FlexRay is faster than CAN and you need to adapt

As vehicle systems become more and more complex, the need for faster data transfer has become the norm. Technicians have become familiar with CAN as the data transport between modules, but CAN speed has been a limiting factor. A high-speed powertrain CAN runs at 500kbits/second. Newer technologies require much faster, higher data transfer rates.

With Safety critical systems such as ADAS, Automatic Cruise Control, and even more coming into the mainstream vehicle parc, FlexRay is now becoming a common fitment.

Technicians familiar with CAN, will have some idea how to test FlexRay systems. Some subtle differences in the diagnostic process will need to be employed. There are new requirements for the test equipment for these faster systems.

Physical Layer Check

The first test we deployed in the past was a physical layer check, which tests the resistance of the Bus to check for network integrity, and any short circuits between Busses or ground. We knew that a 60 Ohm layer check was what we needed, to prove a good circuit. 120 ohms being present at each end of the network. These resistors were placed to stop reflection in the signal bouncing back. Any reading other than 60 Ohms indicates a circuit issue.

The normal physical layer check has changed. FlexRay networks will have between 2 and 4 modules. The terminating modules have 94 Ohms installed, and the intermediate units have a resistance of 2.6 kOhms. A 2-module network will have 47 Ohms across the High and Low Bus. A 3-module system will have 46 Ohms and a 4-module system 45 Ohms.

TA506 HF test leads

Signal Integrity Check

The second test involves an oscilloscope, to check the signal levels and integrity of the data. Due to the speed limitation of CAN, a normal scope was very capable of analysing these. Because FlexRay operates at up to 10 Mbits/second, normal scope leads will not cope with the signals, and a loss of data integrity will be present.

The signal is also different from the older CAN. There is still a Recessive Voltage of 2.5V on both Bus High and Bus Low. But now the signal on Bus High rises first by 500 mV, then goes low to 2V. And the reverse is on Bus Low, going down by 500mV then rising to 3V. Both signals have a differential of 1 volt for a binary signal, one or zero.

The time for 1 Bit on FlexRay is as fast as 100 nanoseconds, compared to 2 microseconds (2000 nanoseconds) for 1 Bit on CAN Bus.

PicoScope has now produced dedicated high-speed test leads, to cover these new high-speed systems. They have the inbuilt 10:1 attenuation, and terminate in the usual 4mm banana connection. Previously available HF probes are not suitable for automotive use. These are still available, but more suited to laboratory use.

The scope also needs to be capable of working with these high-speed signals. We recommend the PicoScope 4425A, as it has the sample rate required.

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