The first CAN networks in BMW cars

Two years after a point-to-point CAN network implementation, BMW introduced in 1995 a CAN network in star topology connecting five electronic control units (ECUs).

(Source: BMW)

BMW used already in 1993 in its 740i/iL model a 500-kbit/s CAN network linking the DME and EGS control units supplied by Bosch. The bus system substituted multiple serial links between these ECUs. This reduced cabling and avoided connection failures. Of course, it saved weight, too.

In 1995, the German automaker equipped its E38 750iL model with a CAN network using a tree/star topology. It connected five ECUs: DME I, DME II, AGS, DCS, and EML. Three years later, the instrument cluster and the steering-angle sensor were added to the CAN network. The 1999 model of the 750iL was the last BMW car using shielded CAN cables. In the next models just twisted-pair cables were implemented. The wire color was uniform throughout the vehicle: CAN-L was GE/BR and CAN_H was GE/SW or GE/RT.
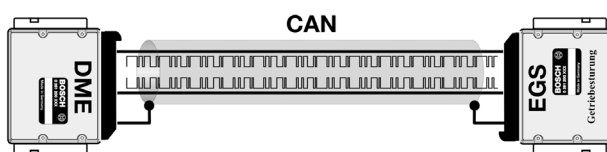
The 120-Ω termination resistors were located in two ECUs between the CAN_H and CAN_L bus-lines. Usually, the resistors were equipped in the ASC/DSC unit and the instrument cluster of the DME unit. Because the two resistors are in parallel, the effective resistance of this termination circuitry is 60 Ω. On some vehicles, there was a jumper wire, which connected two parallel branches together; others had an internal connection at the instrument cluster.
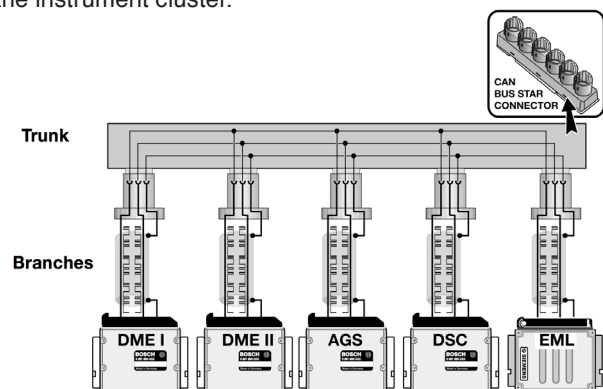

Figure 1: The 740i/iL model from 1993 was equipped with two CAN-connectable ECUs (Source: BMW)

Figure 2: The E38 740iL model from 1995 connected five ECUs to the CAN network (Source: BMW)
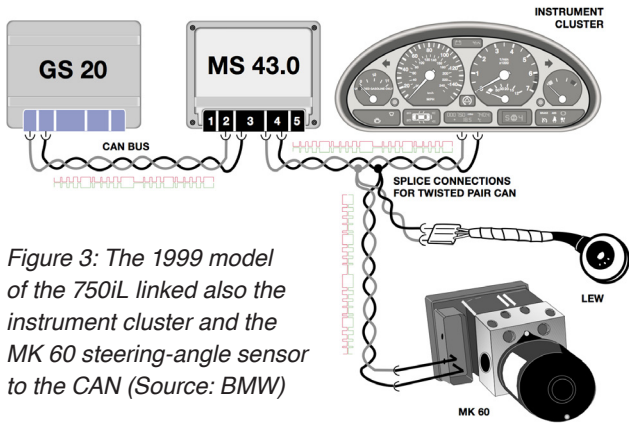
Figure 3: The 1999 model of the 750iL linked also the instrument cluster and the MK 60 steering-angle sensor to the CAN (Source: BMW)
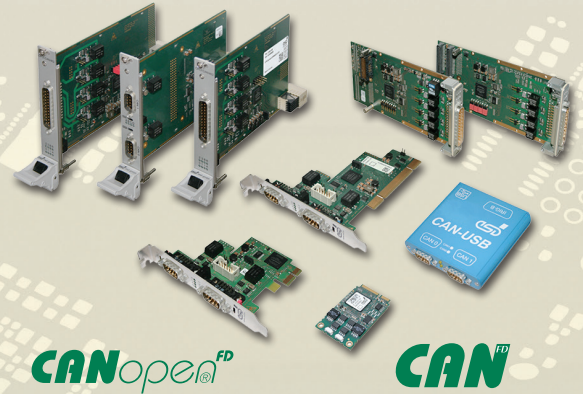
CAN trouble-shooting was a challenge

In the early days of CAN, network trouble-shooting was something new, challenging the repair and maintenance staff. It was done using ohmmeters, voltmeters, and oscilloscopes. Most challenging were sporadic failures. They could be caused due to slowly dropping battery voltage or by a discharged vehicle battery.

A quick check was done by looking to the instrument cluster, whether the shown tachometer and engine temperature values were plausible. Other indicators could be the transmission range or the DSC light. This gave some clues to the communication status of these ECUs. There was also a test module, which could be linked via CAN to the disconnected ECU. Additionally, some ECUs provided a D-Bus (Diagnosis Bus) interface. It was a point-to-point serial bus system running at 9,6 kbit/s, which kinked the tester and the ECU. ◄

Holger Zeltwanger