

Abstract

Handling Parameter Diversity – Efficient Data-Set Management for Calibrating Powertrain Control Units

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When recall campaigns are conducted in the automotive industry on account of a defective engine control unit, it is very often because control-unit parameters have not been calibrated sufficiently.

State-of-the-art engine control units manage more than 25,000 parameters, including characteristics, maps, control parameters and diagnostic thresholds. These must be calibrated for the various vehicle and engine derivatives within the short two to three-year period available for developing them to the state in which they are ready to enter production. Different development departments focusing on their own particular part of the control unit's software work together until all technical objectives, such as power output, torque, emissions, driving behavior, durability, have been achieved.

This is where it is important not to lose sight of the general picture. Who is responsible for which calibration package? When must it be completed by? What configuration is used for testing data sets, what goes into production? What stage has been reached in completing overall calibration? When and why was a specific label last changed?

This paper discusses ways of using an appropriate database system to ensure that none of the many parameters are accidentally overlooked on the way to production-ready calibration:

A responsibility matrix (RASI approach) is used for defining the calibration engineer in charge of calibrating specific labels and algorithm groups. Calibration engineers enter their calibration data into the database where this information is brought together by the particular project's data-set manager to create official data sets. On combining data sets, a check immediately takes place to establish whether contents overlap, whether responsibilities have been disregarded or derivative differences ignored. The process of data-set generation is automatically documented at this stage. Data sets can only be selected from the database once they have been released, with access being controlled by a project-related user administration system.

Status definition can be used to show the degree to which calibration has been completed. In line with their access rights, all developers involved in a project can see how far calibration has progressed and where action still needs to be taken. Project managers are provided with a number of reporting functions for comparing data sets and generating status reports.

Efficient development processes demand the application of the same calibration strategy for cross-platform calibration activities involving identical components and algorithms (e.g. sensors and actuators). It must be easy to take label-group calibration from one data set and apply it to another. Violation of defined setpoint values, such as the incorrect calibration of diagnostic thresholds, can be prevented by means of label-specific comments.

The paper is underpinned by practical examples from production calibration projects conducted by IAV.