostic and repair procedures more accurate, it takes the entire shop's professionalism to a new level.

Teaching tools

Mercedes has found the ScopeMeter test tool so useful that Glassman now travels to TAC hubs providing hands-on training, helping TAC personnel explore the tool's capabilities.

For example: "Set-ups" are the ScopeMeter test tool configurations, the combinations of trigger level, slope, time base and voltage settings, which the technician sets before taking a particular measurement. By pulling set-ups off the web or email and uploading them onto their scopes, technicians miles away can reproduce the problematic waveforms, resulting in much better group understanding and communication.

Stehling said he tells dealership teams how they can benefit by using the scope. "Most of our dealers in the L.A. area have scopes now," he said.

According to Mario Haro, "Using the ScopeMeter test tool puts Mercedes-Benz at the leading edge of service technology and reliability."

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Fluke Corporation

PO Box 9090, Everett, WA USA 98206

Fluke Europe B.V.
PO Box 1186, 5602 BD
Eindhoven, The Netherlands

For more information call:

In the U.S.A. (800) 443-5853 or

Fax (425) 446-5116

In Europe/M-East/Africa (31 40) 2 675 200 or

Fax (31 40) 2 675 222

In Canada (800) 36-FLUKE or

Fax (905) 890-6866

From other countries +1 (425) 446-5500 or

Fax +1 (425) 446-5116

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