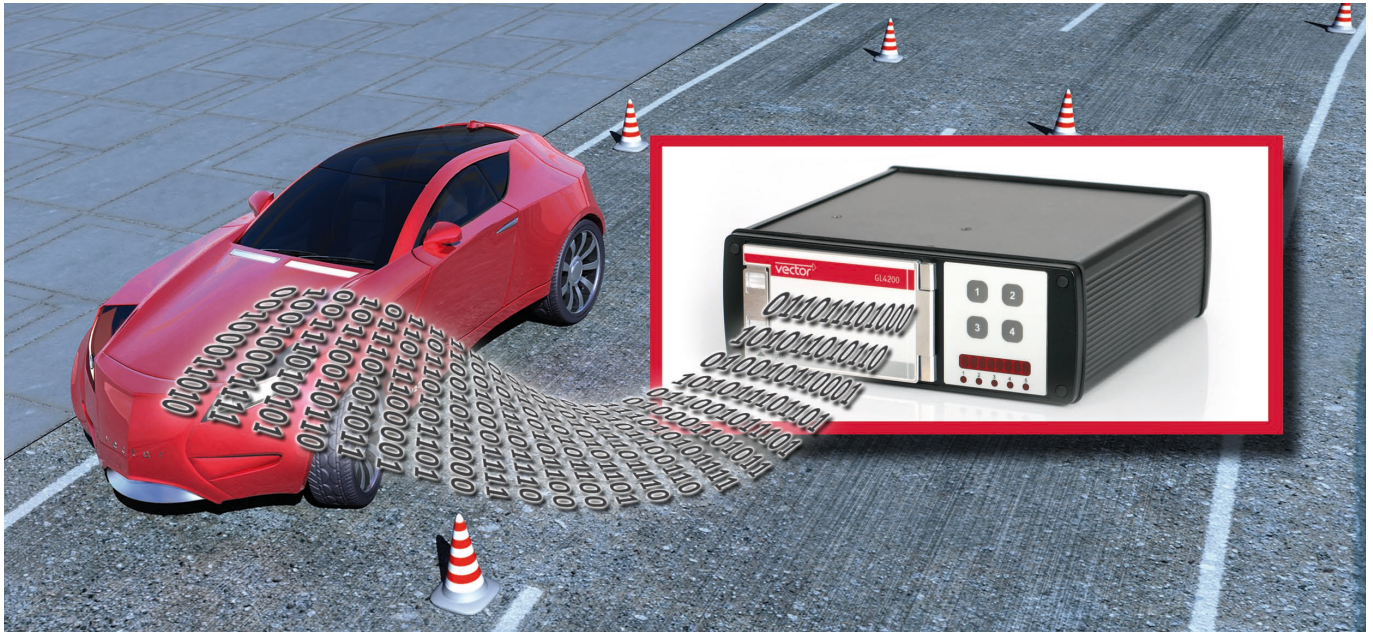


Seamless Logging on Test Drives

Acquire vehicle data reliably with data loggers



When different bus systems are used in vehicles, the effort required for troubleshooting and analysis always increases. Laboratory tests are no longer sufficient to simulate real situations for communication in the total vehicle system. Only extensive test drives in the real environment can deliver the necessary testing depth. In test fleets, data loggers installed in the vehicles are the tool of choice for logging the data traffic of all buses and select I/O lines. This makes it possible to access the test drive data at any time in quality assurance tasks.

Shortly before production maturity, in-depth testing in vehicles is typically conducted in the context of test drives. To achieve the greatest possible test coverage, some of these tests are conducted under extreme environmental conditions. Whether they are winter tests in Finland at -30° C, hot weather tests in Death Valley at over 50° C or week-long drives through the Brazilian rainforest at high humidity and on rough roads, in the end the vehicle and all of its components must operate smoothly. The installed data loggers must be able to withstand these harsh conditions as well. This means that they must be mechanically rugged and operate reliably over a broad range of temperatures.

Various bus systems are used in motor vehicles or commercial vehicles: CAN, LIN and FlexRay. One technical requirement is that the data of all of these buses needs to be logged simultaneously, i.e. time synchronously. The logger must not influence the bus traffic here; it may only observe it. Since the loggers are often permanently installed in test fleet vehicles, and a test series may take several weeks, they must exhibit very low current draw in their quiescent states – another requirement of data loggers. Furthermore, the devices must be ready for operation as quickly as possible, so that the first occurring message can be logged too.

Not only are the loggers typically permanently installed, often they are mounted at very inaccessible points, e.g. under a seat or behind a trim panel in the cargo space, and they may be inaccessible because of other instrumentation. Therefore, it is advantageous if the test engineer can use a UMTS or WLAN wireless connection to read data from a logger. As an alternative, it should also be possible to read data directly via USB or by swapping out the memory medium. To permit clear traceability of certain driving situations to a specific error pattern in later offline analysis and troubleshooting, the test driver has the option of recording audio comments and camera images along with the regular data during the test drive. In parallel, GPS data can be added to the bus communication for geographic reference. After logging, the data is typically converted on the PC, so that it can be analyzed in other programs such as CANoe, CANalyzer or CANape.

Special Data Loggers for Test Fleets

At first glance, it would seem reasonable to use a notebook-based solution for in-vehicle logging. Using a notebook with a suitable network interface should be able to offer all required capabilities,

since logging functionality can be implemented in software. However, commercially available notebooks cannot handle the required temperature range and the system must first be booted, which takes some time – even with fast notebooks. This implies another requirement for data loggers: short startup times. Data must be acquired quickly enough for the first message on the bus to be logged. All of the noted requirements are fulfilled by special fleet loggers such as devices from Vector’s GL3000/GL4000 logger product line (Figure 1). Their extended temperature range also makes it possible to use them under extreme environmental conditions. These special fleet loggers also have a real-time clock, ensuring clear time references for the acquired data.

Data Processing

To reduce the volume of incoming data, even during the test drive, these loggers allow users start logging only in response to pre-defined events. In triggered logging, data is continually written to a ring buffer, so when the trigger event occurs, this ring memory is closed, and the data is saved. Logging is then resumed in a new ring memory. This method substantially reduces data volumes compared to continual logging. Depending on the configuration of the ring buffer, logged data may be available for a time period before the trigger and possibly for a configurable post-trigger time after the trigger occurs. The ring buffer is usually configured with special software (Figure 2).

The special script language Logger Task Language (LTL) can be used to execute complex logging tasks. This can be illustrated by a simple programming example: Creating a classing table during logging. First, the symbolic signals Speed and Brake from a database

are automatically converted to LTL code. The test engineer only needs to add supplemental code for classing with the CLASSIFY operator:

```
VAR Speed = CAN1 DATA 200h [2 3]
    Brake = CAN1 DATA 100h [3(0)]
CLASSIFY
    MyClassify COUNT (Brake)
        OVER Speed (20 CLASSES OF 10 BASE 0)
```

In this example, the Variable Speed value is defined in km/h over 20 classes, each class has a width of 10 km/h, and 0 km/h is set as the start value of the first class. This yields the following class distribution:

Class	Value range [km/h]
1	0 - 9
2	10 - 19
...	...
19	180 - 189
20	190 -

The data of each classing task is saved in text-based results tables that can easily be read into a program such as MS® Excel for post-editing.



Figure 1: Special data loggers for in-vehicle use are rugged and have practical and effective interfaces.

Summary

Currently, there are many different data loggers on the market. However, only fleet loggers are suitable for the harsh operating conditions in the automotive field. Loggers should offer a wide range of features that cover the majority of requirements for today’s vehicles during test drives. They include a large number of CAN, LIN and FlexRay channels, short start-up times and I/O ports on the logger. UMTS, WLAN, USB and Ethernet offer the necessary flexibility to configure the loggers and transfer the logged data. Fleet data loggers from Vector, with their extended temperature range and durable packaging, equip the test engineer with devices ideally suited for use under extreme environmental conditions.

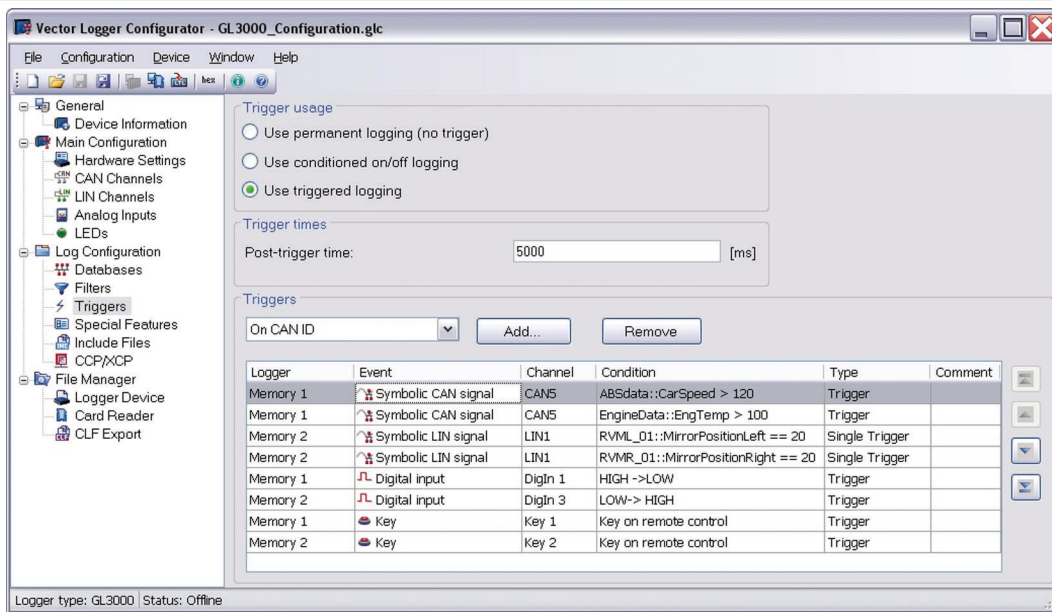


Figure 2:
Trigger configuration in the Vector Logger Configurator



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