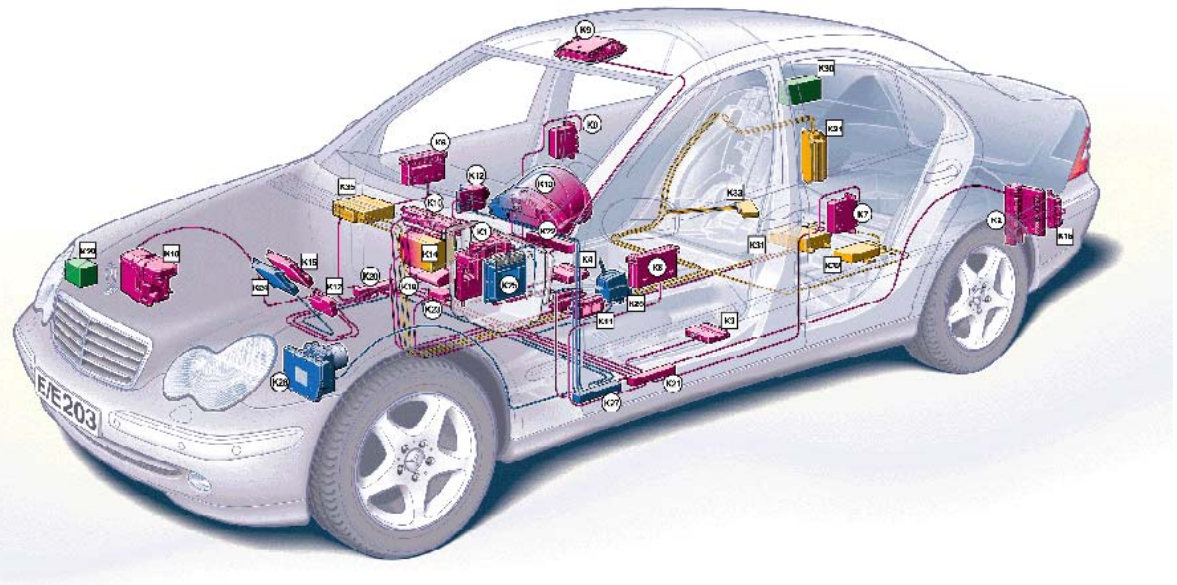




Controller Area Network CAN



P00.19-2321-71

Objectives

- Explain advantages of CAN networks
- Explain how CAN networks operate
- Describe location of CAN connectors
- Explain CAN diagnosis techniques
- Provide reference information on other models
(reference section at back of handout)



What is a CAN System?

A CAN system is:

- A digital communication link between multiple Electronic Control Modules (ECM)
- A 2 wire, bi-directional communication link with data transmitted according to priority
- Message specific addressing

Advantages

- Cost
- Improved immunity to electrical interference
- Fewer connectors
- Fewer pins on control modules
- Weight savings
- Fewer sensors
- Improved diagnosis facilities
- Rapid transmission rates

Types of CAN Communication

Mercedes-Benz uses several CAN networks. Depending on model and year the following may be used.

CAN C - Engine CAN (*also known as chassis CAN*)

Fast communication speeds 125 kbps or 500 kbps

CAN B - Interior CAN (*also known as body CAN*)

Communication speed 83 kbps

Information from CAN C can be sent to control modules on the CAN B or vice versa via the Electronic Ignition Switch (EIS). The EIS is the only control module* that can transfer the messages and is known as the gateway.

Without CAN

Coolant sensor 1

Coolant sensor 2

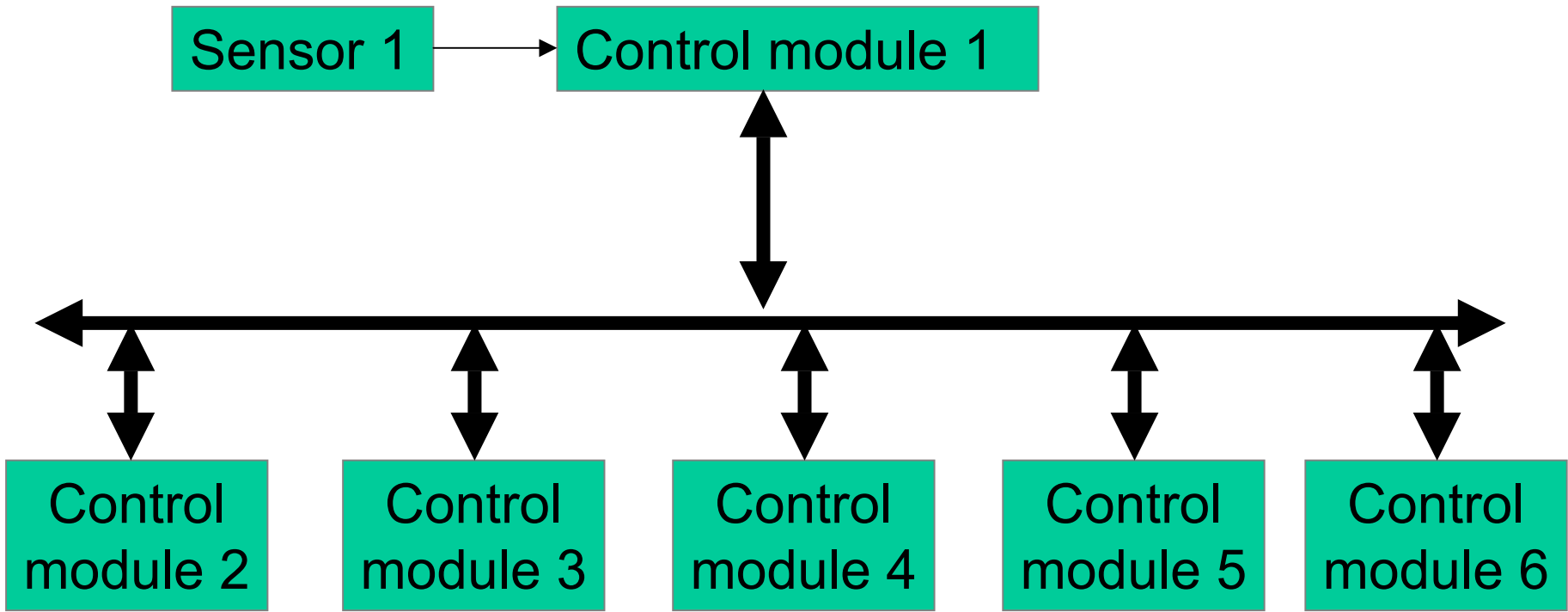
Coolant sensor 3

Control module 1
(e.g. fuel system)

Control module 2
(e.g. climate control)

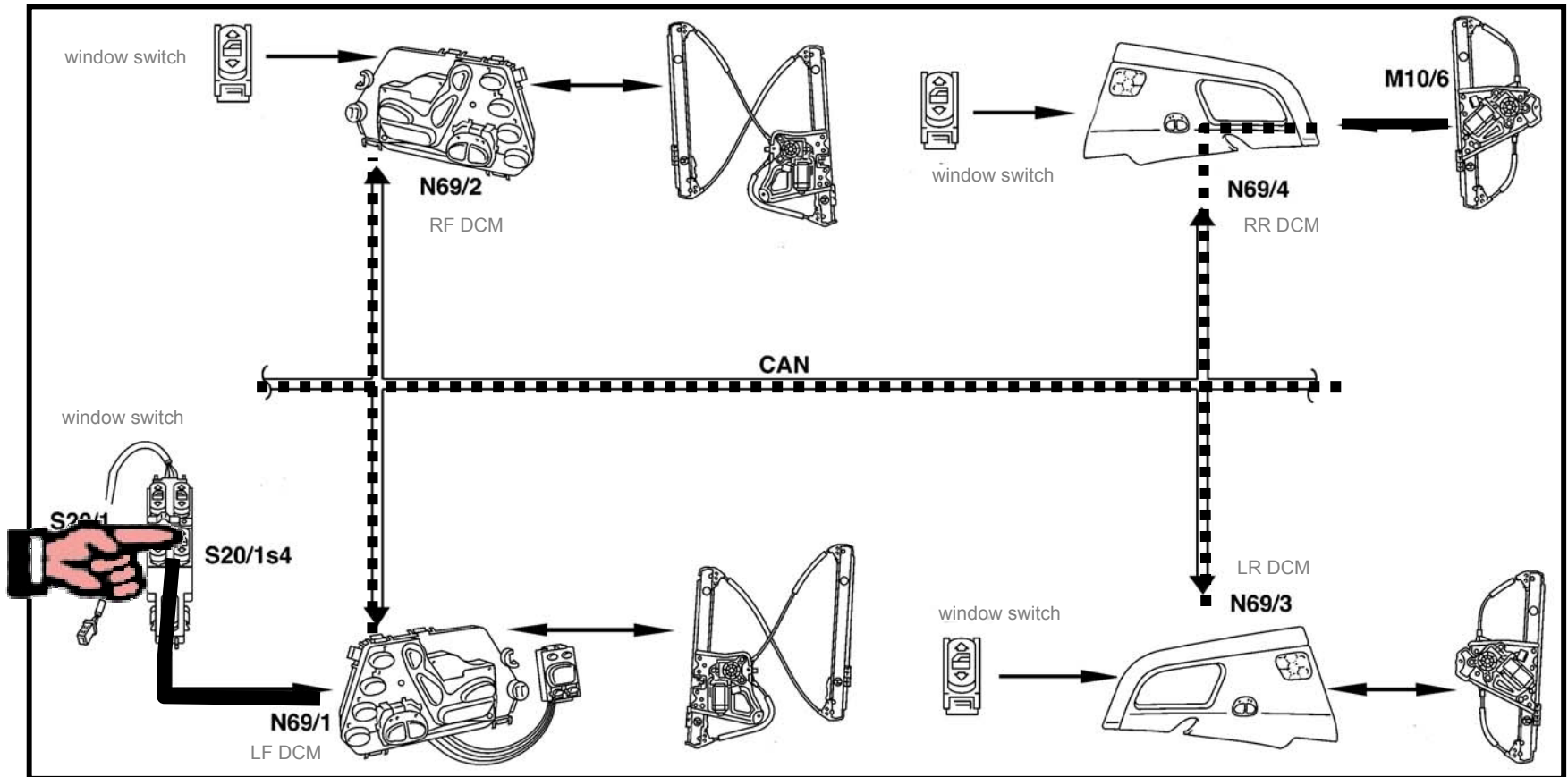
Control module 3
(e.g. ignition)

CAN Bus



CAN B Example

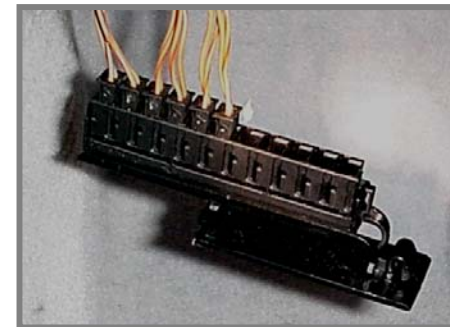
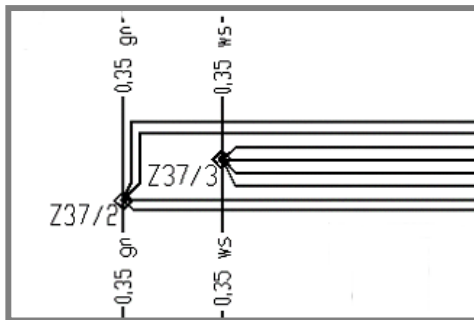
Controlling R.R. window from L.F. door



CAN High & Low

The CAN wiring consist of 2 wires called CAN High (CAN H) and CAN Low (CAN L).

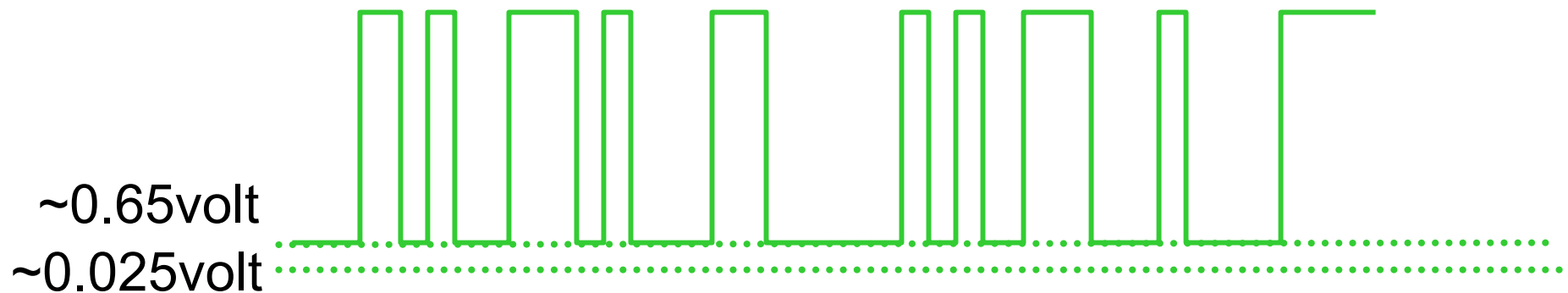
All the control modules are connected in a parallel circuit using either Z splices or plug connector blocks (X30/_).



For the remainder of this presentation and shop modules, we will concentrate on the CAN B network as used in W203 / W220).

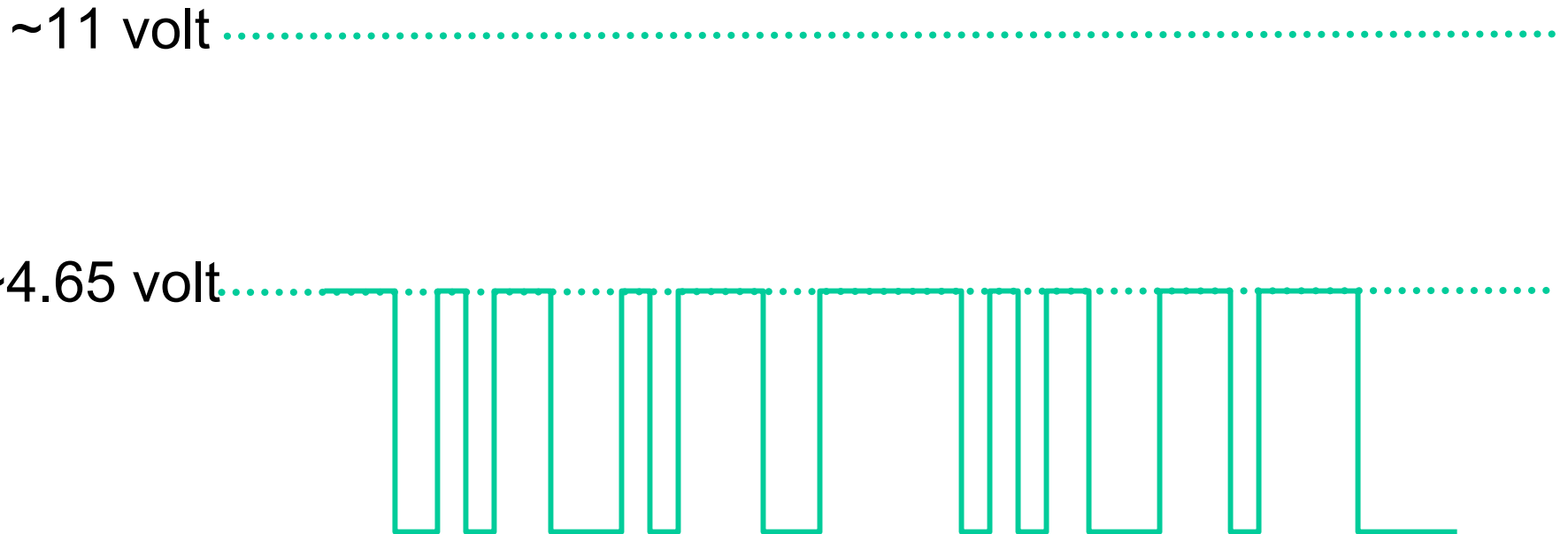
CAN H

- CAN-H has a voltage of approx. 0.025 volts when dormant
- Rises to base voltage of 0.65 volts when communicating
- Data seen as voltage levels going “high”

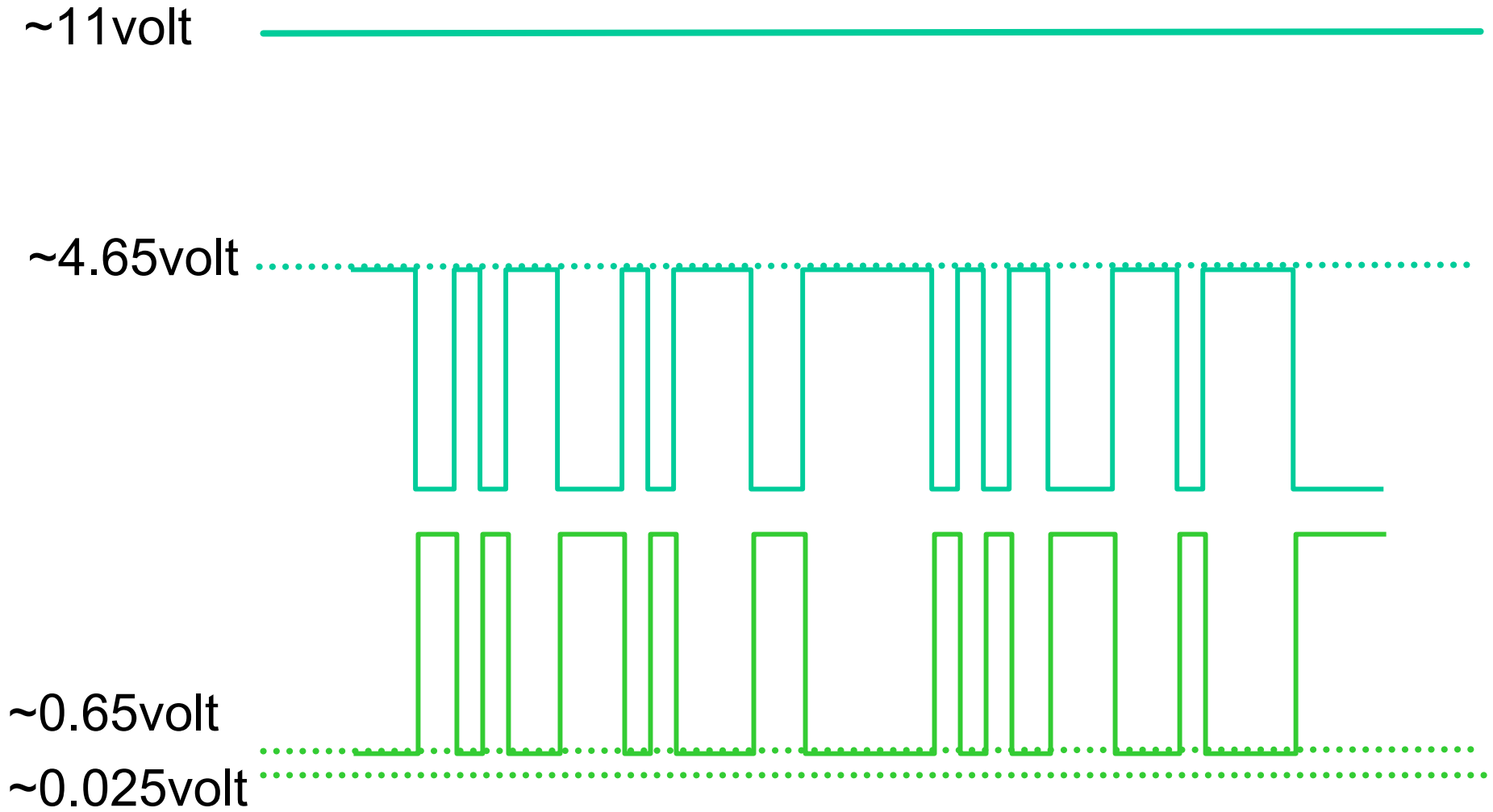


CAN L

- CAN-L has a voltage of 11.0 volts dormant
- Base voltage drops to 4.65 volts when active
- Data seen as voltage level going “low”

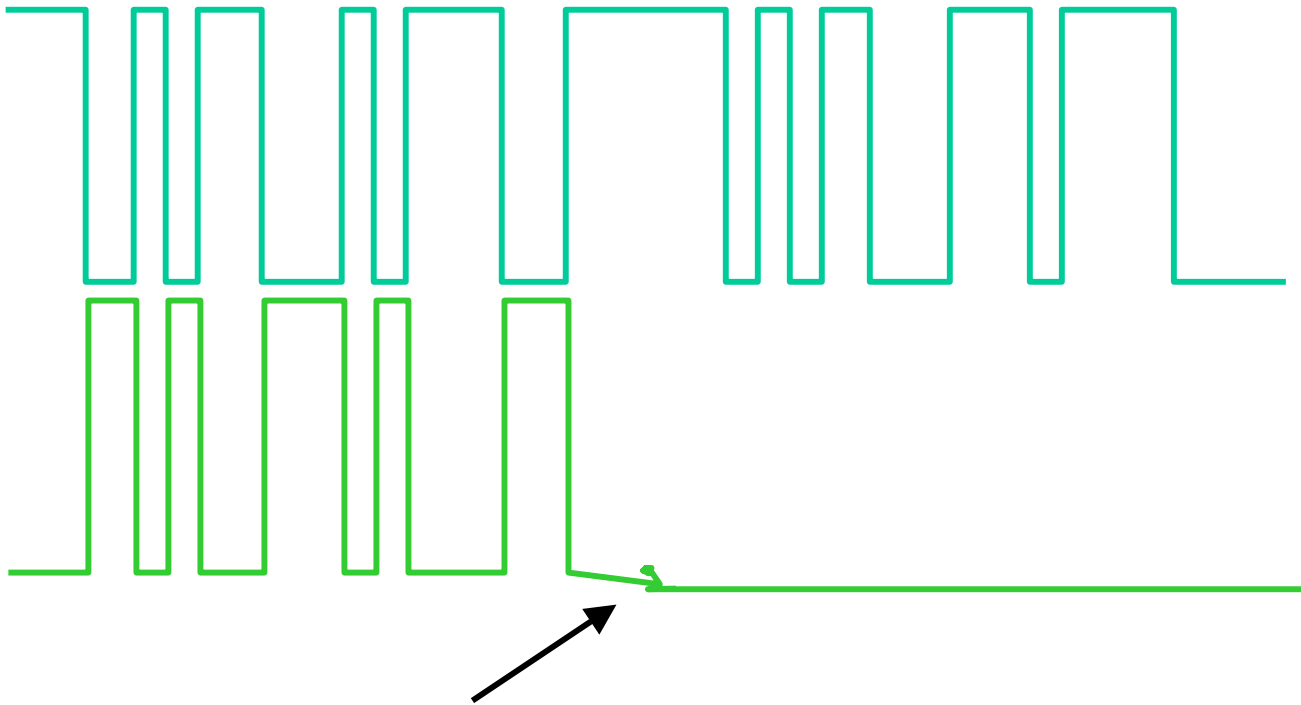


CAN B High & Low



Safety Concept

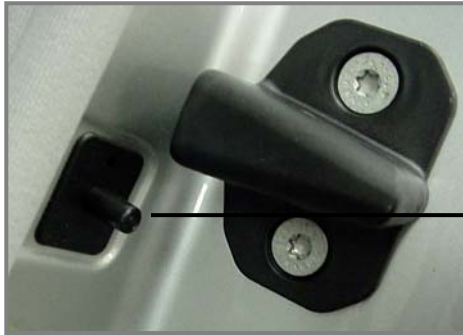
CAN L still communicates (single line operation)



CAN H shorted to ground, cannot communicate

Wake-up Signal

Door switch



Rear SAM



EIS

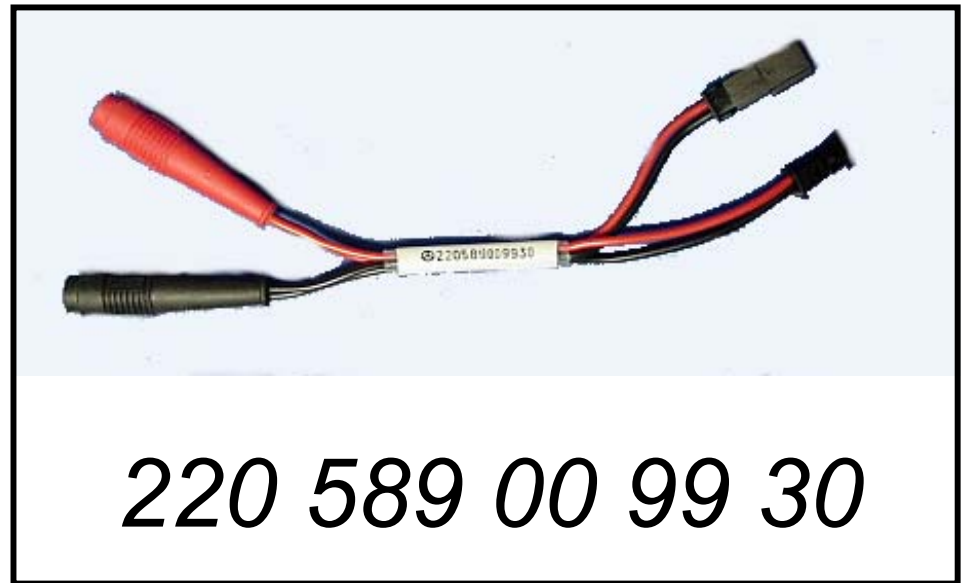


N70 (Overhead Control Panel)

- EIS is the master of the CAN
- EIS wakes up the control modules on the CAN

Tools For Diagnosing CAN B

- Ohm meter
- Volt meter
- Oscilloscope
- CAN B test harness
- SDS
- WIS

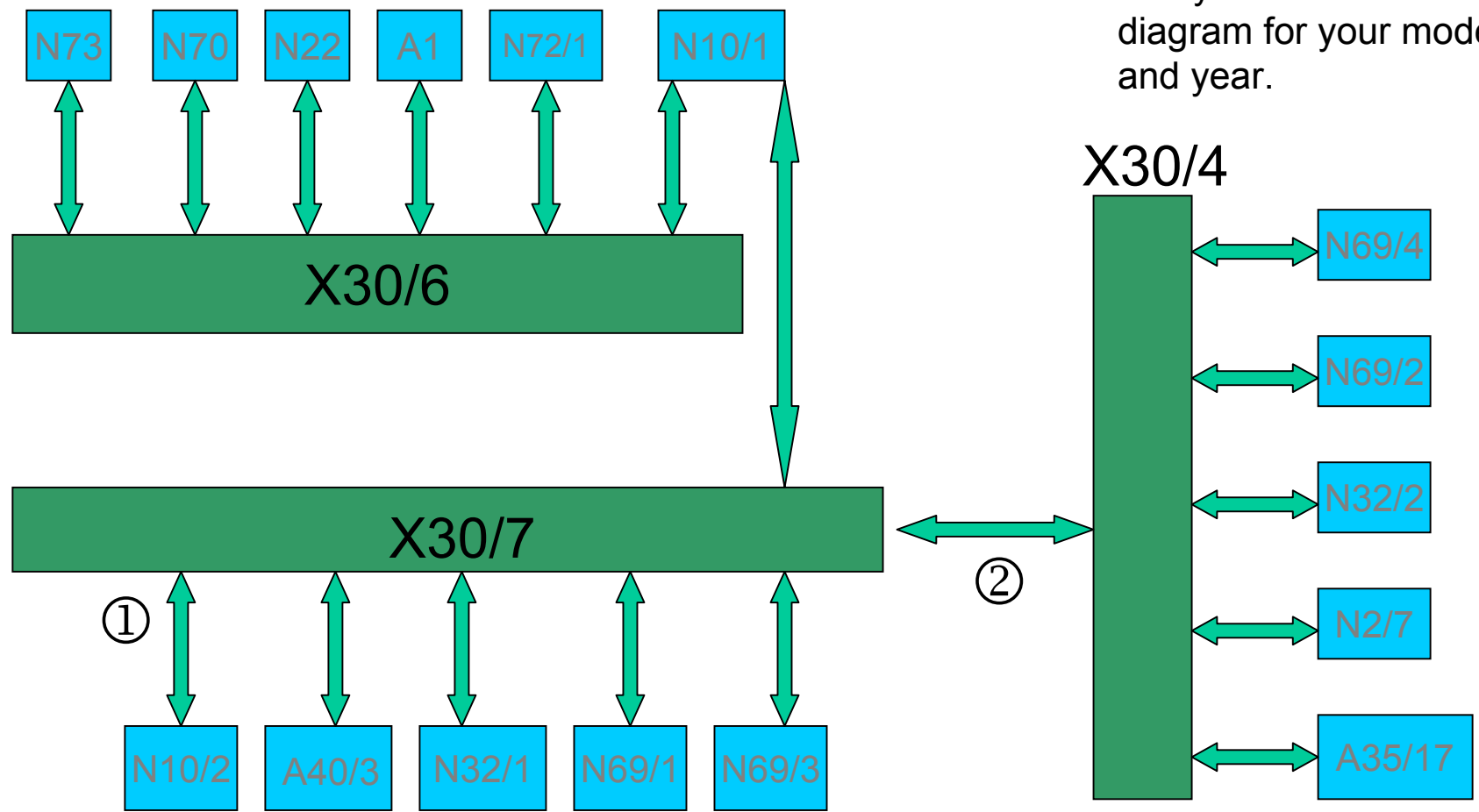


Note: The red lead is not always the CAN H



W203 CAN B (MY 2001)

via N10/1



Note: Always refer to the wiring diagram for your model and year.

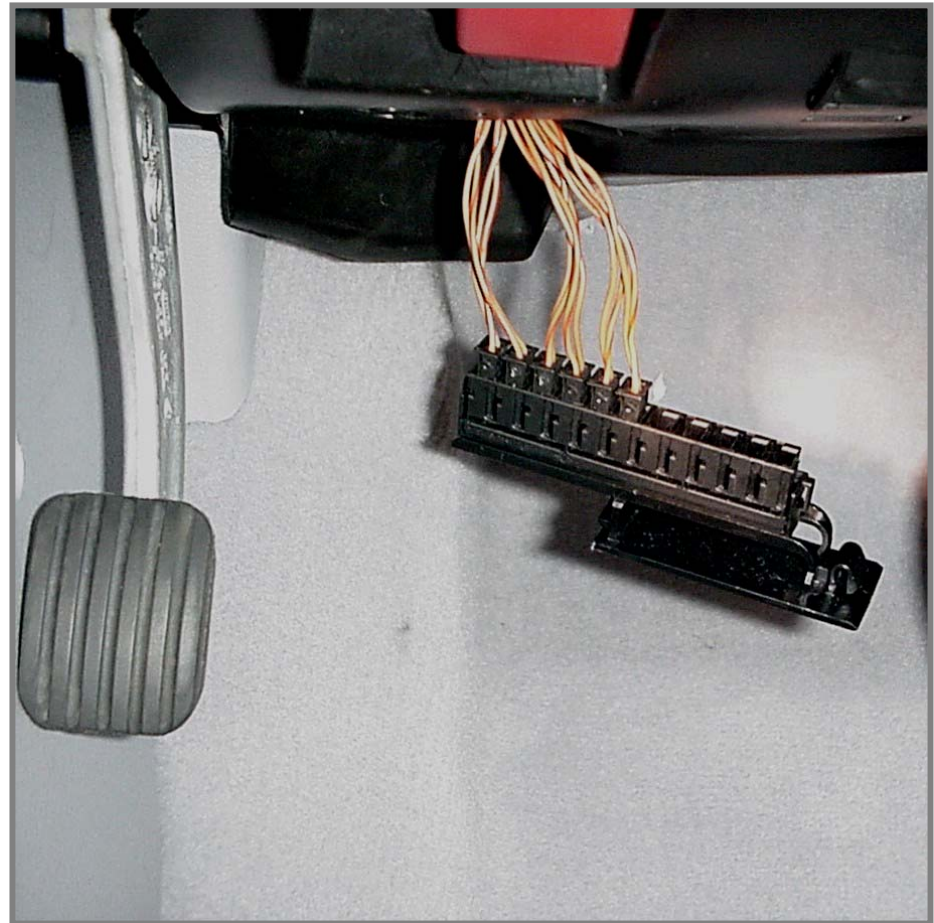
① early	late
GN/WT	RD
GN	BN

②
BN/BK
BN

CAN H wires are BN/RD
CAN L wires are BN
except where indicated

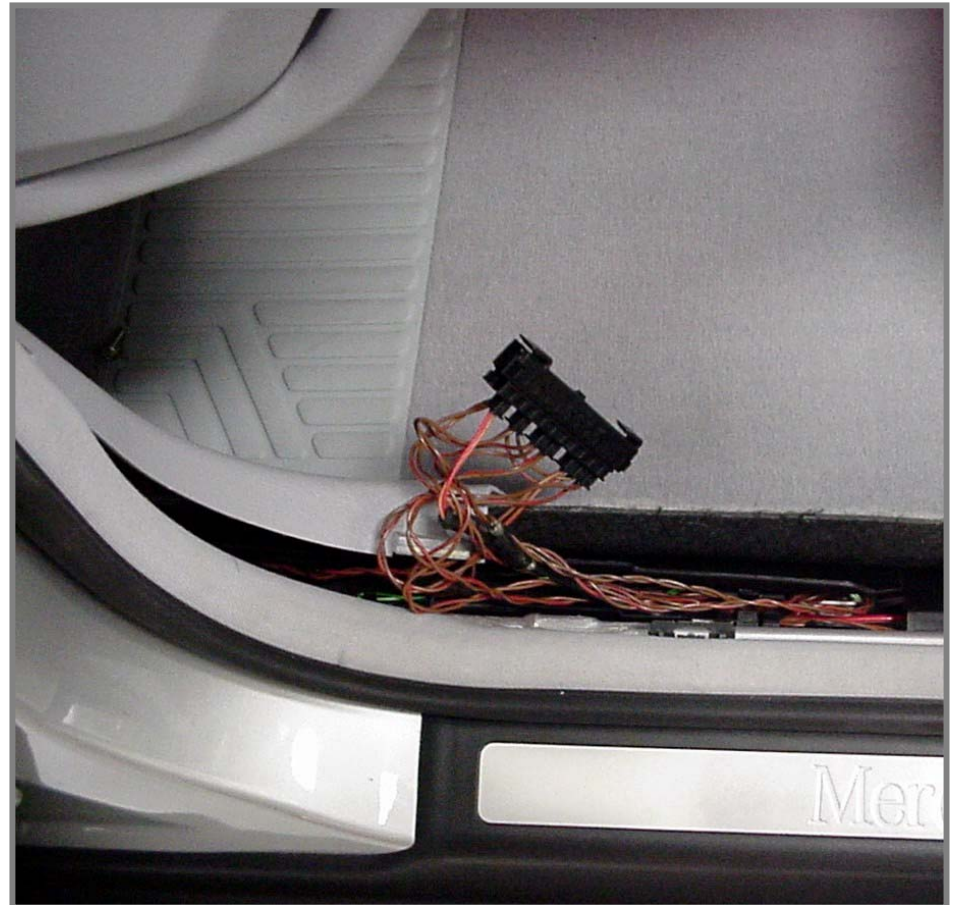
W203 CAN B Connector X30/6

- N73 - EIS
- N72/1 - UCP
- A1 - ICM
- N22 - AAC
- N70 - OCP
- N10/1 - Front SAM



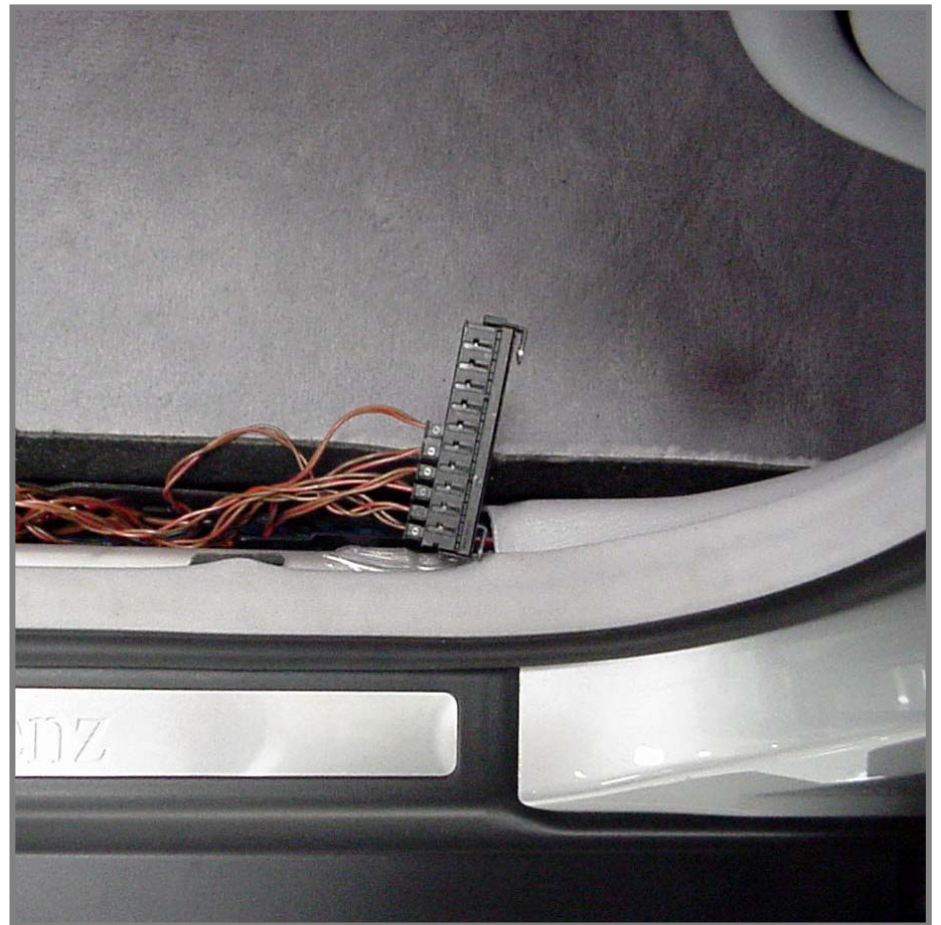
W203 CAN B Connector X30/7

- N10/1 - Front SAM
- A40/3 - COMAND
- A2 - Radio
- N69/1 - DCM-FL
- N69/3 - DCM-RL
- N10/2 - Rear SAM
- N32/1 - ESA-FL



W203 CAN B Connector X30/4

- N69/2 - DCM-FR
- N69/4 - DCM-RR
- N2/7 - SRS
- A35/17 - TELE AID
- N32/2 - ESA-FR



CAN B Malfunctions

- Shorted CAN B
- Constantly active CAN B
- Incorrect version coding

Shorted CAN B

When both the High and Low CAN B are shorted to ground or positive no communication is possible between control units.

This can happen if:

- a. Control unit shorted
- b. Wiring harness shorted

How could we determine if the CAN B is shorted?

- a. Monitor CAN B voltage out of EIS
- b. Monitor CAN B oscilloscope pattern out of EIS
- c. Monitor the DAS (SDS)

Constantly Active CAN B

CAN B needs to go into a dormant state when the ignition switch is in the 0 position. EIS is the control unit in charge of activation and deactivation of the CAN B.

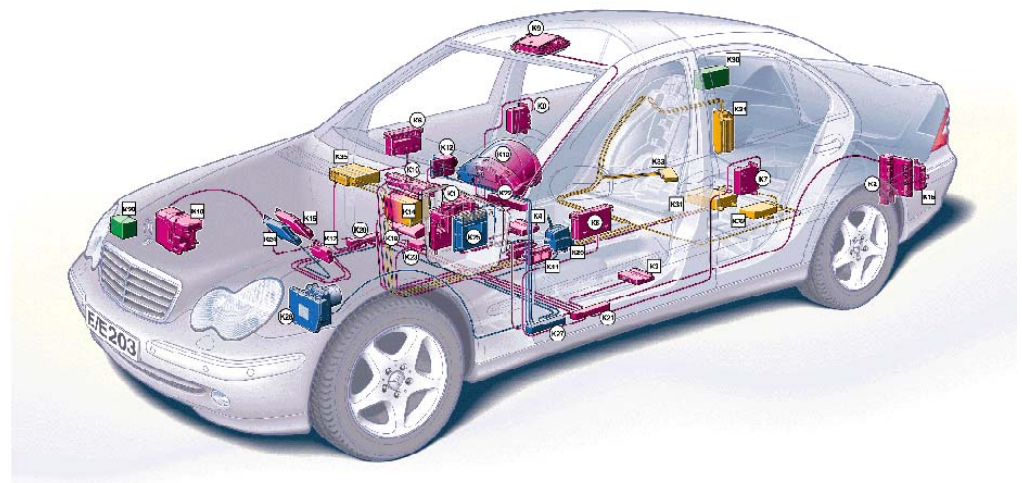
If a control unit in the CAN B keeps sending a signal the EIS will not request the CAN B to go into a dormant state.

How can we determine if the CAN B has not gone into a dormant state?

- a. Monitor CAN B activity with an oscilloscope
- b. Monitor CAN B voltage

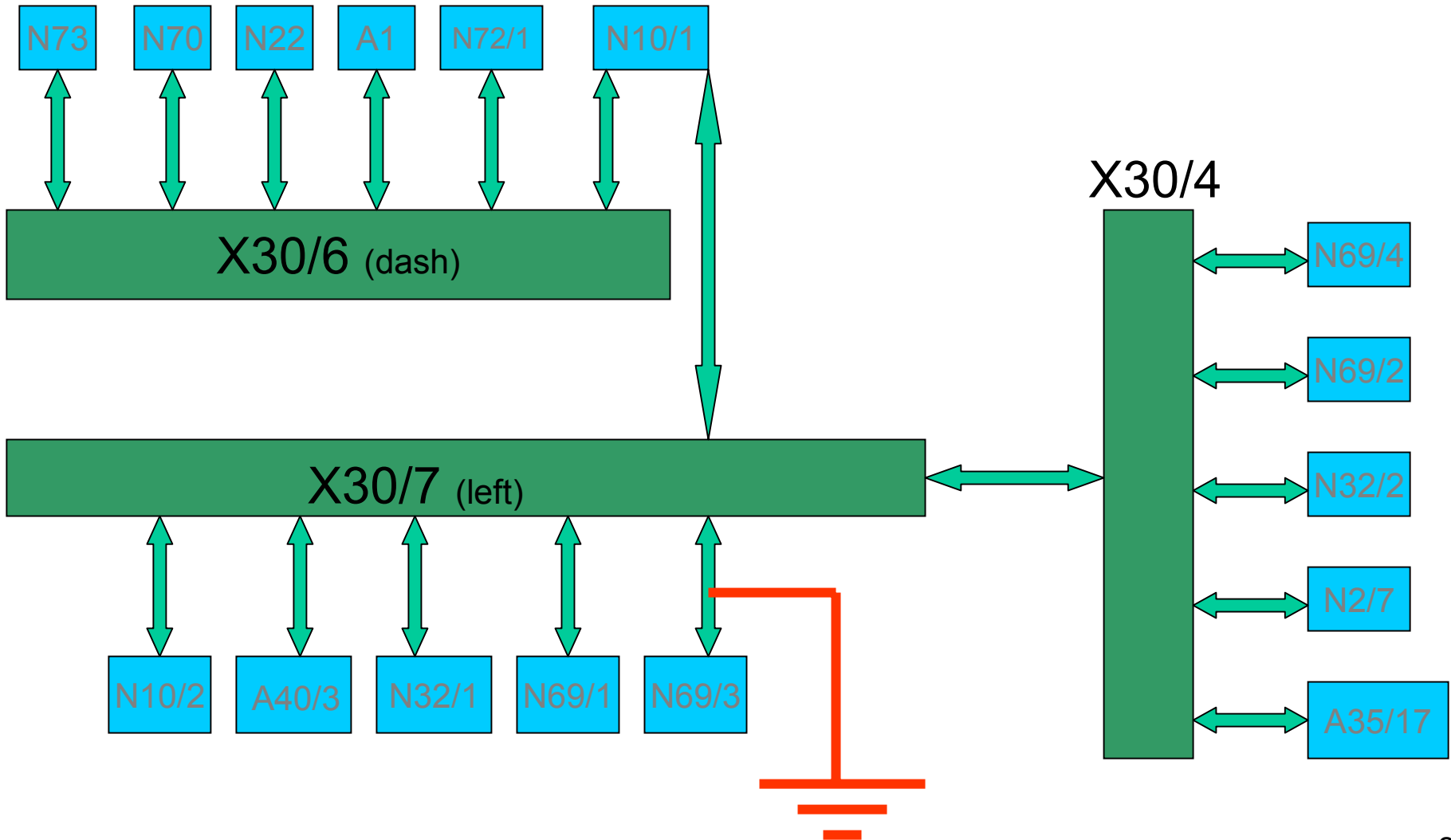
Diagnostic Exercise For CAN B

The following diagnostic exercise involves a W203 with a shorted control unit.

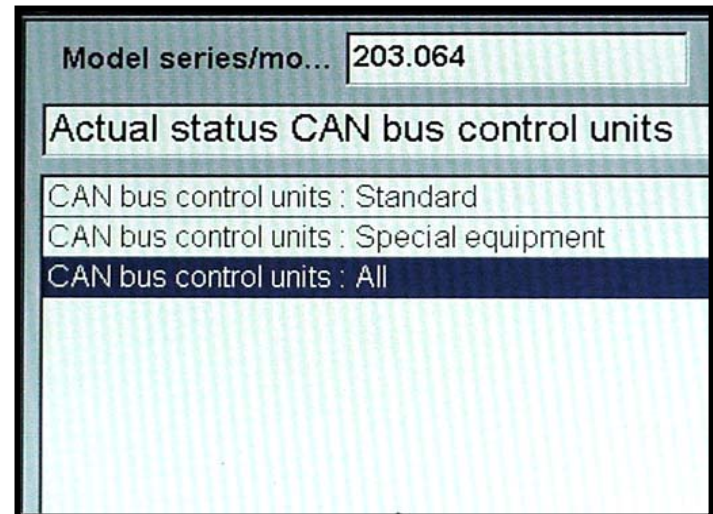
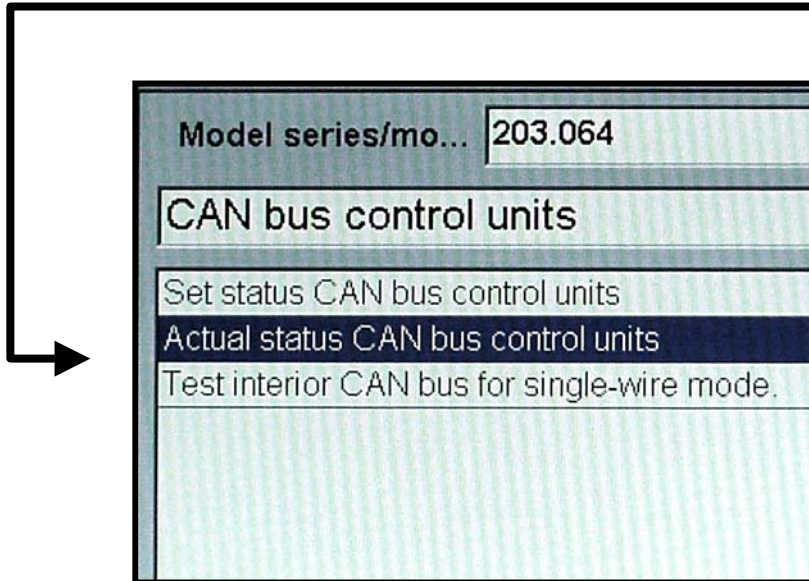
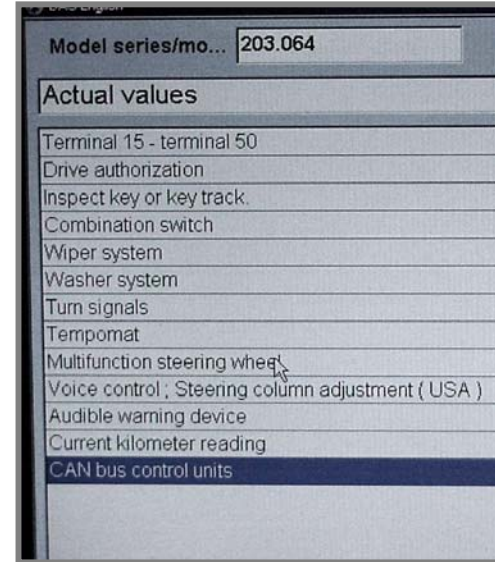
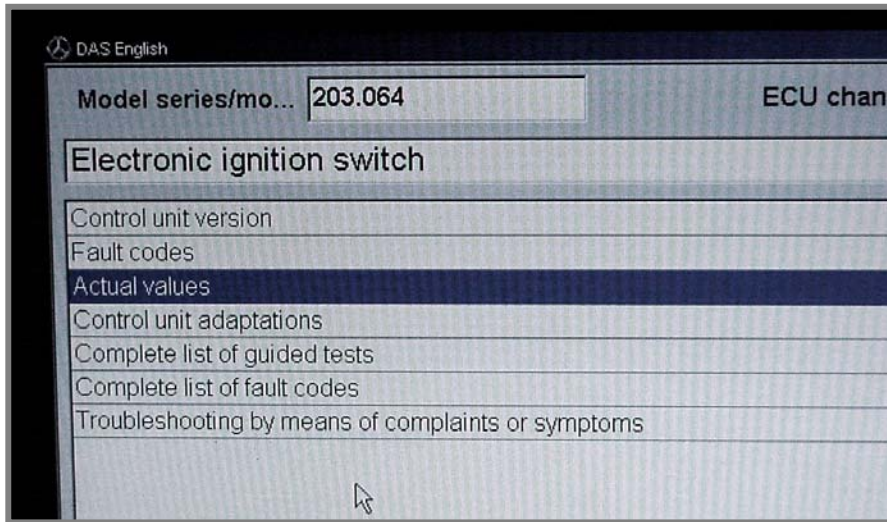


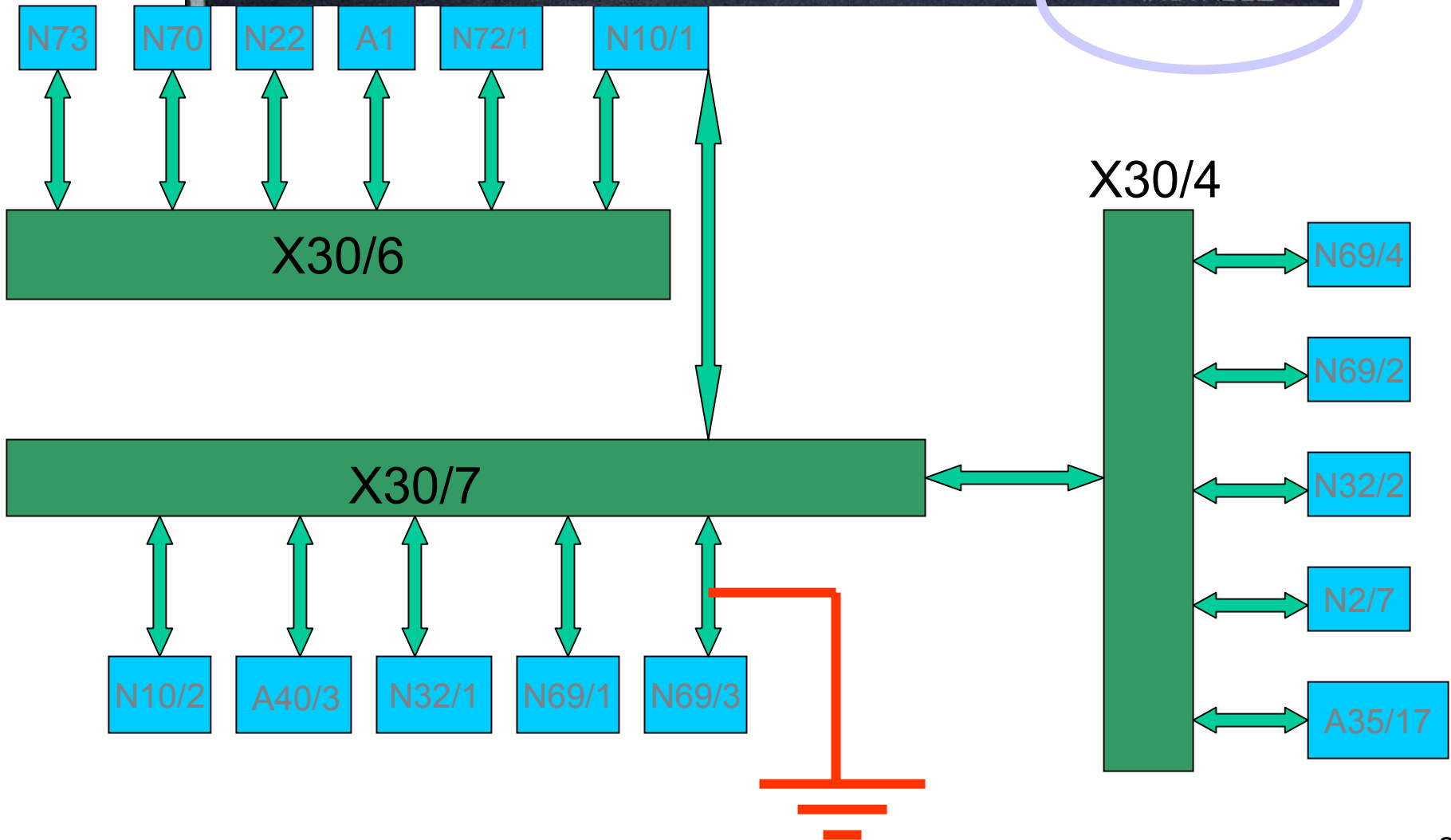
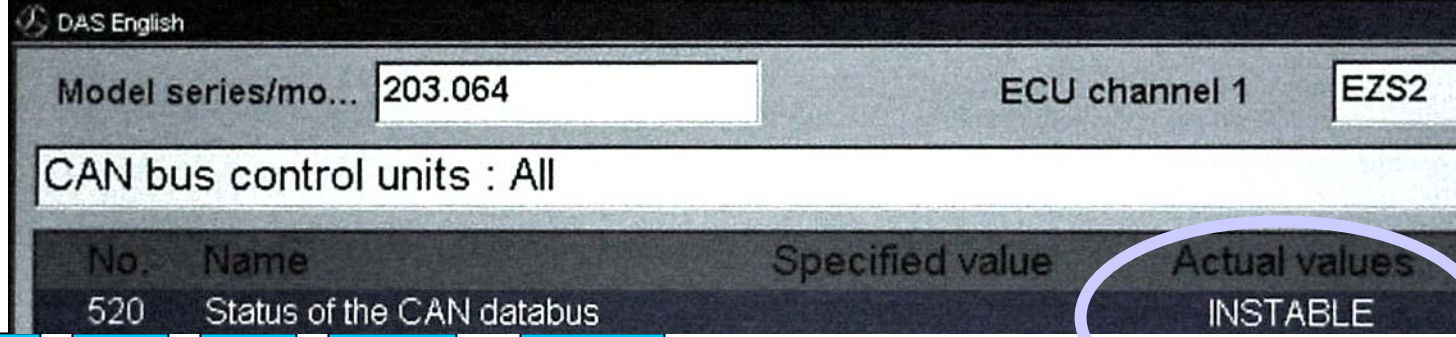
P00.19-2321-7f

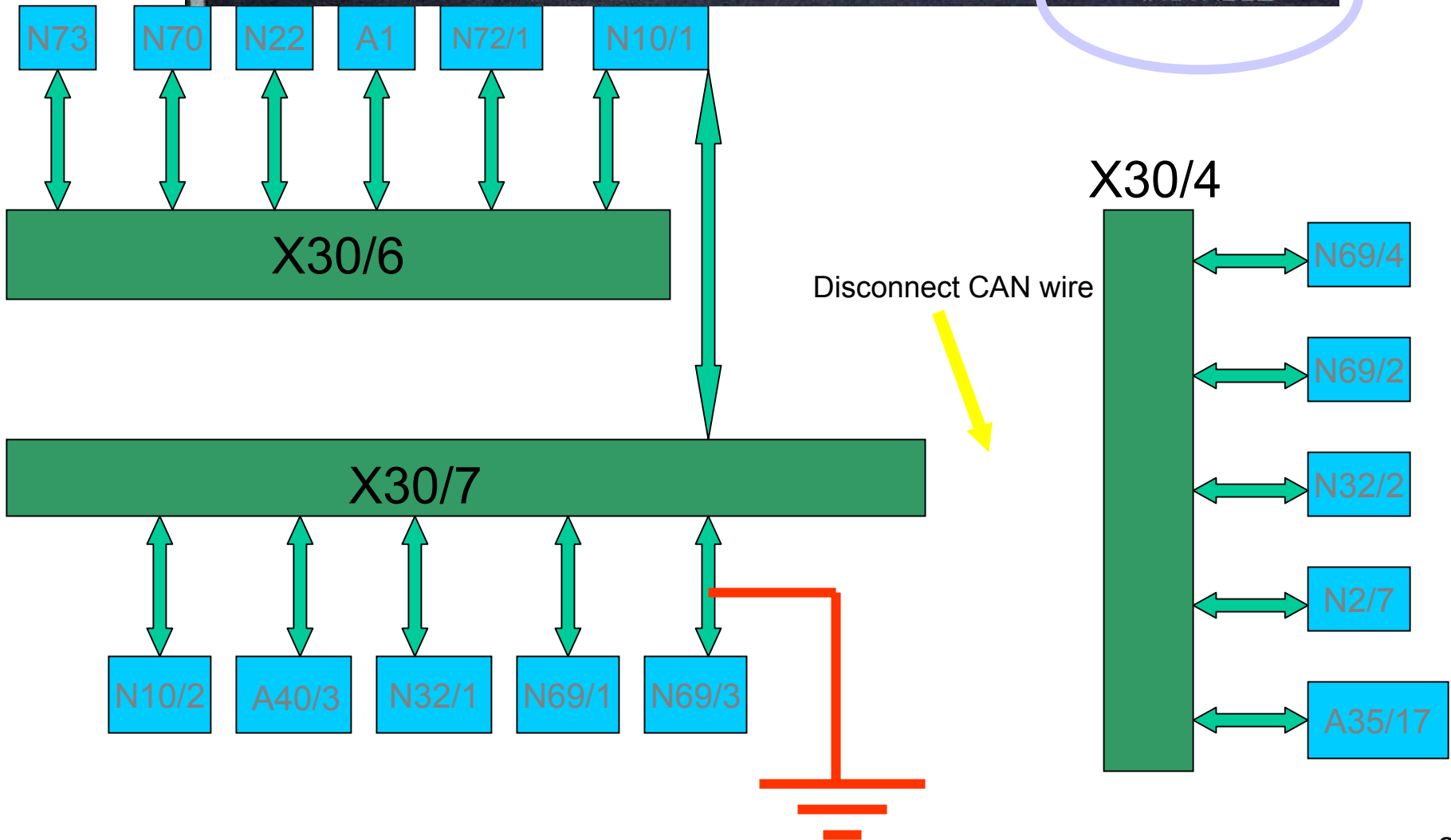
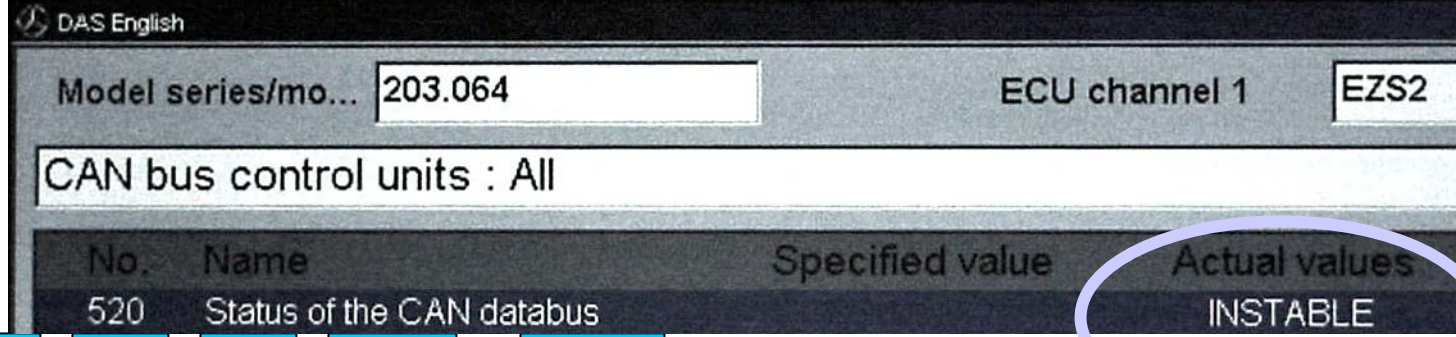
W203 CAN B



Diagnostic Exercise For CAN B





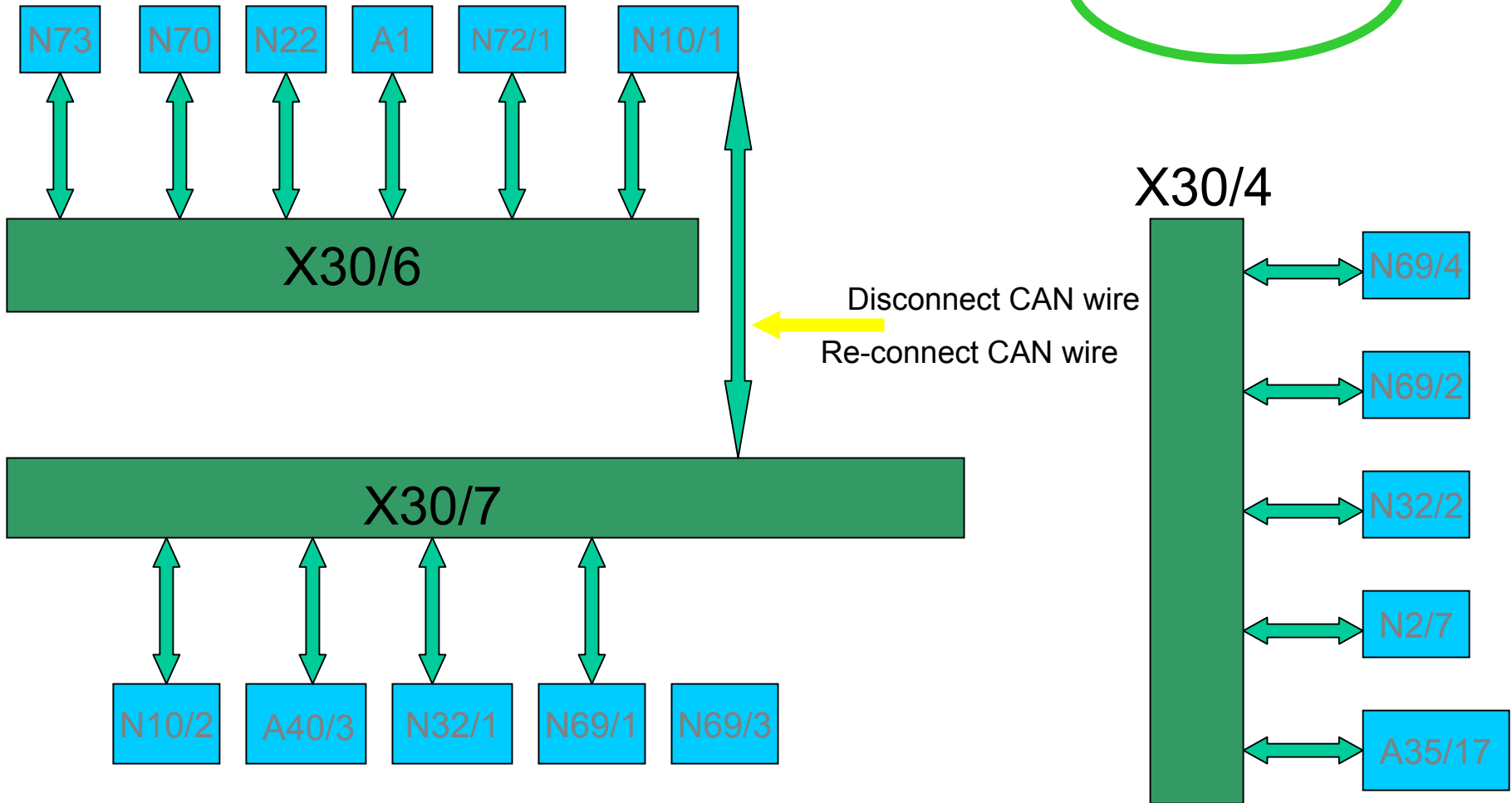


DAS English

Model series/mo... 203.064 ECU channel 1 EZS2

CAN bus control units : All

No.	Name	Specified value	Actual values
520	Status of the CAN databus		STABLE



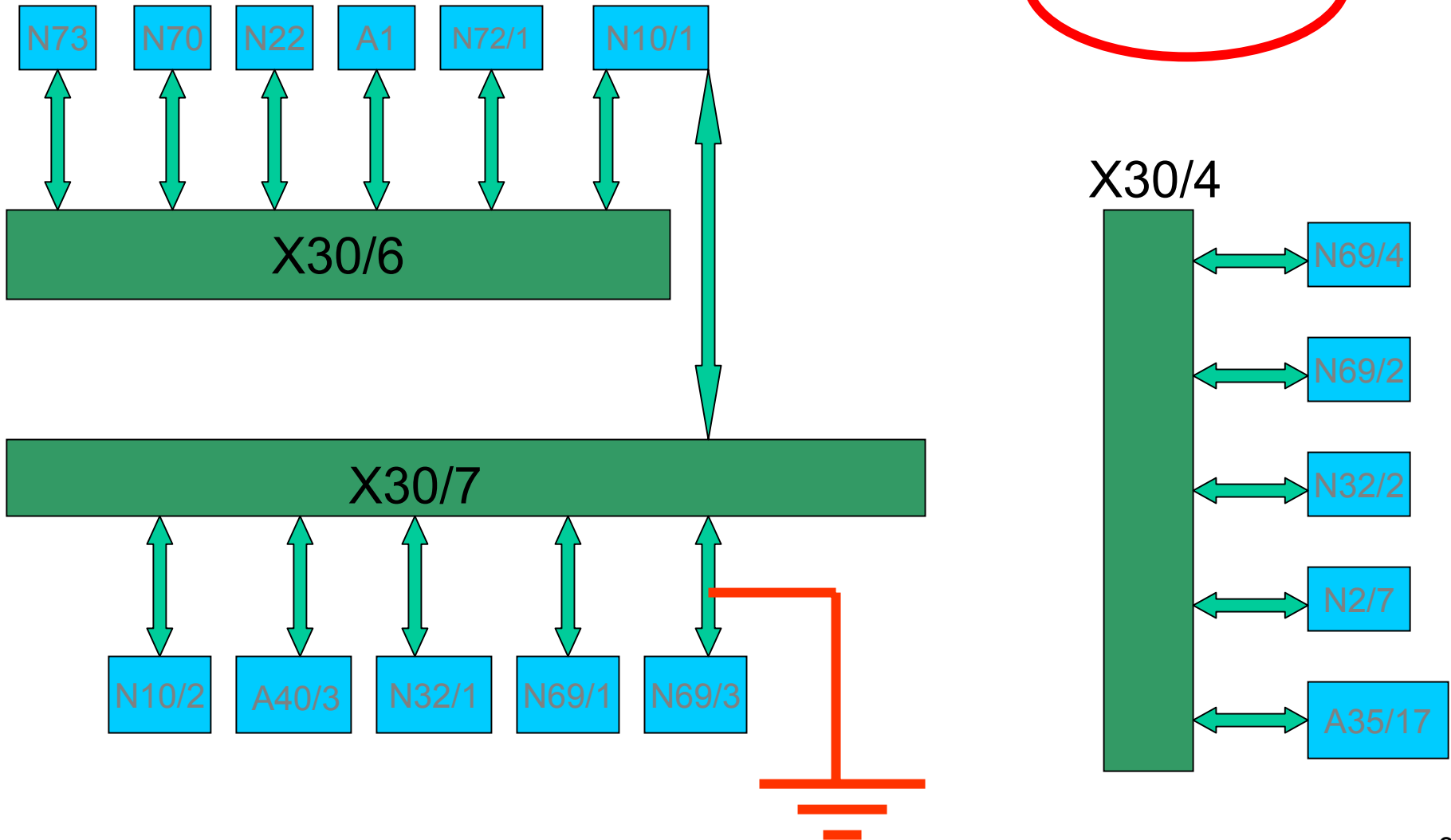
Re-connect CAN wires until network instable again

DAS English

Model series/mo... 203.064 ECU channel 1 EZS2

CAN bus control units : All

No.	Name	Specified value	Actual values
520	Status of the CAN databus		INSTABLE

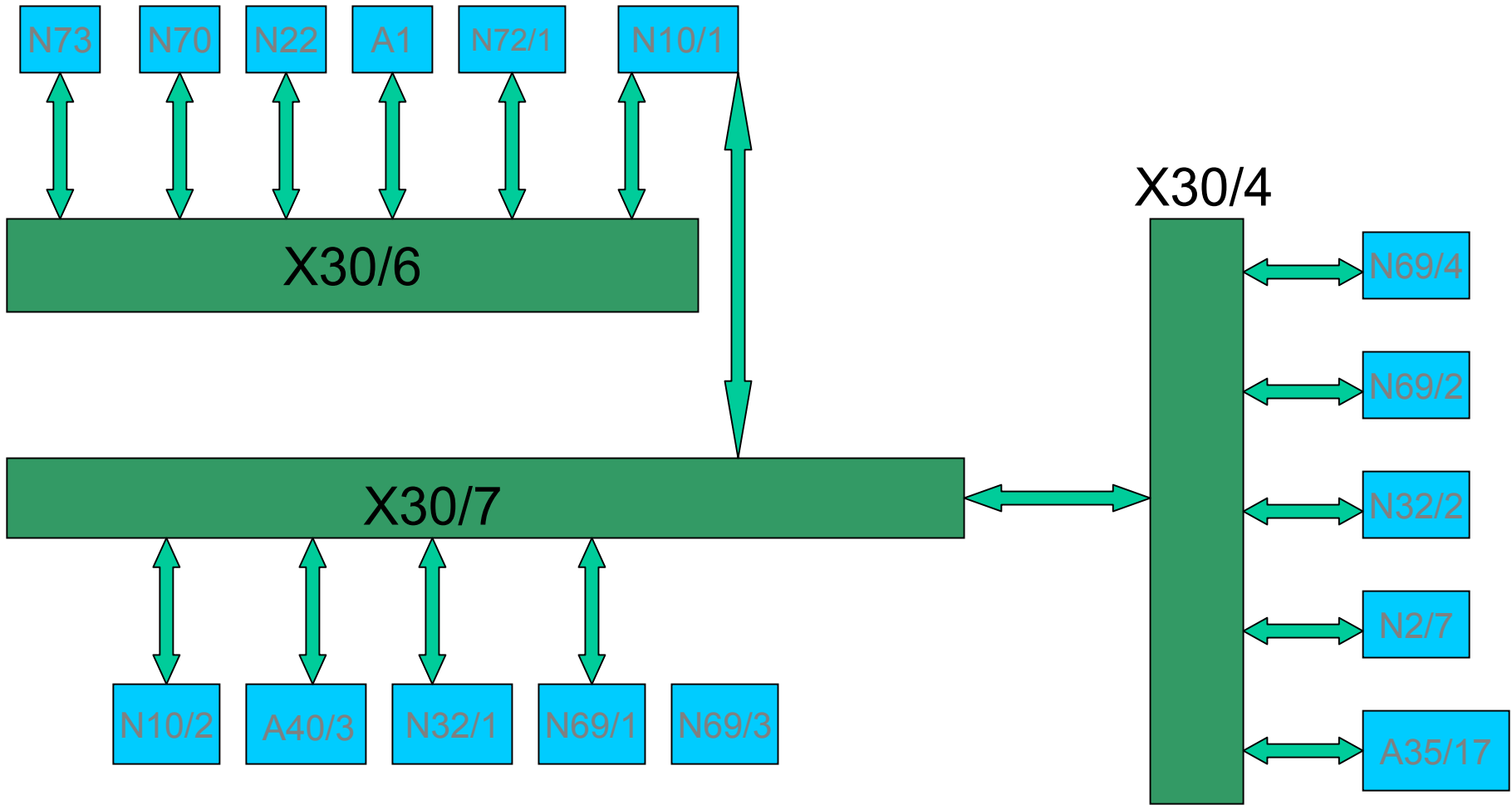


DAS English

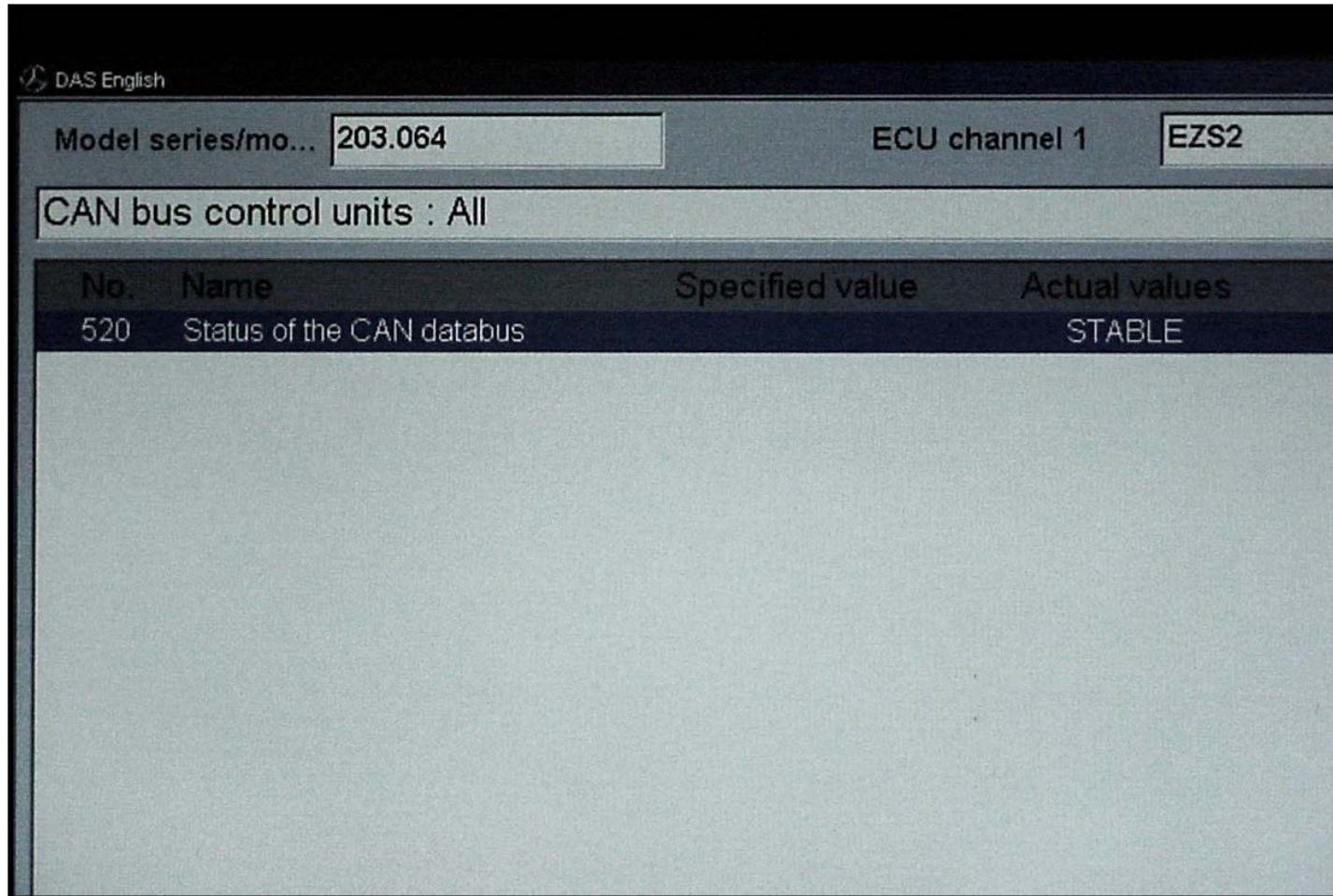
Model series/mo... 203.064 ECU channel 1 EZS2

CAN bus control units : All

No.	Name	Specified value	Actual values
520	Status of the CAN databus		STABLE



Diagnostic Exercise For CAN B



Press the F2 key for a list of control units that the EIS can communicate with

Diagnostic Exercise For CAN B

DAS English

Model series/mo... 203.064 ECU channel 1 EZS2

CAN bus control units : All

No.	Name	Specified value	Actual values
093	CAN communication with control module Keyless Go	✓	-//-, NOT FITTED or FAULTY
094	CAN communication with control module TPC	✓	-//-, NOT FITTED or FAULTY
095	CAN communication with control module STH	✓	-//-, NOT FITTED or FAULTY
096	CAN communication with control module TELE AID or E-Call	✓	✓
076	CAN communication with control module SVMCM	✓	-//-, NOT FITTED or FAULTY
099	CAN communication with control module LCP	✓	-//-, NOT FITTED or FAULTY
079	CAN communication with control module DCM-RL	✓	-//-, NOT FITTED or FAULTY

Reference Materials for Further Reading

WIS documents :

GF00.19-P-0001PP	Extended vehicle network function
SN00.19-P-0004GH	Complete networking (163 as of 9/01)
GF54.00-P-0004A	Data bus system function
GF54.00-P-0005A	CAN data bus, function
GF54.00-P-0005-01A	CAN data bus data telegram
GF54.00-P-0005-02A	CAN data bus specification
GF54.00-P-0005-04A	CAN data bus applications
GF54.00-P-0999ZZ	CAN data bus, contents, function description

Additional Information for Other Models



CAN B Voltages W203, C215 & W220

- CAN H active: 0.65V, dormant: 0.025V
- CAN L active: 4.65V, dormant: 11.0V

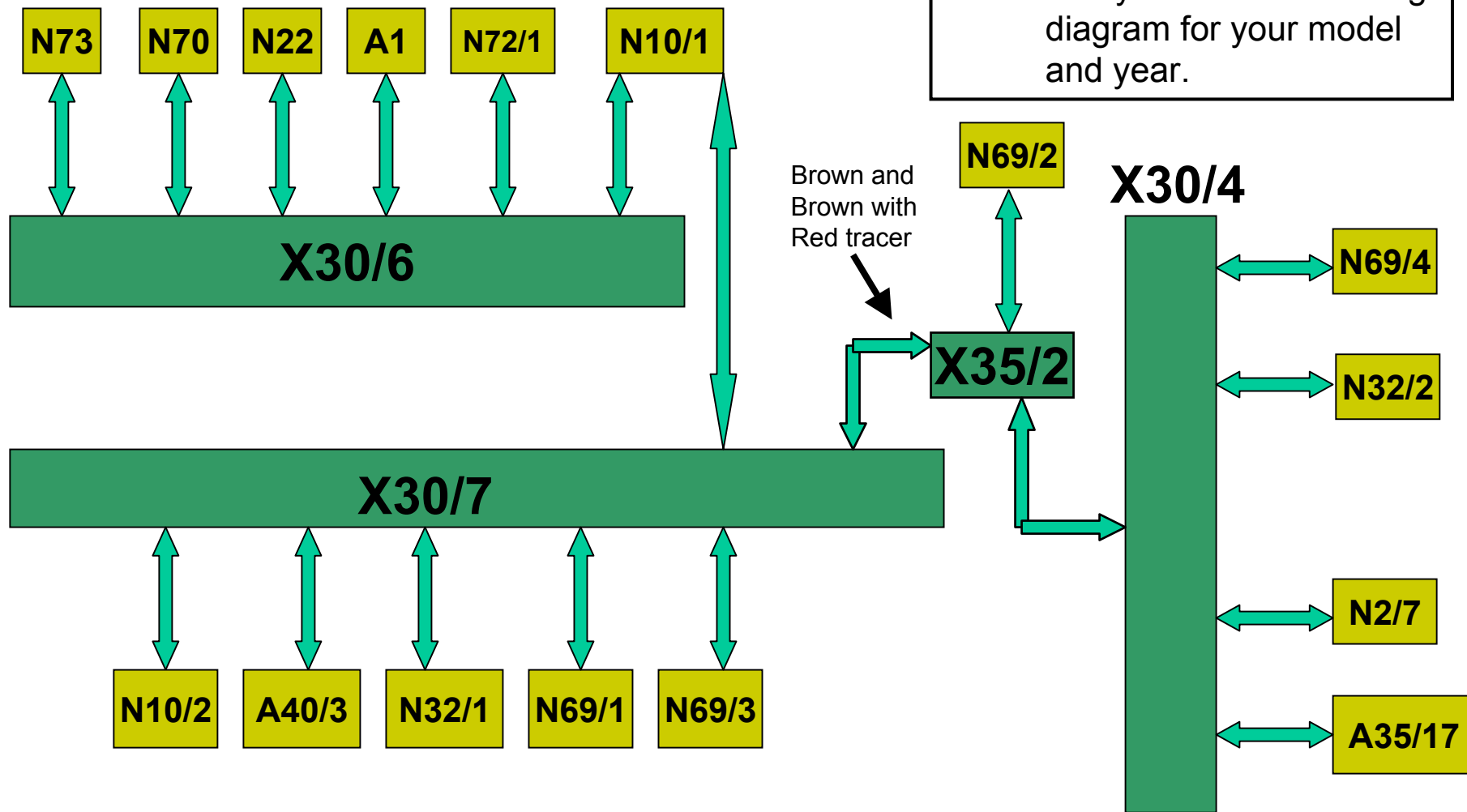
CAN B Voltages W202, C208 & W210

- CAN H active: 1.8V, dormant 0.025V
- CAN L active: 3.2V, dormant 4.8V

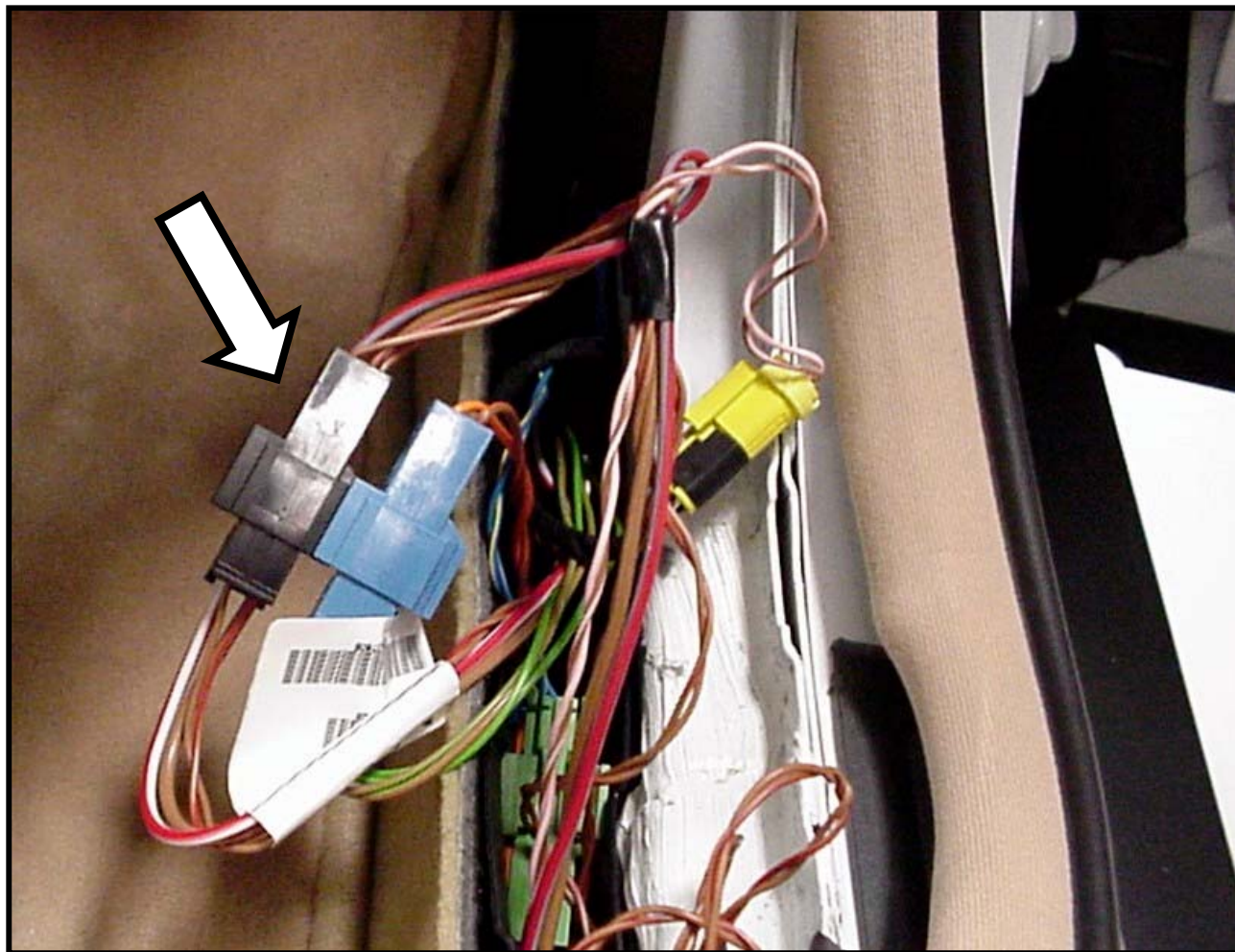
CAN B on W203 with connector X35/2

(Vehicles from approx. 06/02)

Note: Always refer to the wiring diagram for your model and year.



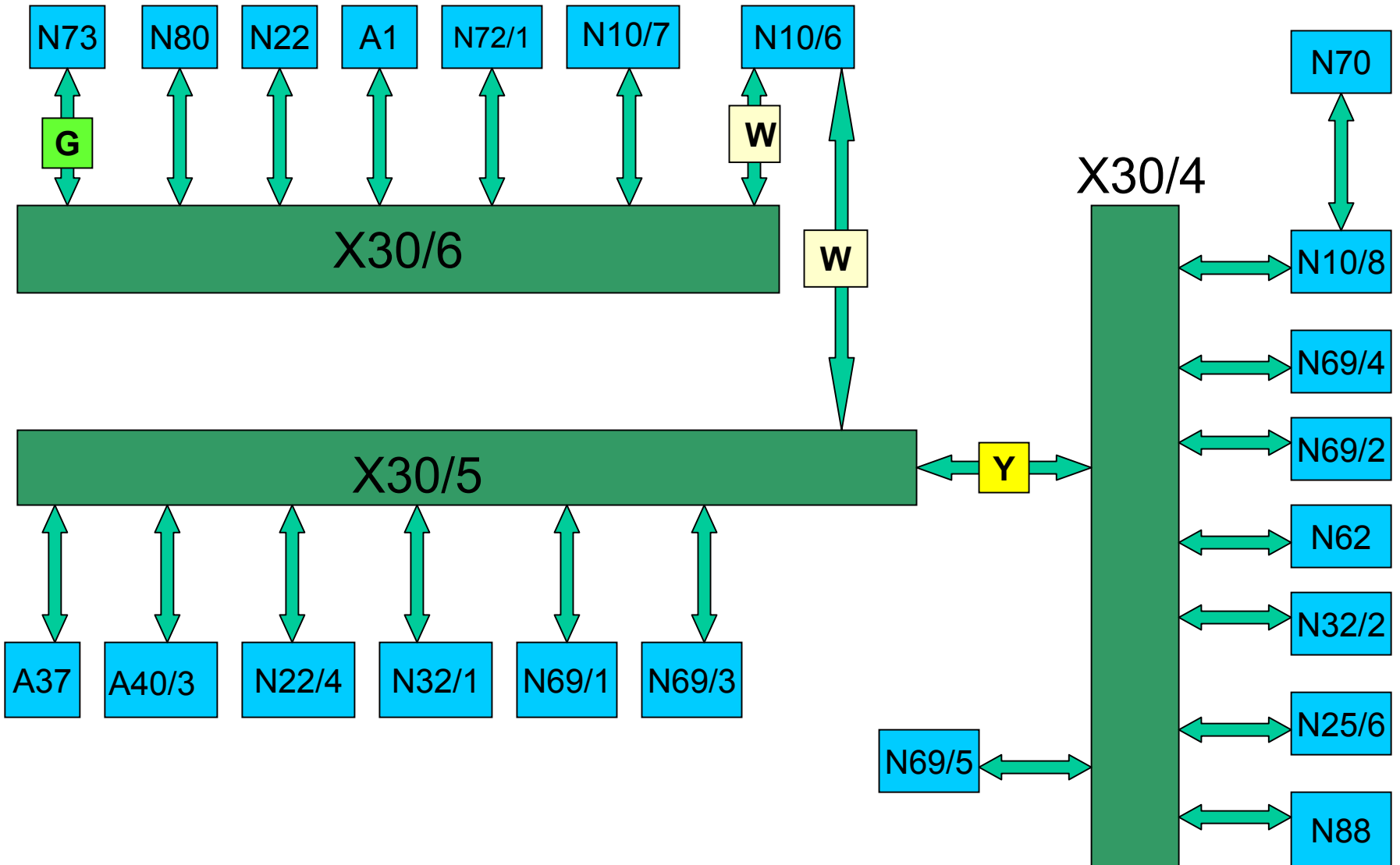
X35/2



Location: Right front sill

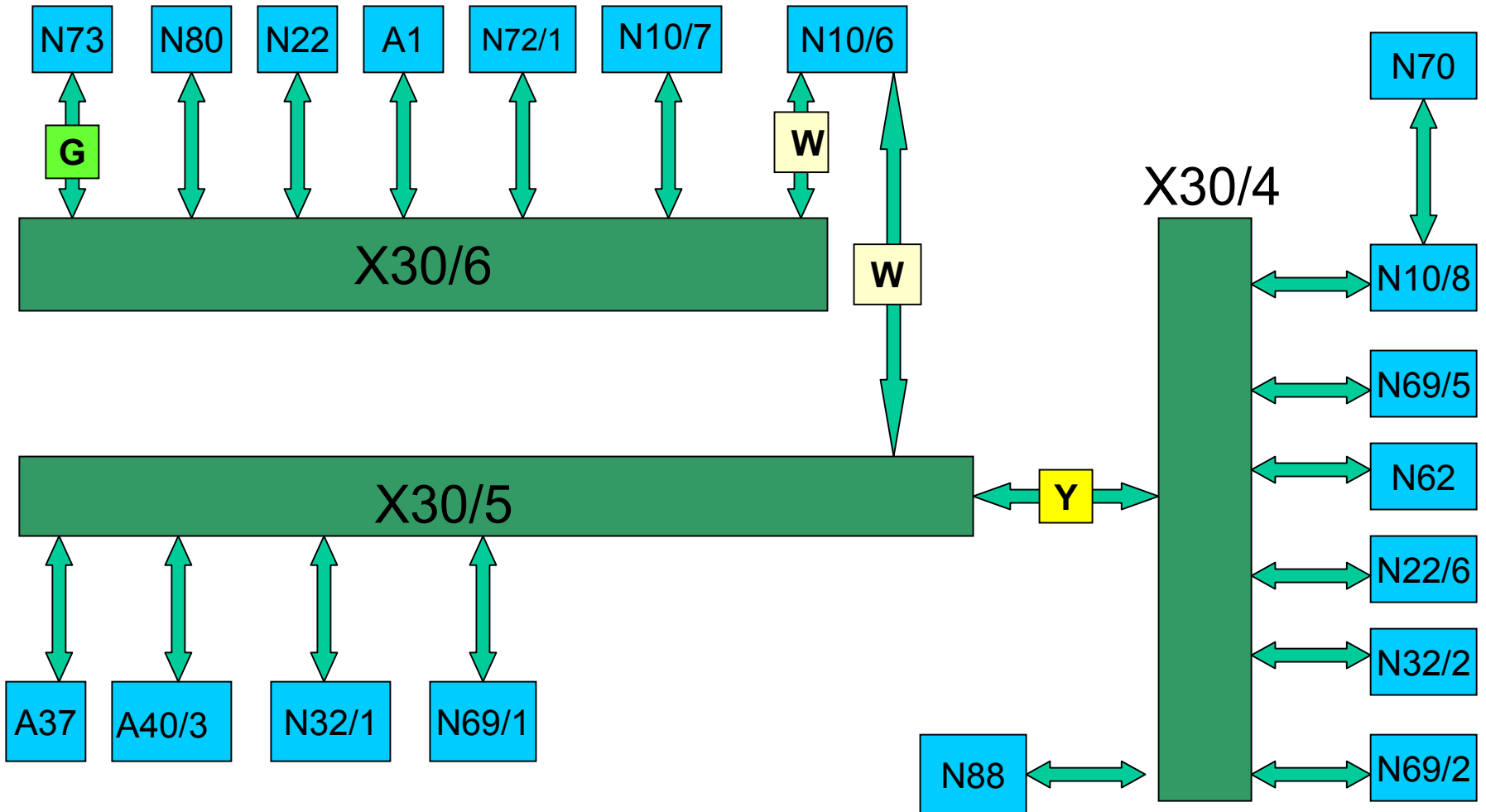
W220 CAN B

- G** Green Band
- W** White Band
- Y** Yellow Band



C215 CAN B

- G** Green Band
- W** White Band
- Y** Yellow Band



Location of X30's for C215 & W220



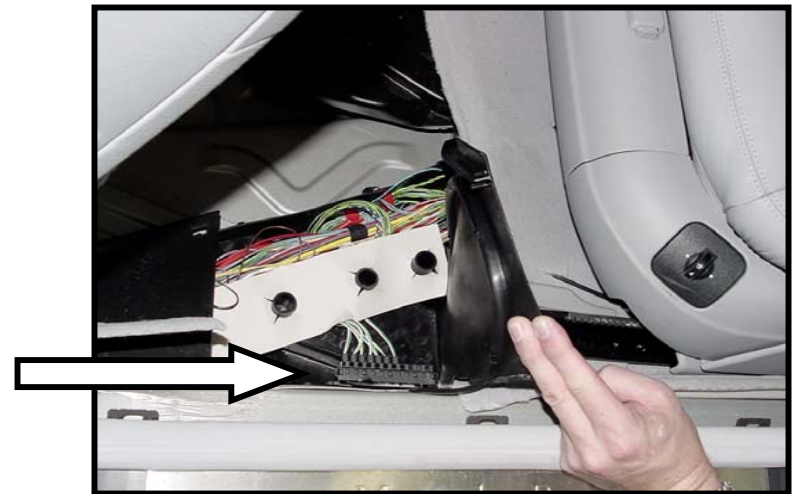
X30/6



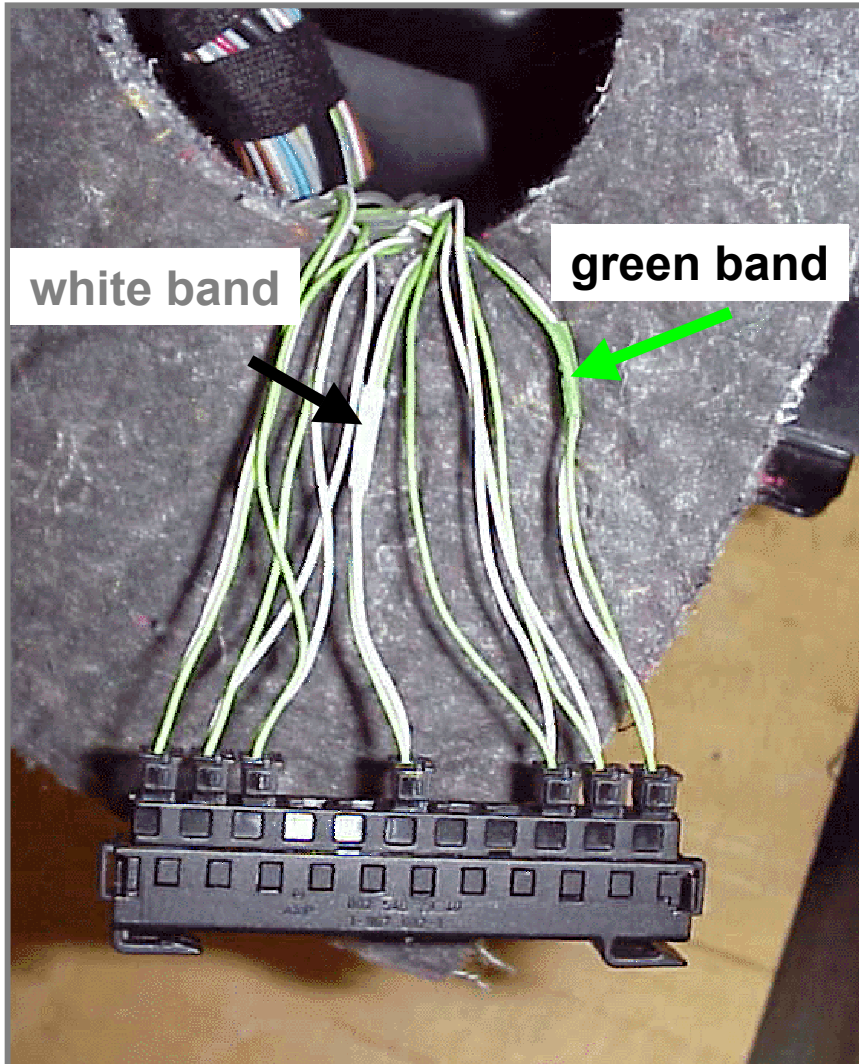
X30/4



X30/5

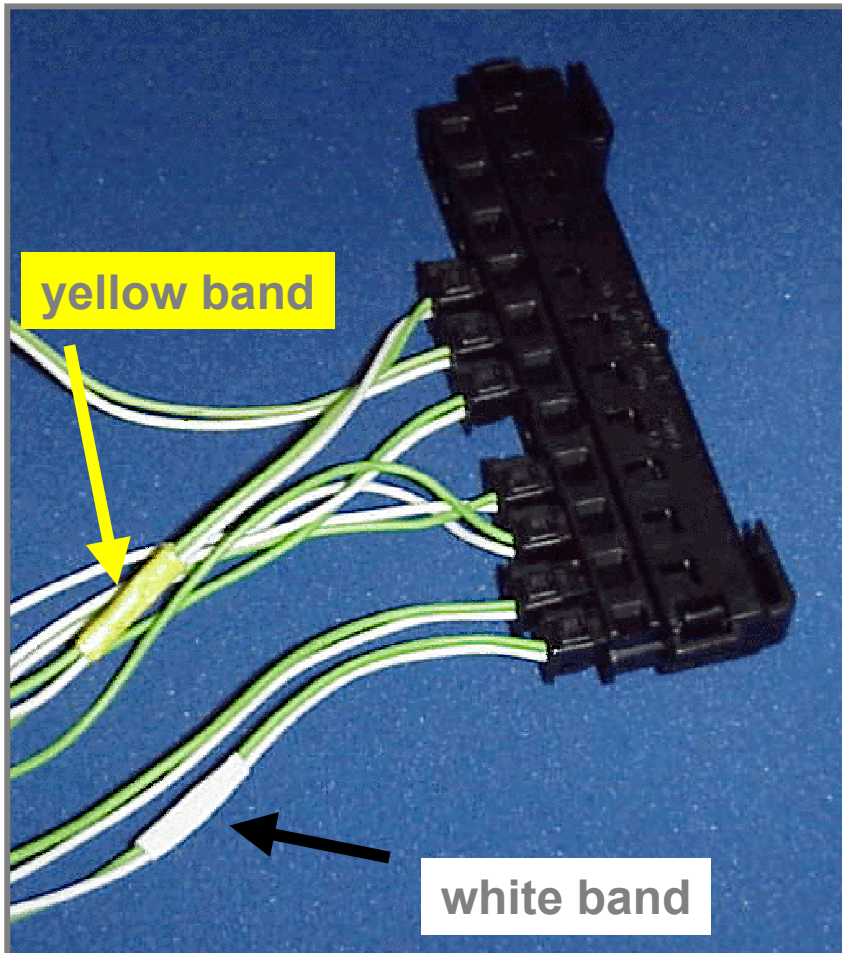


C215 / W220 Connector X30/6



- Wires with the green band go to N73 (EIS)
- Wires with the white band go to N10/6 (Left SAM)

C215 / W220 Connector X30/5



- Wires with the white band go to N10/6 (Left SAM)
- Wires with the yellow band go to X30/4

Control Units Connected to X30/6 C215 / W220

- N73 - Electronic Ignition Switch
- N80 - Steering Column Module
- N22 - Automatic Air Conditioning
- A1 - Instrument Cluster
- N72/1 - Upper Control Panel
- N10/7 - Right SAM
- N10/6 - Left SAM

Control Units Connected to X30/5 C215 / W220

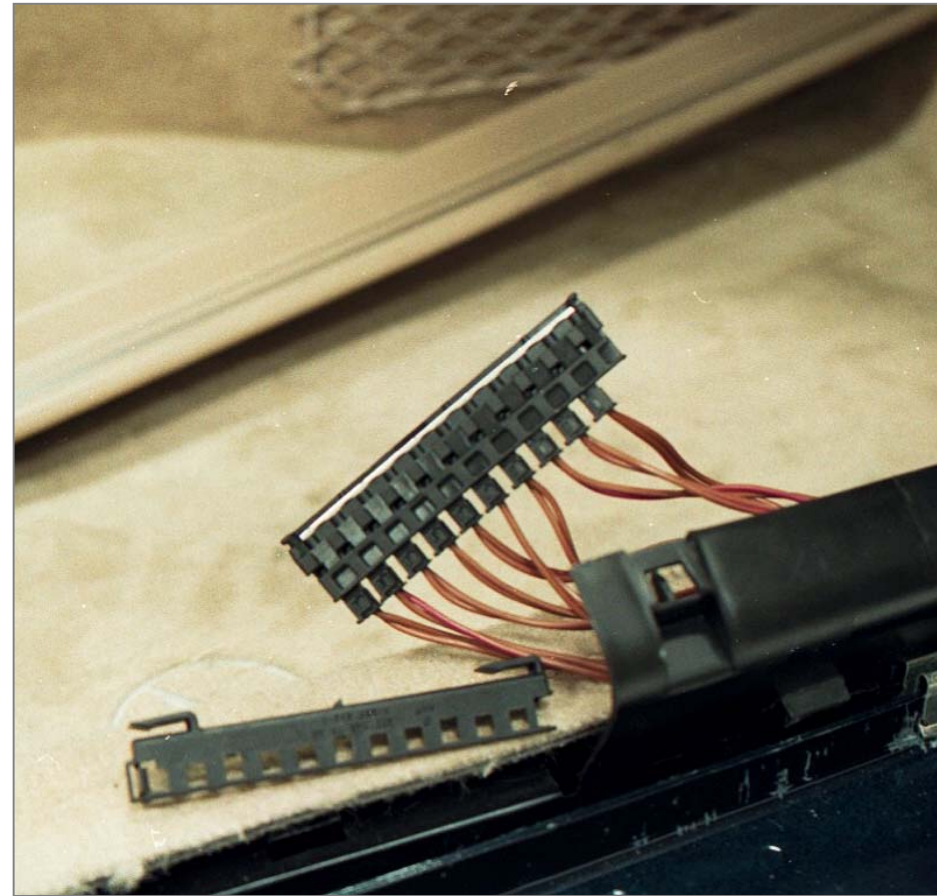
- A37 - PSE
- A40/3 - COMAND
- N22/4 - Rear automatic air conditioning
- N32/1 - Electric seat adjustment left
- N69/1 - Door control module 1
- N69/3 - Door control module 2
- N10/6 - Left SAM

Control Units Connected to X30/4 C215 / W220

- N10/8 - Rear SAM
- N70 - Overhead control panel (Via N10/8)
- N69/2 - Door control module 2
- N69/4 - Door control module 4
- N62 - Parktronics
- N32/2 - Electric seat adjustment right
- N25/6 - Electric seat adjustment rear
- N88 - Tire pressure monitoring
- N69/5 - KeyLess Go

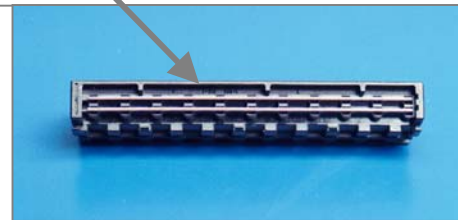
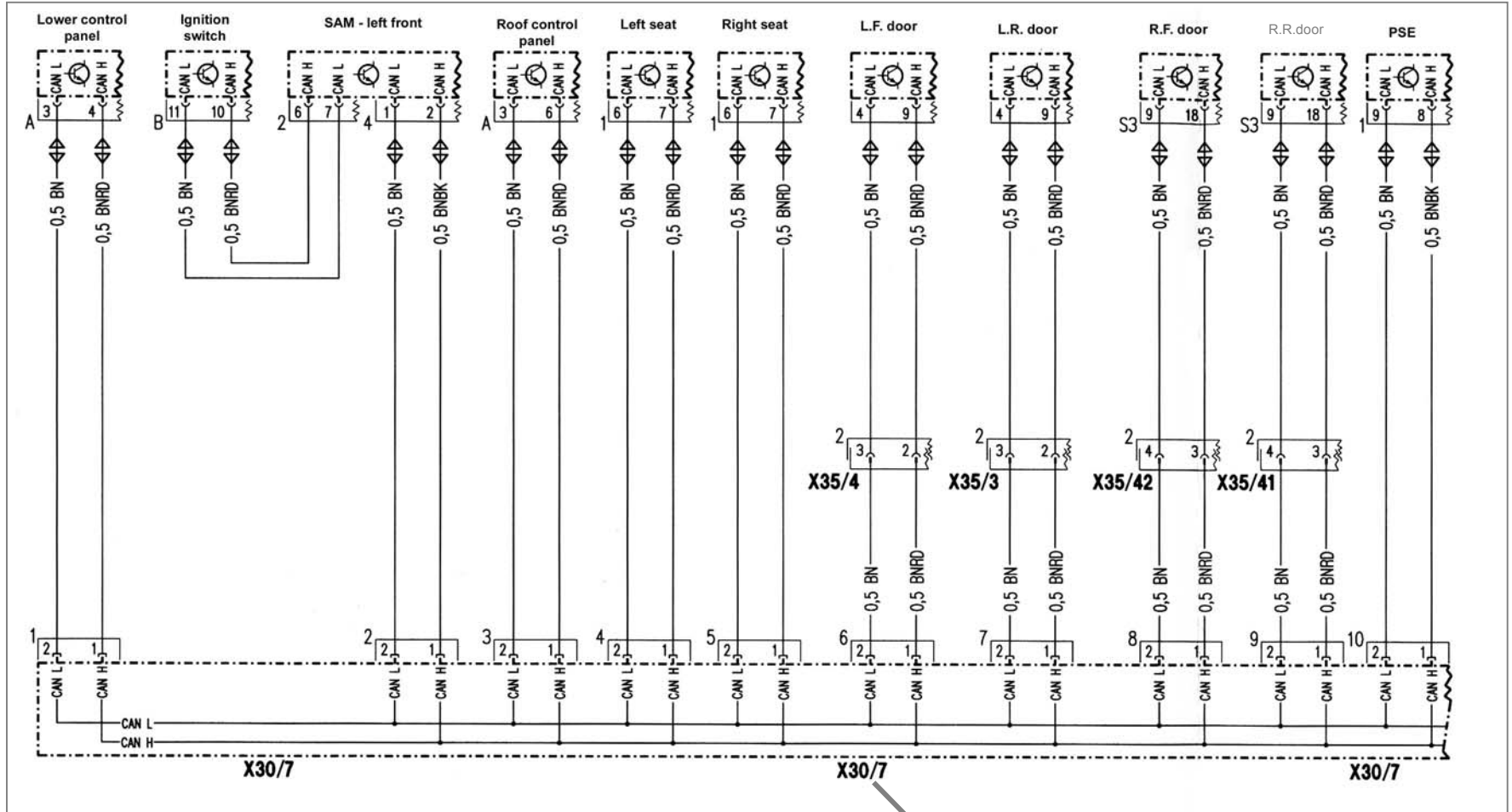
W202, 208, 210 CAN B

- Electronic Ignition Switch
EIS - N73
- Signal Acquisition and Actuation Module
SAM - N10/1
- Door Control Modules
DCM's - 1 for each door N69/1-4
- Pneumatic System Equipment
PSE - A37
- Electronic Seat Adjustment
ESA's - N32/1&2
- Overhead Control Panel
OCP - N70
- Lower Control Panel
LCP - N72

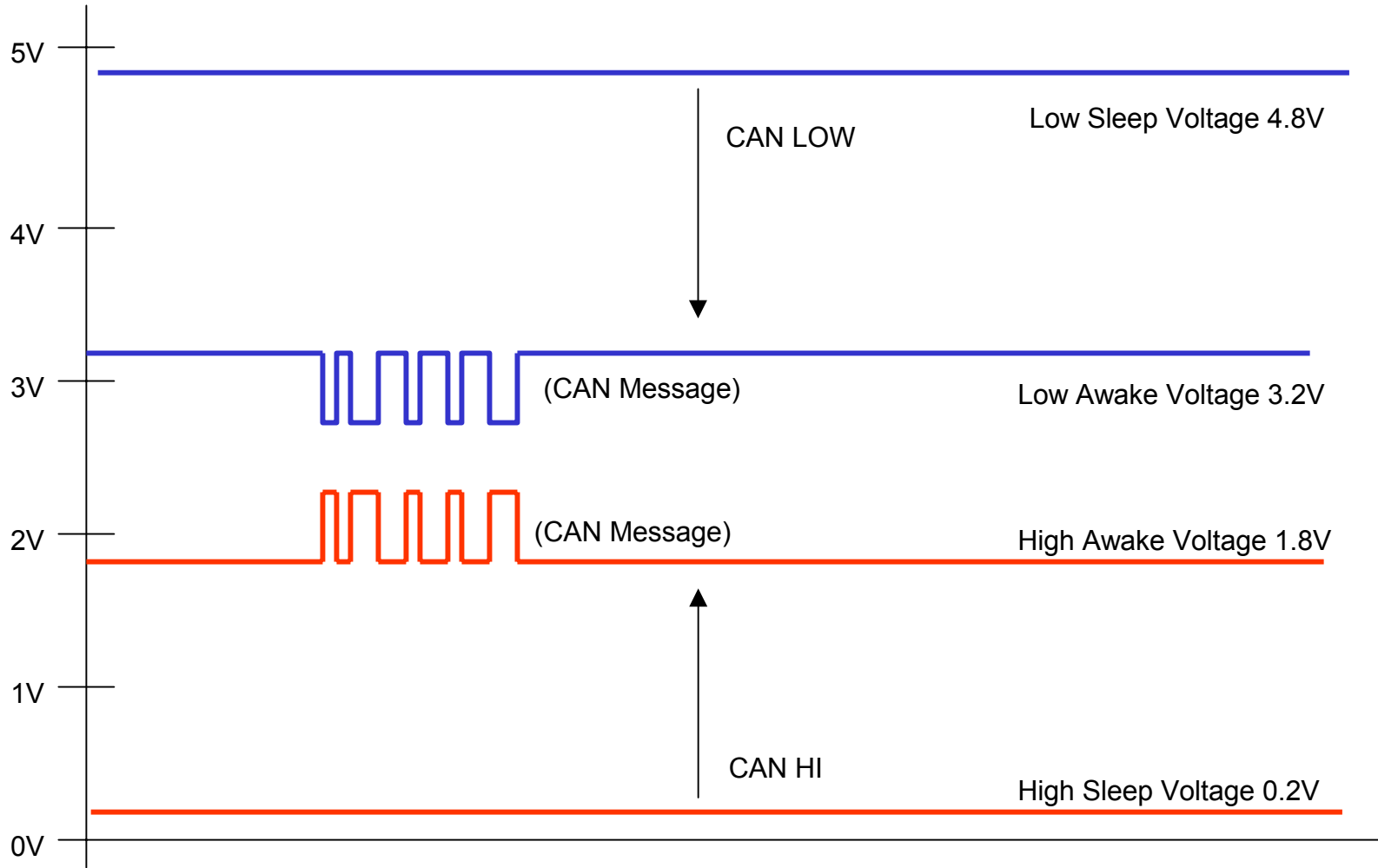


X30/7 - Right front door sill

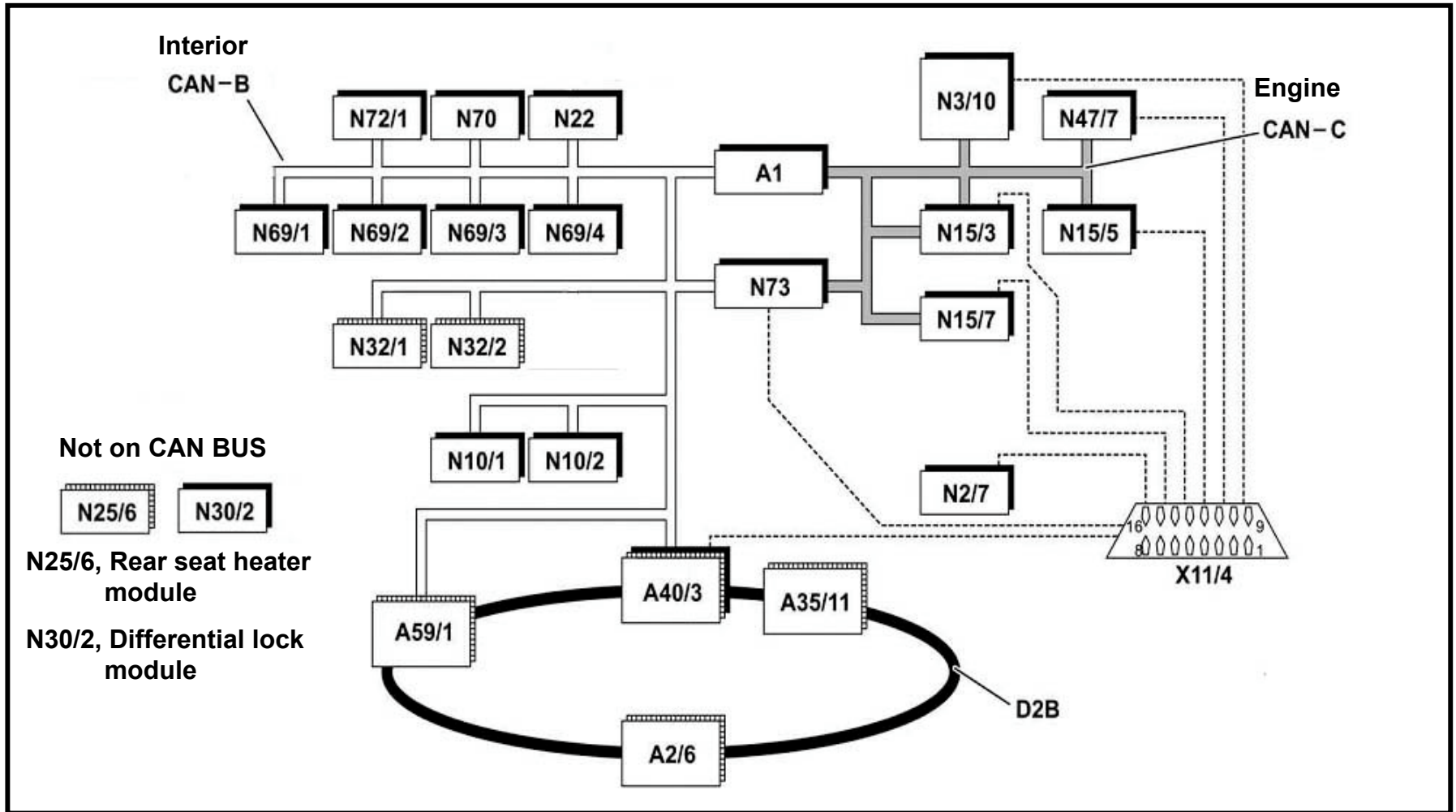
W210 CAN B



W202, 208 & 210 CAN B

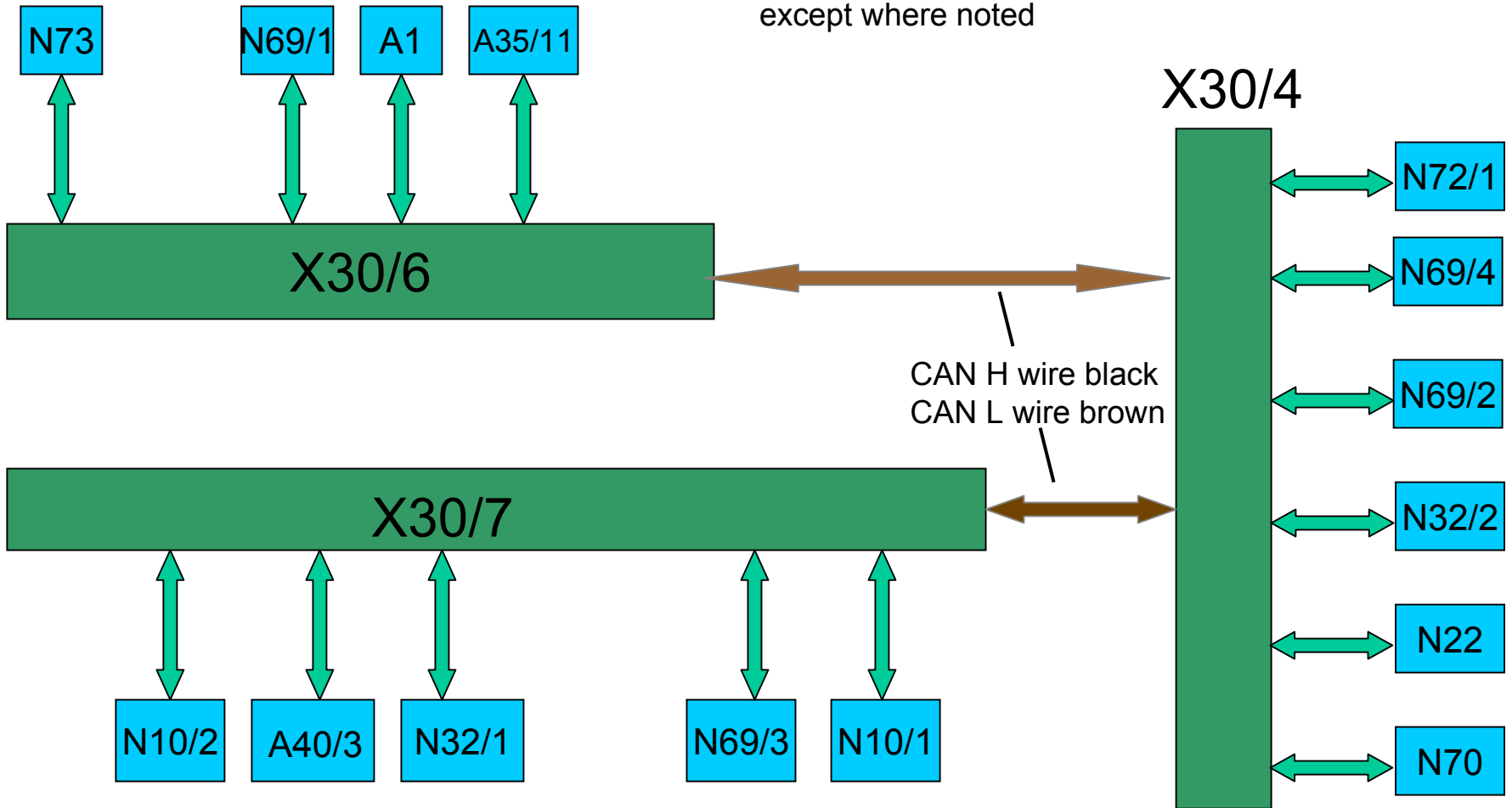


G Class (463) Networking



CAN B Diagram for 463

All CAN H wires are red
All CAN L wires are brown
except where noted

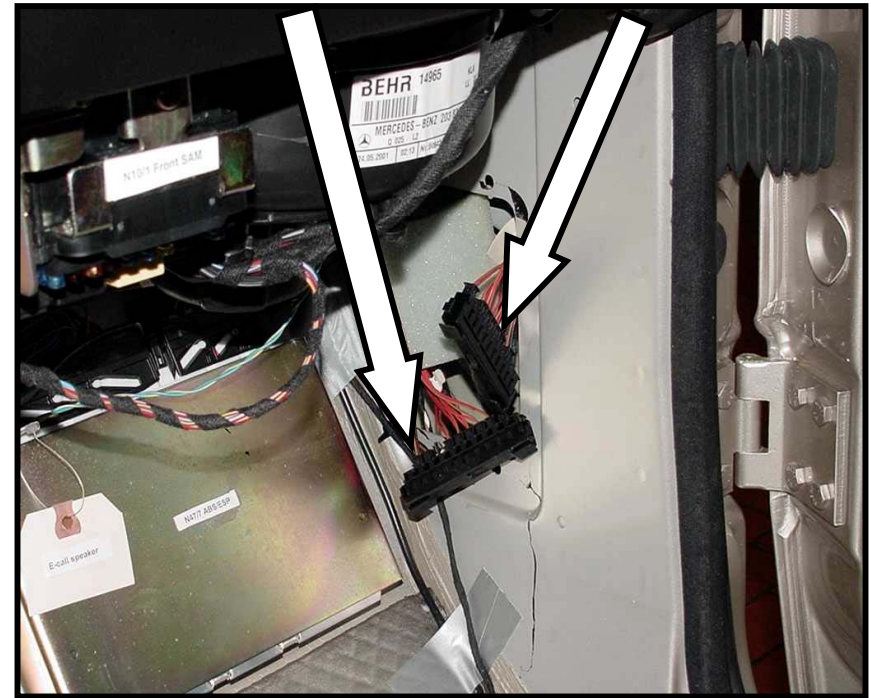


463 CAN B Connector Locations

X30/6 under drivers dash



X30/4 and X30/7 in passenger kick panel



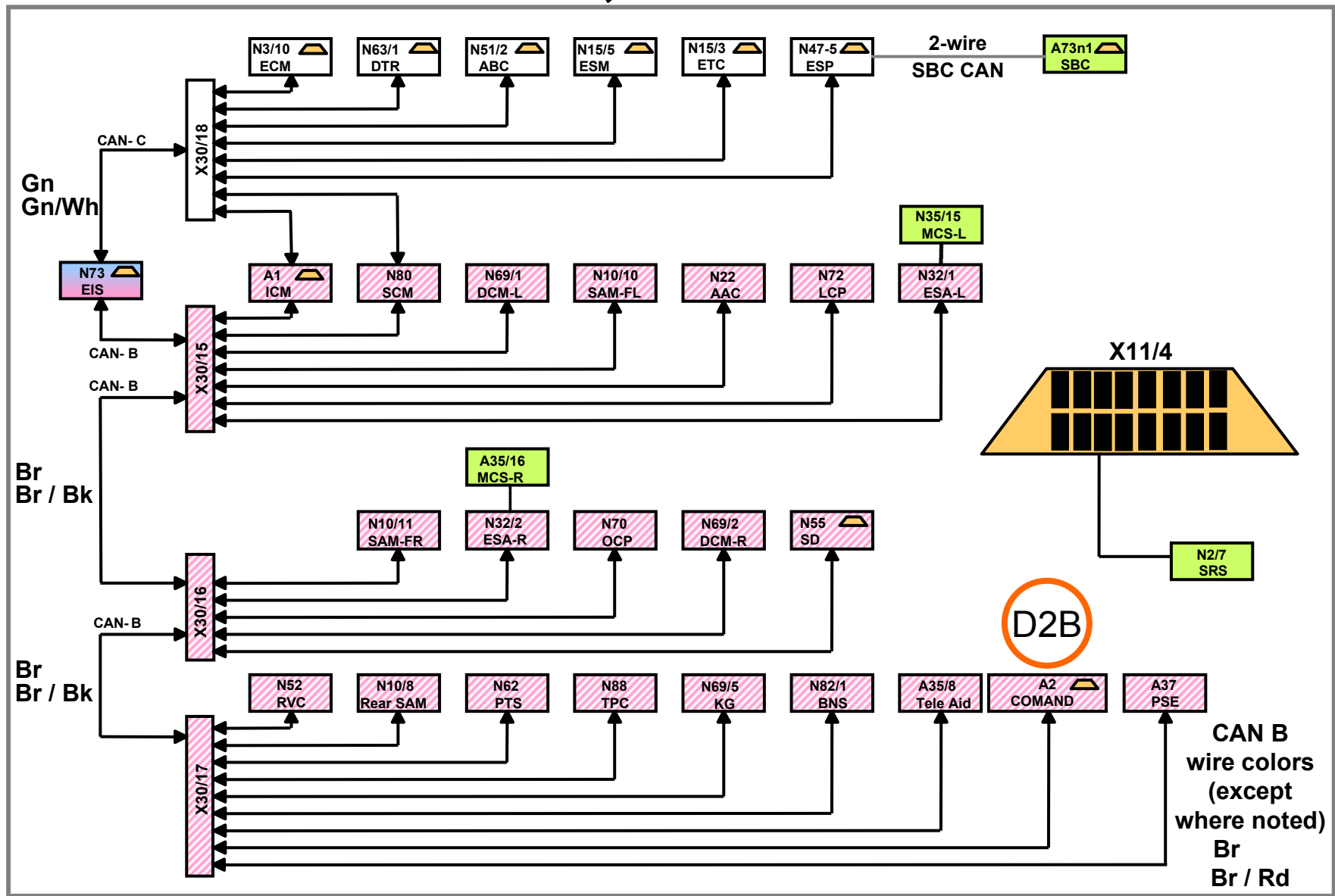
CAN wires are labeled with a tag on
X30/4 & X30/7

463 CAN C Connector



Location: Right side of center console

R230 CAN B , CAN C & D2B

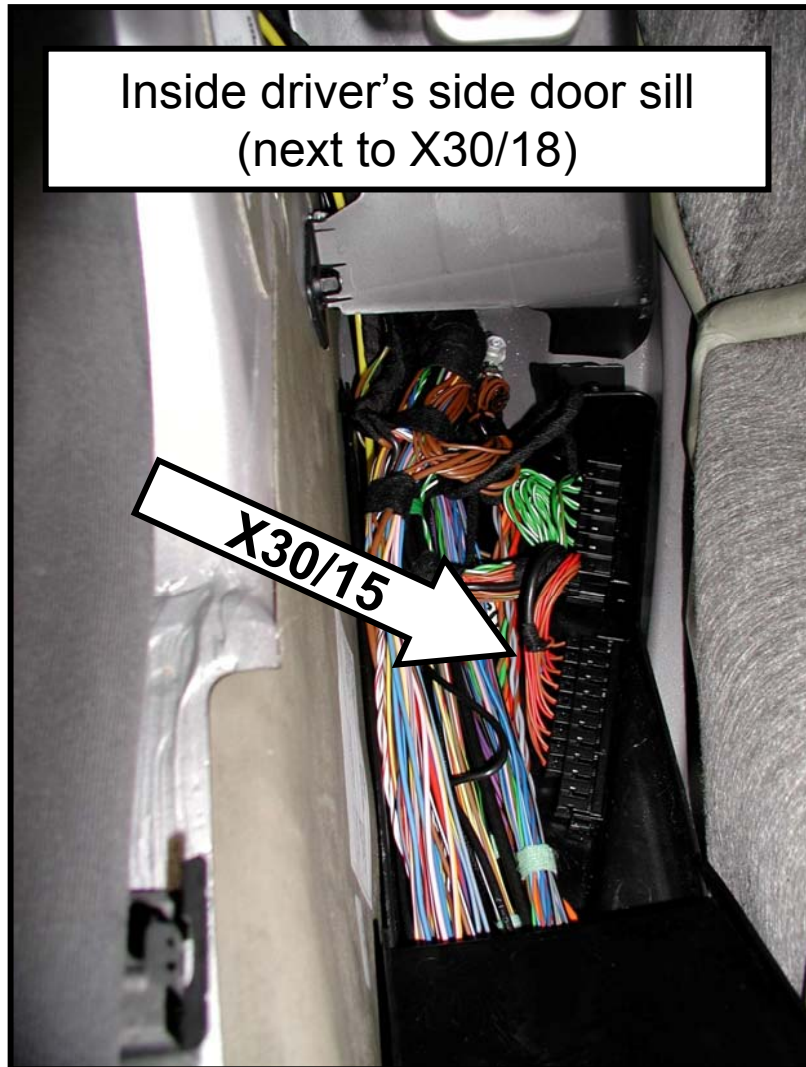


White box: CAN C

Pink box: CAN B

Light green box: not connected to either CAN

R230 CAN B Connector X30/15



EIS (N73)

IC (A1)

SCM (N80)

DCM-L (N69/1)

SAM-FL (N10/10)

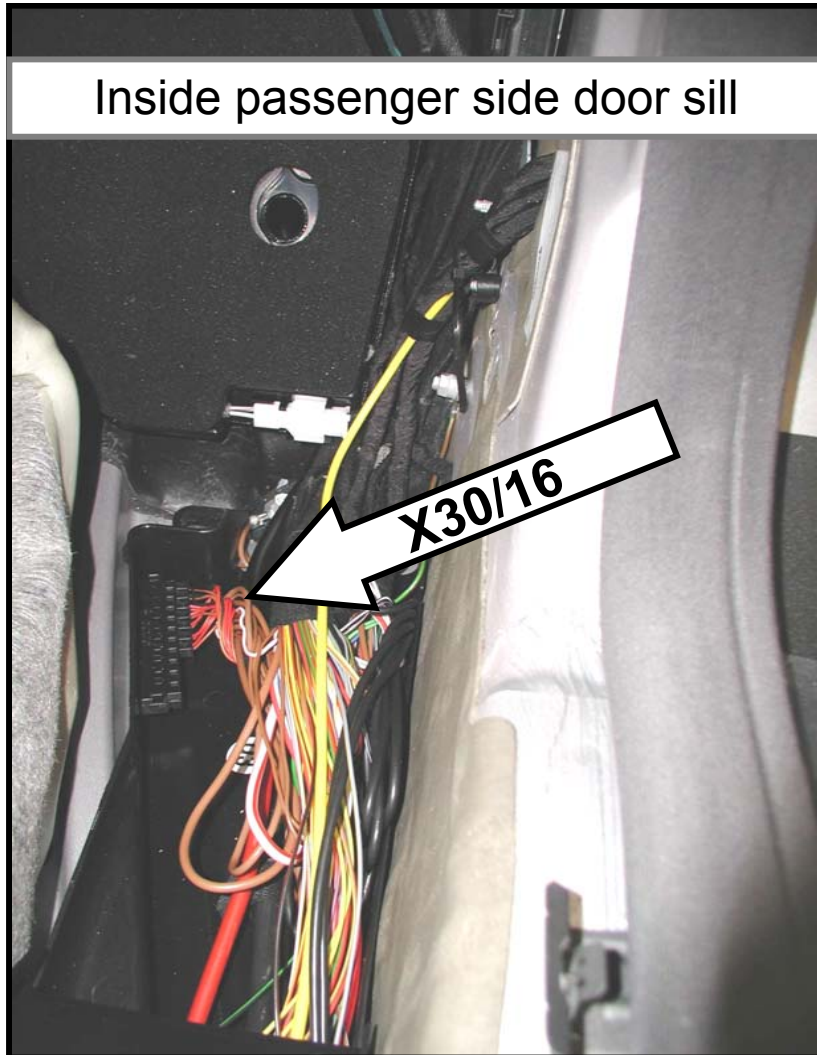
AAC (N22)

LCP (N72)

ESA-L (N32/1)

MCS-L (N35/15)

R230 CAN B Connector X30/16



SAM-FR (N10/11)

OCP (N70)

DCM-R (N69/2)

SD (N55)

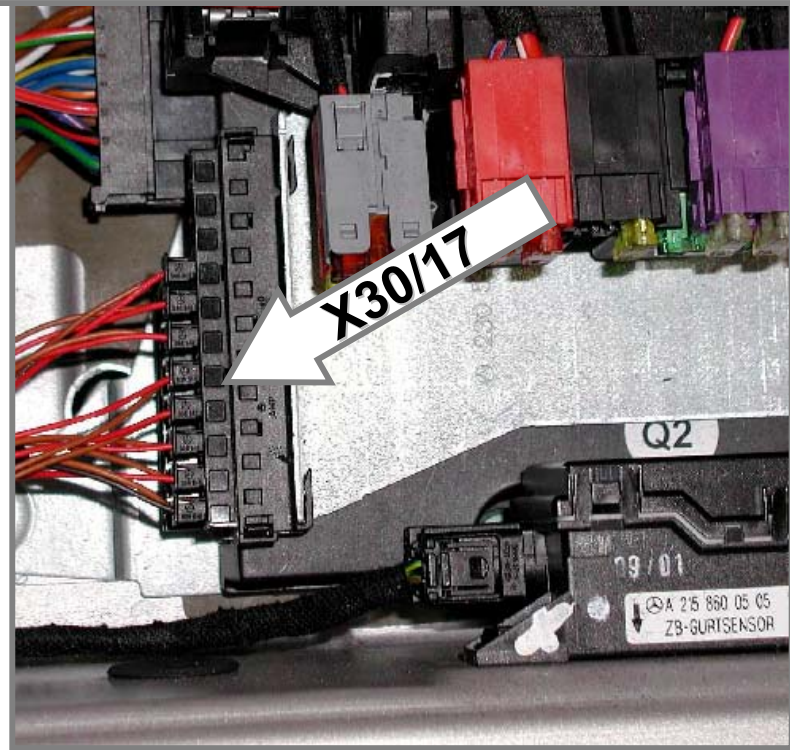
ESA-R (N32/2)

MCS-R (A35/16)

R230 CAN B Connector X30/17



Behind passenger seat, next to SAM



RVC (N52)

SAM-Rear (N10/8)

PTS (N62)

TPC (N88)

KG (N69/5)

BNS (N82/1)

TELE AID (A35/8)

COMAND (A2)

PSE (A37)

D2B

R230 CAN C Connector X30/18



EIS (N73)

IC (A1)

SCM (N80)

ECM (N3/10)

DTR (N63/1)

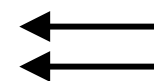
ABC (N5/12)

ESM (N15/5)

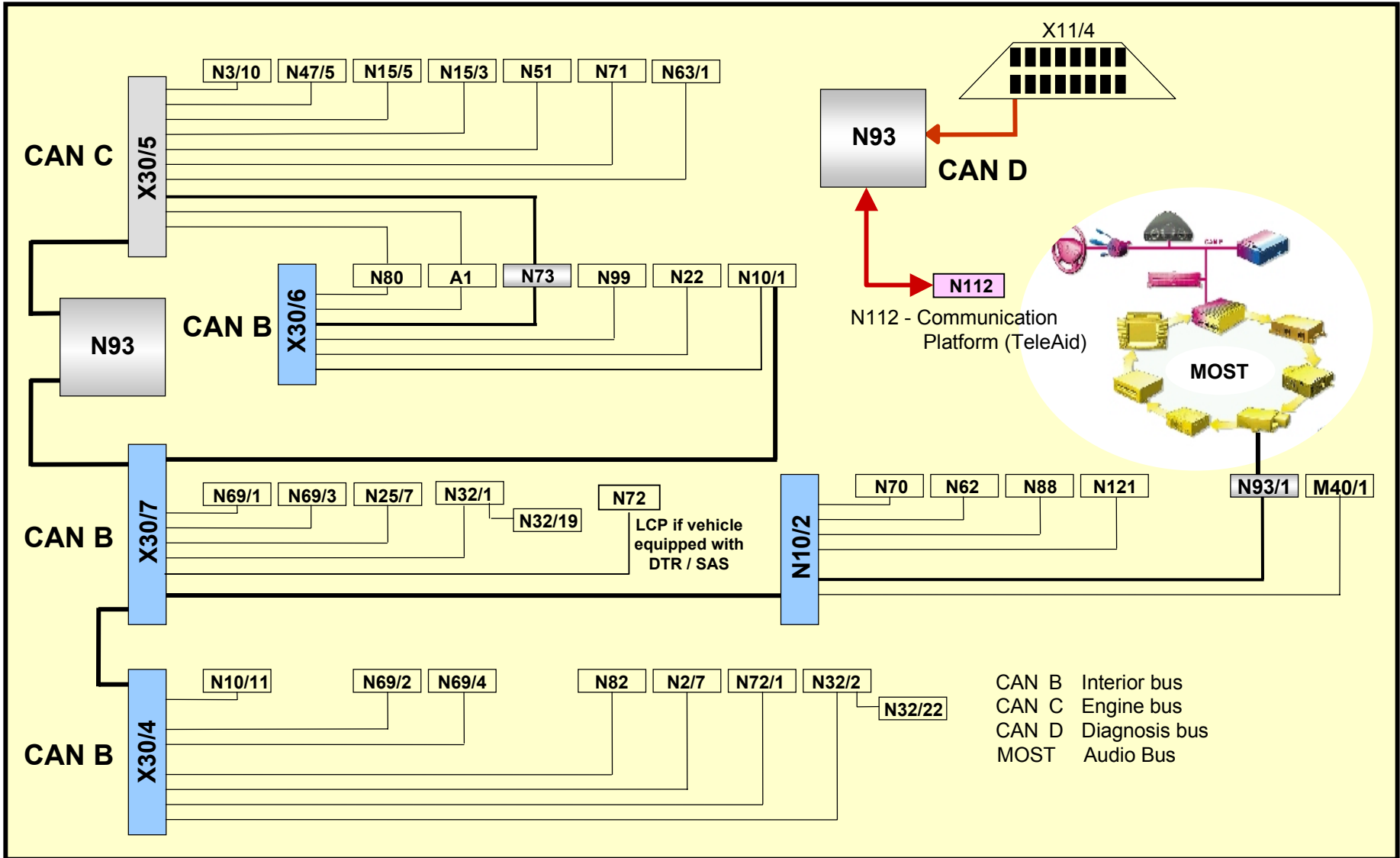
ETC (N15/3)

ESP (N47-5)

SBC (A73n1)



W211 Networking Diagram



W211 Networking Legend

CAN C

N3/10	ME-SFI Control Module
N15/3	ETC - Electronic Transmission Control
N15/5	ESM - Electronic Selector Module
N47/5	ESP - Electronic Stability Program
N51	SAS - Semi-Active Air Suspension
N63/1	DTR - Distronic Control Module
N71	HRA - Headlamp Range Adjustment
N93	CGW - Central Gateway Module

CAN B

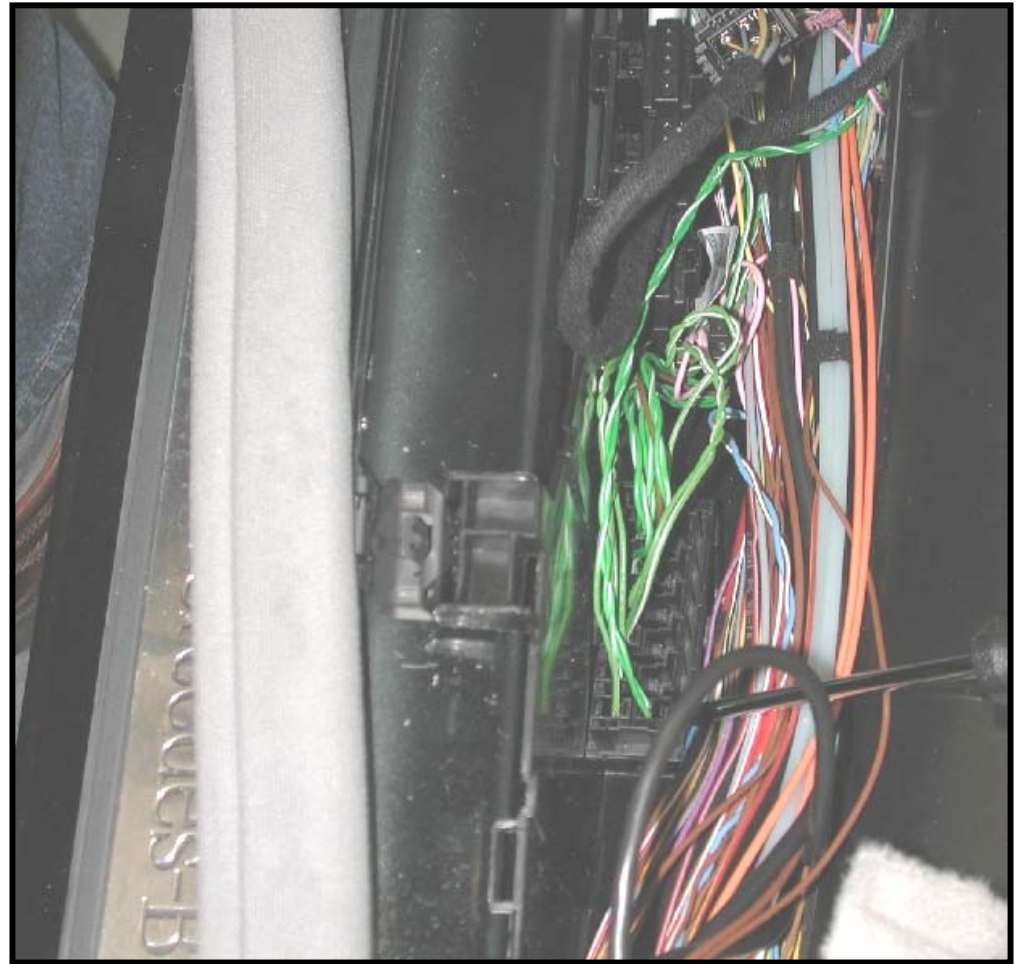
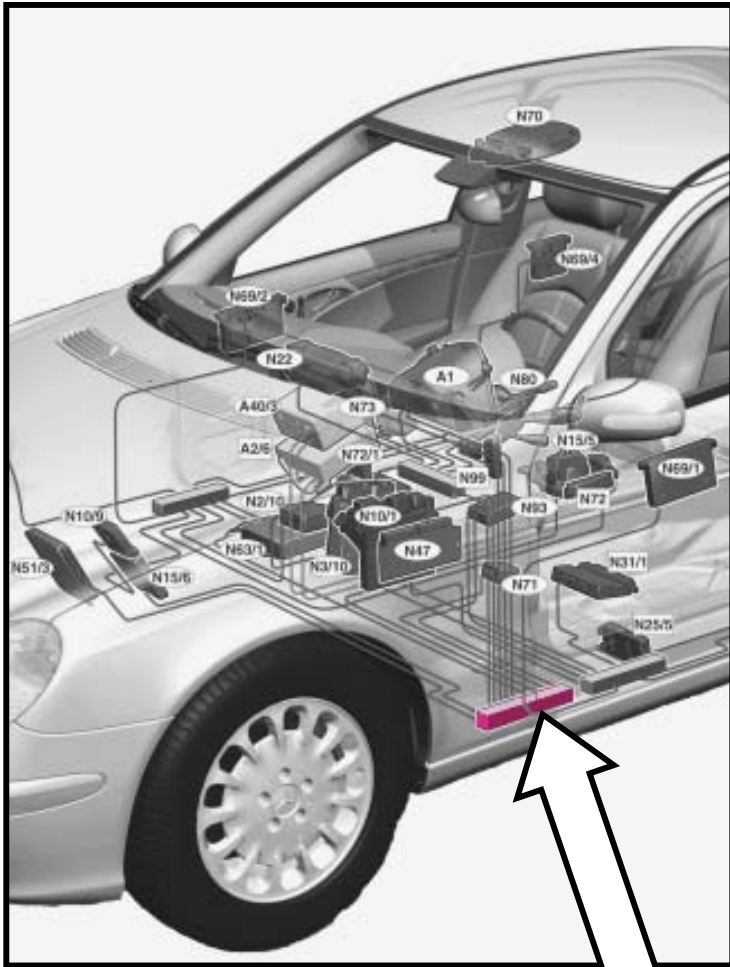
M40/1	Pneumatic Pump of Dynamic Seat
N2/7	Supplemental Restraint System
N10/1	SAM-D - Driver-side
N10/2	SAM-R - Rear
N10/11	SAM-P - Passenger-side
N22	AAC - Automatic Air Conditioning Control
N25/7	HS and Seat Ventilation Control Module
N32/1	ESA - Left Front Seat Adjustment
N32/2	ESA - Right Front Seat Adjustment

N32/19	Left Front Dynamic Seat Control
N32/22	Right Front Dynamic Seat Control
N62	PTS - Parktronic Control
N69/1	DCM - Left Front Door Control Module
N69/2	DCM - Right Front Door Control Module
N69/3	DCM - Left Rear Door Control Module
N69/4	DCM - Right Rear Door Control Module
N70	OCP - Overhead Control Panel
N72/1	UCP - Upper Control Panel
N82	BCM - Battery Control Module
N88	TPC - Tire Pressure Monitor Control Module
N93/1	AGW - Audio Gateway Control Module
N99	SWH - Steering Wheel Heater
N121	RTL - Remote Trunk Locking Control Module

CAN C & B

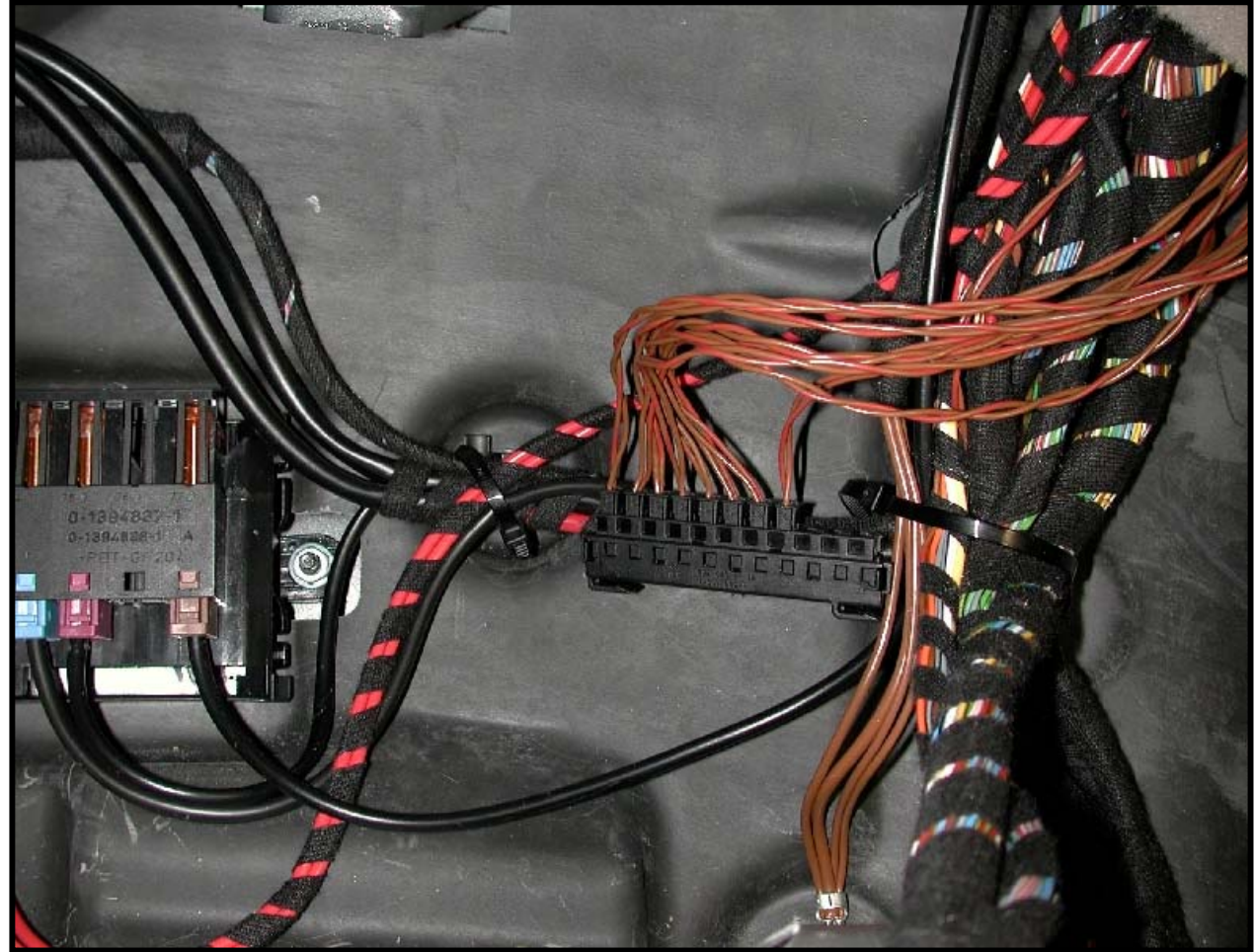
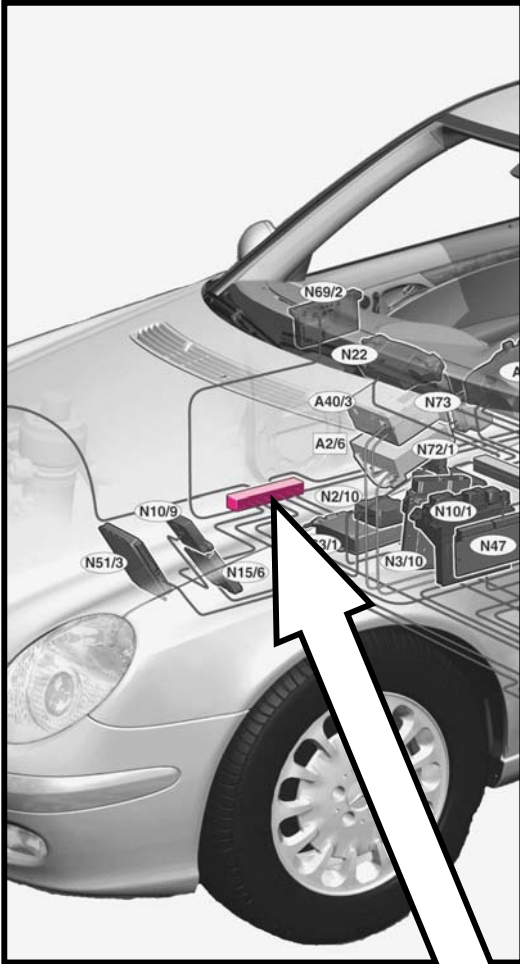
A1	ICM - Instrument Cluster
N73	EIS - Electronic Ignition Switch Control
N80	SCM - Steering Column Module
N93	CGM - Central Gateway Module

CAN C Connector (X30/5)



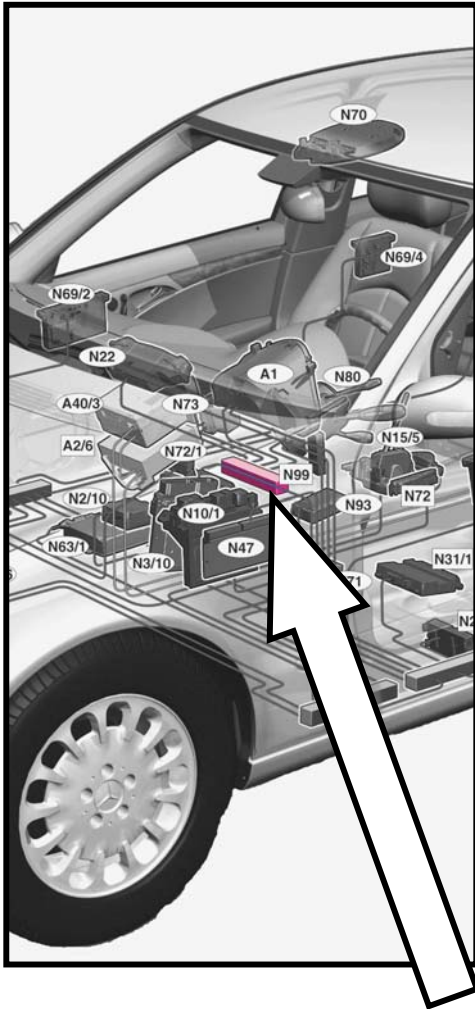
Location: Drivers rocker panel wiring trough

CAN B Connector (X30/4)



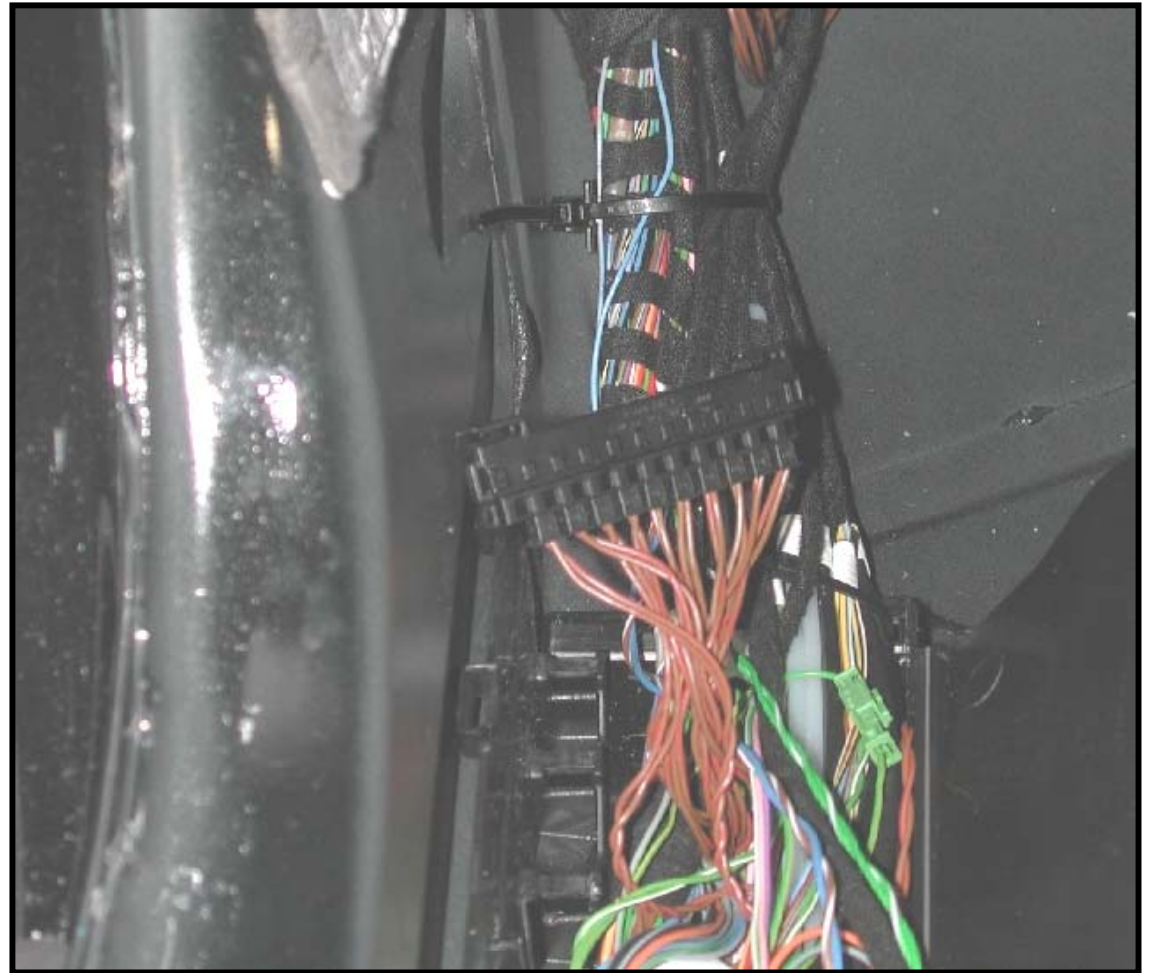
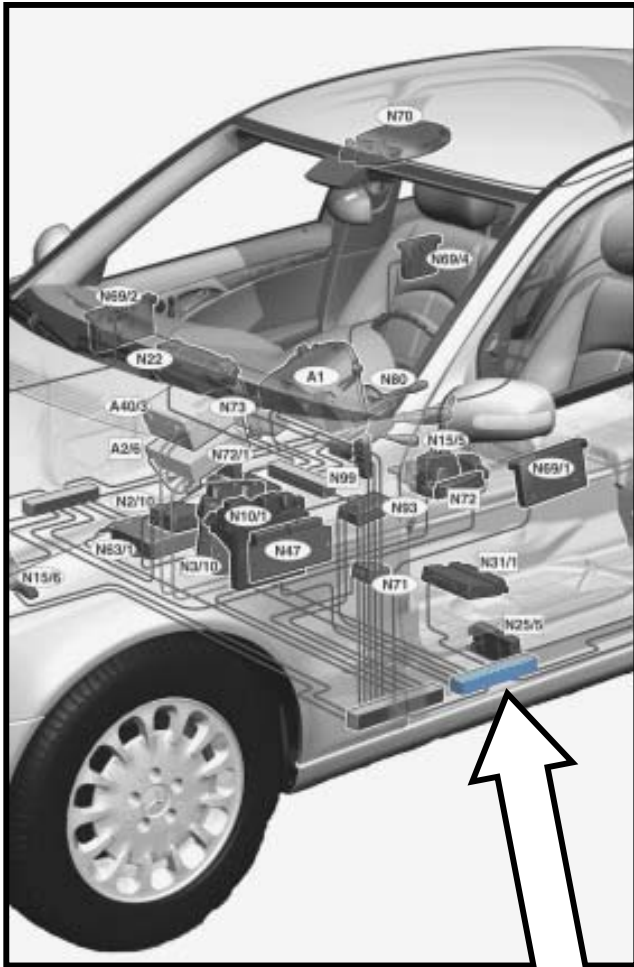
Location: Right side passenger footwell

CAN B Connector (X30/6)



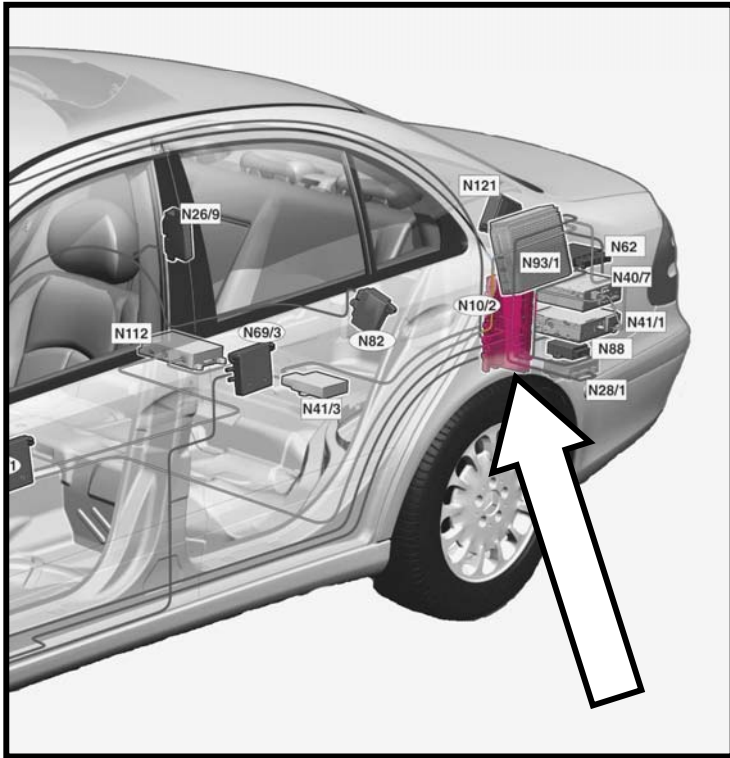
Location: Passenger side HVAC case

CAN B Connector (X30/7)

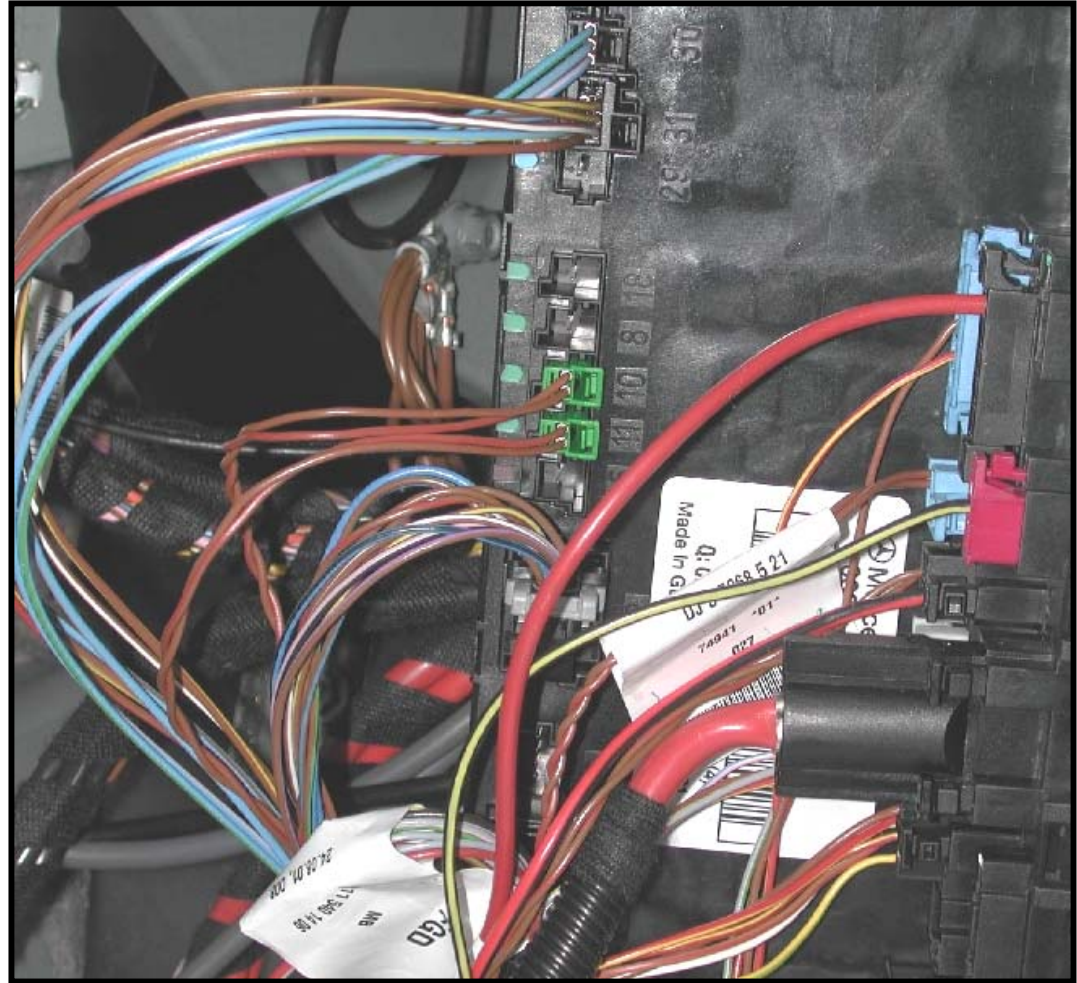


Location: Drivers rocker panel wiring trough

SAM-Rear (N10/2)



Several control modules are connected to the CAN B network via N10/2.



Location: Left side trunk

W211 CAN D

- Is the diagnostic link between Central Gateway Module (N93), Communications Platform (N112) and SDS / DAS
- CAN D voltage
 - High = 2.5v
 - Low = 2.5v
- CAN D voltage awake
 - High = activity to 3.5v
 - Low = activity to 1.5v
- All modules on CAN B are diagnosed by SDS / DAS through CAN D

