

Automotive Test Equipment

by

Ron Johnson

Until just a few years ago, the electrical system of an automobile engine was quite simple: a battery, mechanical distributor and points (switch contacts), a coil (step up transformer), and spark plugs. Now, most vehicles use solid state electronics, including several microcomputers, analog to digital converters and a variety of analog sensors, to monitor and control the operation of the engine, transmission and other systems.

For the most part, though, the increased use of electronics in the vehicle has not been the concern of the average electronics technician. Automotive technicians are responsible for troubleshooting and repair of automotive electrical systems. The area that has affected electronics technicians, however, relates to the test equipment the auto techs use to analyze and tune engines.

In the same way that an oscilloscope can be used to display waveforms from a transistor amplifier or a motor control circuit, specialized automotive 'scopes are used to display the ignition and charging waveforms from a vehicle. Automotive scopes use special cable harnesses and sensors that connect to several points on the engine. They monitor parameters such as the battery voltage and current, ignition coil primary and secondary waveforms, the "number one" spark plug signal, engine

vacuum, and coolant temperature.

Some engine analysis systems include a separate gas analyzer that samples and analyzes the constituent components of the exhaust gas. Oxygen, carbon monoxide, carbon dioxide and hydrocarbon concentrations indicate whether pollution emission standards are being met.

The latest computerized analyzers are really sophisticated data acquisition systems that do a complete engine analysis in just a few minutes. Usually they prompt the automotive technician through a series of tests. Data specific to the model of engine being tested is recalled from computer memory and compared to test data. Diagnostic software analyzes this comparison and the computer prints out recommended service procedures that should be done on the vehicle.

Of course, any kind of equipment can fail occasionally, and that's where the electronics technician comes in. Working as a manufacturer's service representative, or as an independent contractor, the technician provides regular maintenance, as well as emergency service, to the equipment owner. Typically, this kind of service involves travel to the customer's location where the technician uses an "engine simulator" to test and calibrate the analyzer. The simulator is an electronic signal source which produces waveforms similar to those produced in the

engine. To calibrate the exhaust analyzer, special calibration gases are injected into the system and adjustments are made to the electronics.

Repair of these units may involve procedures as simple as replacement of an engine harness cable or as complex as troubleshooting a printed circuit board. Circuitry ranges from analog amplifiers using transistors, FET's and op amps, to switching circuits that implement SCR's and triacs.

The 'scope section of the analyzer operates similarly to a conventional oscilloscope but has specialized triggering and deflection circuitry. Computerized systems use typical micro controller chips but the signal processing circuitry is designed specifically for accessing analog automotive signals. Gas analyzers have complex plumbing arrangements for filtering and removing water vapour from the vehicle exhaust. They also use infra-red optical and electro-chemical sensors to detect and measure the gases.

While automotive test equipment is very reliable, it is in continuous use and subjected to a harsh environment in the

automotive service shop. The result is the need for regular service. To handle this kind of service the electronics technician must have an thorough understanding of his own field as well as that of how an automobile engine operates. He also needs good mechanical aptitude and problem solving abilities.

As with any job the employee who can be versatile and improvise has the advantage. This is especially true with automotive test equipment. In addition to his service responsibilities, the technician is sometimes called on to train automotive shop personnel in the operation and use of the equipment. Sales and customer service is often the responsibility of the field service technician as well.

Growing concern over environmental issues has led many governments to legislate periodic testing and certification of automobiles to ensure conformation to standards. Add the fact that automobiles are becoming more high tech and it looks likely that every automotive shop will soon need to have an analyzer. This, in turn, will create a need for electronic technicians able to perform service on them.