Electronic interfaces for bodybuilders to the Mercedes-Benz chassis Actros, Axor, and Atego

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International Bodybuilder Management MB Trucks (TE/SFB)

Agenda

I   **Principles of vehicle networking Actros2/Atego2/Axor2**

II   Electronic interfaces (including components, e.g. plugs, lines)

III   Parameterizable special module (PSM)

IV   Miscellaneous

Principles of vehicle networking Actros2/Atego2/Axor2

• **Differences in basic functions**

In the **Actros2**, the **base module (BM)** is the **central control unit** for networking (KontAct).

In the **Atego2/Axor2**, the base module (BM) is not a control unit, and so the **central control unit** function is assumed by the **instrument cluster** (INS 2004).
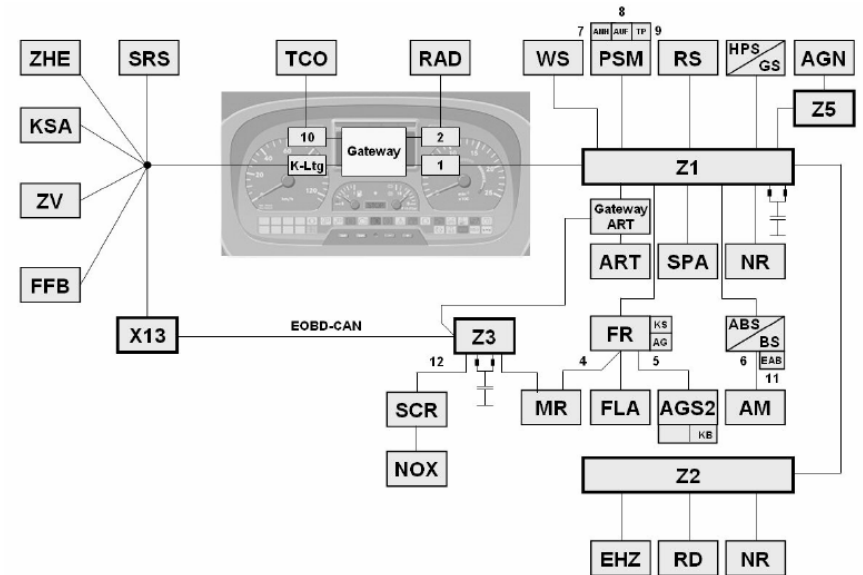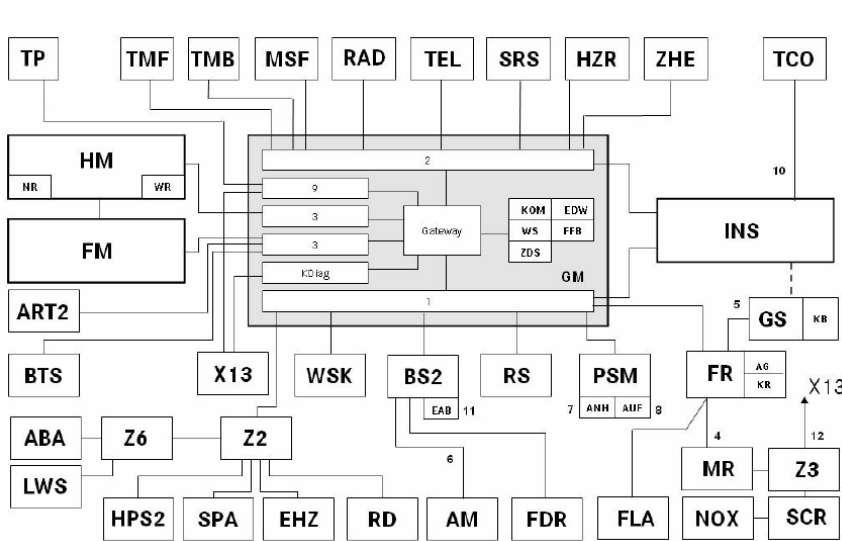
Actros2

KontAct (conception of electrical/electronic networking in the Actros)

Atego2/Axor2

IES (**I**ntegrated **E**lectronic **S**ystem)

Principles of vehicle networking Actros2/Atego2/Axor2

- Legend cross-linking Actros2

ABA	Active Brake Assist	RS	Retarder control	
AM	Axle modulator	SCR	Selective catalytic reduction	
AG	Automatic gear selection	SPA	Lane assistant	
ANH	Trailer electronics CAN interface	SR	Stability control	
ART	Autonomous intelligent cruise control	SRS	Supplemental restraint system	
ART 2	Autonomous intelligent cruise control 2 (One Box Design from 2005)	TCO	Tachograph	
AUF	Body electronics CAN interface	TEL	Telephone	
BS2	Brake system 2	TMF	Driver door module	
BTS	GGVS battery disconnect switch	TMB	Front passenger door module	
EAB	Electronic trailer brake CAN interface	TP	Telematics platform	
EDW	Theft warning system	WR	Roll control	
FFB	Radio remote control	WS	Maintenance system	
FLA	Flame starting system	WSK	Torque converter clutch	
FM	Front module	X13	Diagnostic socket EOBD (European On Board Diagnosis)	
FR	Drive control	ZDS	Central data memory	
BM	Base module	ZHE	Auxiliary heater	
GS	Transmission control	ZL/CL	Auxiliary steering	
RM	Rear module	Z2	Terminal point 2	
HPS2	Hydraulic pneumatic power shift 2	Z3	Terminal point 3	
HZR	Heater control	Z6	Terminal point 6	
INS	Instrument			
KB	Clutch operation			
KDiag	Diagnosis K-line	1	Vehicle CAN bus	500 kBaud
KNot	K-line emergency running mode	2	Interior CAN bus	125 kBaud
KOM	Communications interface	3	Frame CAN bus	250 kBaud
KR	Clutch control	4	Engine CAN bus	125 kBaud
LWS	Steering wheel angle sensor	5	Transmission CAN bus	250 kBaud
MSF	Modular switch panel	6	Brake CAN bus	500 kBaud
MR	Engine control	7	Trailer electronics CAN interface	125 kBaud
NOX	NOX sensor with controller unit	8	Body electronics CAN interface	125 kBaud
NR	Level control	9	Telematics CAN bus	250 kBaud
PSM	Parameterizable special module	10	TCO CAN bus	125 kBaud
RAD	Radio	11	EAB CAN interface	125 kBaud
RD	Tire pressure monitor	12	SCR CAN bus	250 kBaud

Principles of vehicle networking Actros2/Atego2/Axor2

•Legend cross-linking Atego2, Axor2

Possible electronics in the electrical compartment:

ABS	Antilock brake system
AGN	Allison automatic transmission
AGS2	Automatic transmission control 2
BS	Brake system
FLA	Flame starting system
FR	Drive control
GS	Transmission control
HPS	Shift force assist
KSA	Convenience locking system
NR	Level control (if there is space in the electrical compartment)
PSM	Parameterizable special module
RS	Retarder control
SRS	Supplemental restraint systems
WS	Maintenance system
ZHE	Auxiliary heater
CL	Central Locking

Further abbreviations:

AG	Automatic gear selection
AM	Axle modulator
ART	Autonomous intelligent cruise control
EAB	Electronic trailer brake CAN
KB	Clutch operation
KS	Clutch control
RAD	Radio
SCR	Selective catalytic reduction
SPA	Lane assistant
SRS	Supplemental restraint system
TCO	Tachograph
X13	Diagnostic socket EOBD (European On Board Diagnosis)
Z1	Star point
Z2	Terminal point
Z3	Star point
Z5	Terminal point

Possible electronics in the rear panel:

EHZ	Electrohydraulic auxiliary steering
NR	Level control (if the electrical compartment is full)
RD	Tire pressure monitor

1	Vehicle CAN bus	500 kBaud
2	Interior CAN bus	125 kBaud
4	Engine CAN bus	125 kBaud
5	Transmission CAN bus	250 kBaud
6	Brake CAN bus	500 kBaud
10	Speedometer CAN bus	125 kBaud
11	CAN interface for trailer	125 kBaud
12	SCR CAN bus	250 kBaud

Principles of vehicle networking Actros2/Atego2/Axor2

• **Virtual control units, integrated control units Actros2**

Virtual control units

Control units are combined within the networking of *Actros2*. This means that they no longer have their own housing. They only exist as software, and are thus virtual:

* WS   Maintenance System
* KOM   Communications processor
* EDW   Anti-theft alarm
* ZDS   Central Data Memory

> **Note**
> Virtual control units are not available as components, but they can be selected with diagnostic equipment for adjustments. They behave like control units that exist as hardware.

Integrated control units

Several previous control units have been completely integrated into other control units. These are not virtual control units because they no longer show up in DAS and can no longer be called up. Their actuation, fault codes and actual values are shown under a new number in another control unit. The following control units have been integrated:

* AG   Automatic gear selection is integrated in the drive control
* KR   Clutch control is integrated in the drive conrol
* FFB   Radio remote control receiver
* NR   Level control is integrated in the front module and rear module
* WR   Roll control is integrated in the front module and rear module
* KB   Clutch operation is integrated in the gear control

> **Note**
> Integrated control units are functions that have been incorporated into other control units. The fault codes can be found in DAS under the new control unit. The access via functions was added in DAS to make the new control units easier to locate.
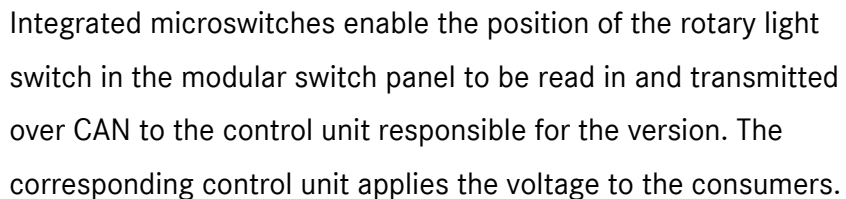
Principles of vehicle networking Actros2/Atego2/Axor2

- **Signal level of the CAN bus systems in Mercedes-Benz trucks**

There are various CAN BUS systems used in Mercedes-Benz commercial vehicles. They vary in the speed of K-line as well as of low-speed CAN and high-speed CAN. In order to clearly differentiate them, they were given names corresponding with their tasks.

K-line	U_{Supply}	= internal 24 V	This is the data line with the lowest data speed, 9.6 kBaud.
	U_{High}	= ≈ 22.0 V	It serves as a connection between the vehicle and the diagnostic socket, thus as the data line for the off-board diagnosis.
	U_{Low}	= ≈ 2.0 V	
	U_{Hub}	= 20.0 V	
Frame, vehicle, telematics and brakes CAN	U_{Supply}	= internal 5 V	There are 2 versions:
	U_{High}	= ≈ 3.5 V	* The frame CAN and the telematics CAN with 250 kBaud each
	U_{Low}	= ≈ 1.5 V	* The vehicle CAN and the brakes CAN with 500 kBaud each
	U_{Hub}	= 2.0 V	
Tachograph CAN, trailer CAN PSM, body CAN PSM, trailer CAN BS	U_{Supply}	= internal 5 V	125 kBaud
	U_{High}	= ≈ 3.5 V	
	U_{Low}	= ≈ 1.5 V	
	U_{Hub}	= 2.0 V	
Interior CAN	U_{Supply}	= internal 5 V	125 kBaud
	U_{High}	= ≈ 4.8 V	
	U_{Low}	= ≈ 0.3 V	
	U_{Hub}	= 4.5 V	
Engine and transmission CAN	U_{Supply}	= 24 V U_{Batt}	125 kBaud is used for the engine CAN bus
	U_{High}	= $\approx 2/3\ U_{batt.}$	250 kBaud is used for the transmission CAN bus
	U_{Low}	= $\approx 1/3\ U_{batt.}$	
	U_{Hub}	= 8 V	

Principles of vehicle networking Actros2/Atego2/Axor2

- **Practical application example**

Activation of exterior lights Actros2

Activation of exterior lights Atego2/Axor2

Integrated microswitches enable the position of the rotary light switch in the modular switch panel to be read in and transmitted over CAN to the control unit responsible for the version. The corresponding control unit applies the voltage to the consumers.

Based on the position of the rotary light switch, a voltage is applied to the consumers via the fuses.

Principles of vehicle networking Actros2/Atego2/Axor2

• **Practical application**

Some additional functions require a control unit to be retrofitted to the vehicle.
An example of this would be the parameterizable special module, or PSM.

With regard to this, the following points must be observed for the **ATEGO2/AXOR2** and the **ACTROS2:**

ATEGO2/AXOR2:
- Manufacture of electrical connections for power supply
  and CAN bus according to wiring diagram.
- Parameterization of control unit list in the instrument cluster.
- Teach in of CAN freeze frame data in the drive control or common
  powertrain controller.

ACTROS2:
- Manufacture of electrical connections for power supply and
  CAN bus according to wiring diagram.
- Parameterization of control unit list in the base module with subsequent
  updating of central data memory in the base module.
- In the central data memory: control unit, retrofit with subsequent
  updating of central data memory.
- Parameterization of control unit list in the instrument cluster with updating of central data memory.

- Teach-in of CAN environment in the drive control or common powertrain controller.

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Electronic interfaces (including parts, e.g. plugs, lines)

· **Standard scopes for voltage pick-up for auxiliary consumers on Actros2, Atego2, Axor2**

Installation point plug X7 on Actros2 base module
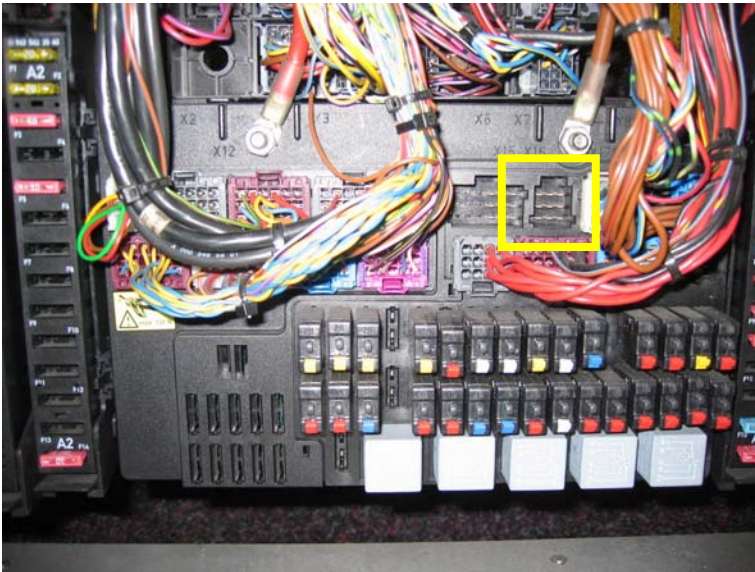
Installation point plug X7.1 on the Axor2 cab connector
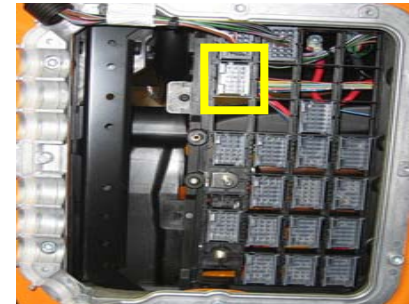
Plug X7.1 on the Atego2 cab connector

Electronic interfaces (including parts, e.g. plugs, lines)

- **Voltage pick-up and pin assignment for auxiliary consumers on Actros2**

24V consumers with less than 10A power consumption may be picked up at the X7 plug of the base module.

The **total current consumption** on the X7 plug is limited to **10A.**

For a **power consumption of 10A or above,** the **ED9 pre-installation** or KEVR must be installed (max. power consumption 100A).

PE54.21-W-2400J
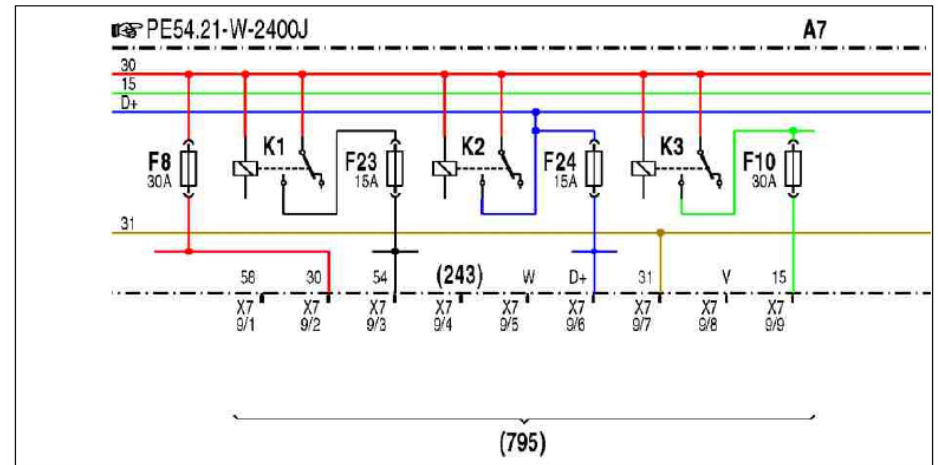
| A7 | Grundmodul | 243 | Rückfahrscheinwerfer | 795 | Stecker X 7, elektrische Schnittstelle zum Aufbau |

W54.21-1288-79

Pin assignment of 9-pin plug on base module:

Pin 1	terminal 58	max. 2 A		Pin 6	terminal D+	max. 2 A
Pin 2	terminal 30	max. 10 A		Pin 7	terminal 31	max. 10 A
Pin 3	terminal 54	max. 2 A		Pin 8	v-signal	max. 50 m A; 8 pulses/m
Pin 4	backup lamp	max. 2 A		Pin 9	terminal 15	max. 2 A
Pin 5	terminal W	max. 50 mA				

Electronic interfaces (including parts, e.g. plugs, lines)

• **Voltage pick-up and pin assignment for auxiliary consumers on Atego2, Axor2**

24V consumers with less than 10A power consumption may be picked up at the X7.1 plug of the on the cab/chassis port in the electrical compartment.

The **total current consumption** on the **X7.1** plug is limited to **10A.**

Pin assignment of 18-pin plug:

Pin 1	terminal 30	10 A	Pin 7	terminal W	max. 10 mA	Pin 13	load compartment lamp, negative (special equipment)	
Pin 2	terminal 31	10 A	Pin 8	v-signal	max. 10 mA	Pin 14	load compartment lamp, positive (special equipment)	
Pin 3	terminal 15 (F39 10 A)	2 A	Pin 9	TCO additional recorder		Pin 15	PSM remote clutch control (special equipment)	
Pin 4	terminal 58 (F2 10 A)	2 A	Pin 10	TCO additional recorder		Pin 16	PSM remote clutch control (special equipment)	
Pin 5	terminal D+ (F7 15 A)	2 A	Pin 11	not assigned		Pin 17	not assigned	
Pin 6	backup lamp (F34 10 A)	2 A	Pin 12	not assigned		Pin 18	not assigned	

12V consumers must be connected through a voltage converter.

If a consumer is connected to one of the two vehicle batteries, they can no longer be properly charged by the alternator.

Electronic interfaces (including parts, e.g. plugs, lines)

- Base module installation location Actros2

Front passenger footwell

Cab interface
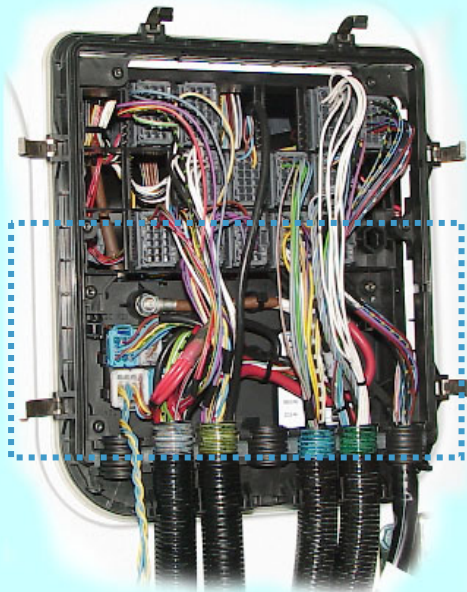
Electronic interfaces (including parts, e.g. plugs, lines)

- **Signal pick-up on the Actros2 base module, function of power take-off**

Activation of a power take-off **NA1, NA3 (NMV)** or live power take-off (MOT)
through the modular switch panel in the cab is ***integrated into the base module.***

This enables single power take-offs to be parameterized, without having to install a PSM
(parameterizable special module).

Master module in modular switch
panel (MSF) is connected to the
interior CAN bus
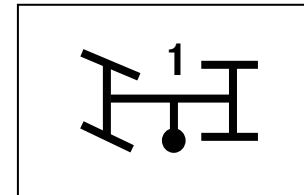
Power take-off 1 (NA1)
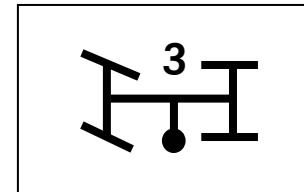
Power take-off 3 (NMV)
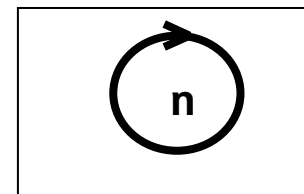
Live power take-off (MOT)

The ***power take-off function*** in the base module is
active only if a ***PSM*** is ***not*** installed in the vehicle.

Parameter equations and additional information are available in the body manufacturer portal's technical information area under
electrical/electronic components.

Electronic interfaces (including parts, e.g. plugs, lines)

•**Signal pick-up, accessory functions on X12 Plug on Actros2 base module**

The base module can use the *4 function pins* (X12 21/15, X12 21/18, X12 21/21, and X12 21/17)

to realize *additional functions to match customer requests.*

Parameterizable switching outputs:

Linking of any CAN events
(engine speed, parking brake, high beams, retrofit switch)

CAN capable
Retrofit switches 1 to 5
in the modular switch panel

The following are pre-programmed in the as-delivered state:

X12 21/15 = input condition 1:   High beams actuated
       input condition 2:   Retrofit switch 1 (CAN) actuated
       Type of logic: AND

X12 21/18 = input condition 1:   Standing lights actuated
       input condition 2:   Retrofit switch 2 (CAN) actuated
       Type of logic: AND

X12 21/21 = input condition 1:   Retrofit switch 2 (CAN) actuated
       input condition 2:   Not used
       Type of logic: OR
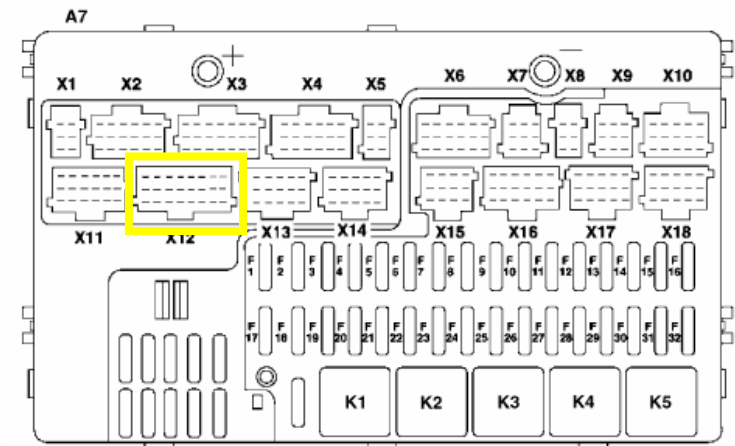
Electronic interfaces (including parts, e.g. plugs, lines)

• **Signal pick-up, auxiliary functions on X12 Plug on Actros2 base module**

The **function pin 17** on the X12 plug in the base module is realized through an **extended function equation.**

Up to 4 CAN events or shift signals can be linked at any time.

This function is available in base module version "Release 2."

X12 21/17 =   E1:   not used
E2:   not used
E3:   not used
E4:   not used

Threshold value: Minimum value of a signal

Hysteresis: Describes by how much a threshold value may be undercut, to enable the equation to be fulfilled.
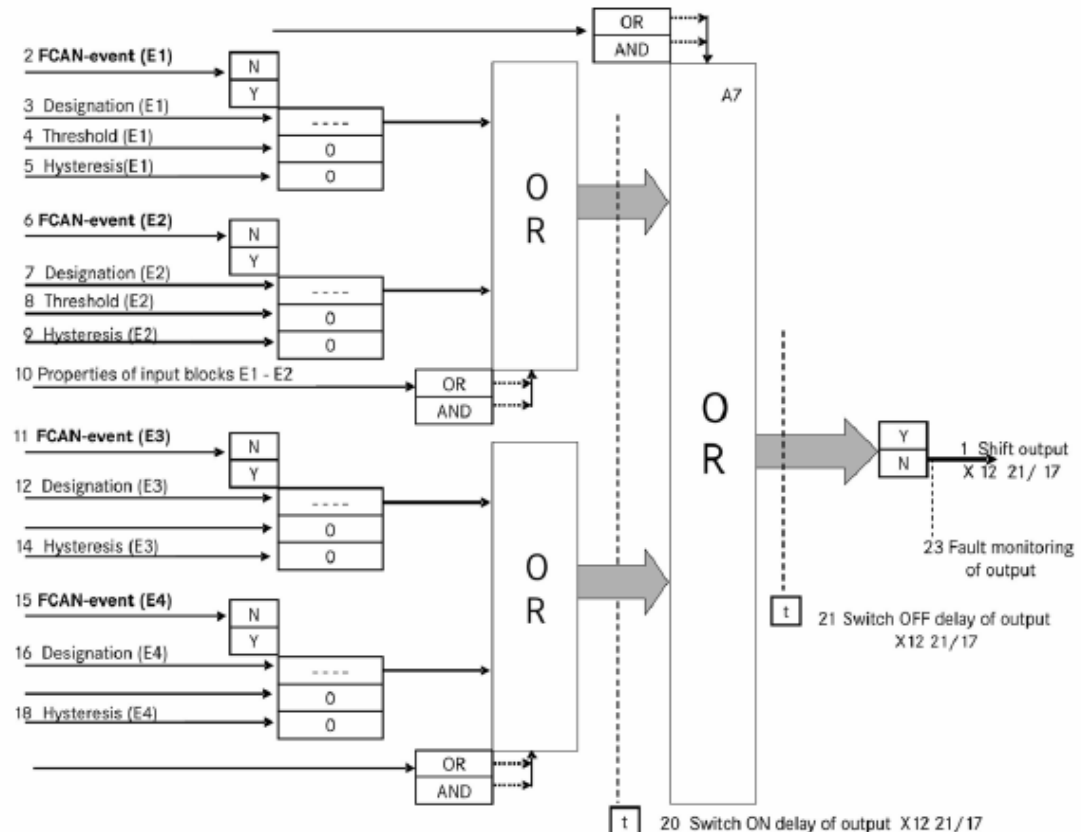
Electronic interfaces (including parts, e.g. plugs, lines)

• **Signal pick-up on the Actros2, Atego2, Axor2 base module**

Information on function pins in the Actros2 base module

- The **outputs** of the function pins may be loaded with **max. 0.5A.**

- Connected inductance (solenoid valves, relays, etc.) must be equipped with an **overload diode.**

- The parameters of the function pins can be parameterized with DAS.

- Before parameterization of the function pins, check whether the respective output on the base module is

  being used for other purposes.

- Examples of proper and intended use of the potential and function pins are described in the
  WIS document SI54.21-W-0013A.

- The factory pre-programming can be altered using DAS.

Information on the pickup on the X7 plug (Actros) or X7.1 (Axor/Atego)

The **cross-section** of the supply line must be **matched** to the **amperage** of the auxiliary consumers.

The following basic rules apply here. The maximum current density of a line is dependent on its

cross-section.

For 1–10 mm² it is 8 A/mm².

For 10–35 mm² it is 6A/mm².

The voltage drop of the battery to the consumer must not be more than 0.5V!

If it is higher than 0.5V because of the length of the line, then the next largest cross section must be chosen.

Electronic interfaces (including parts, e.g. plugs, lines)

• **Parts, plugs, lines for signal pick-up**

Cable duct on the cab/frame separation point

For **_additional cable ducts_** on the cab-chassis plug connection (cab/frame separation point), special care must be taken to ensure that the passage is **_sealed._** This can be effected using diverse accessory parts such as reducing pieces, stop plugs, or corrugated hoses.

A proper seal looks as follows:

Cable duct

Terostat

Reducing piece

Blind plug

This principle is to be used not only on the cab/frame separation point, but also on all sealed cable ducts.
If the sealing is not adequate, moisture may gather in the interior because of the capillary effect on the lines. Droplets of water may form at the end of the line, generally at the connector of the connected control unit, and thereby destroy the control unit.

Electronic interfaces (including parts, e.g. plugs, lines)

• **Parts, plugs, lines for signal pick-up**

Connection for additional consumers in outer area

To mount **additional consumers** in the outer area of the vehicle on an existing wiring, it is essential to **prepare** and connect a so-called **Y-cable.**

This is mounted using a plug, which matches the jack of the original consumer, onto the vehicle's cable set.
The signals are picked up in the line of the Y-cable through J-connectors, and made available at two plugs for the consumers.

The following must be observed when making the Y cable:

• The cable in the J-connector must be soldered or crimped.

• The J-connector must be bonded using a heat-shrinkable tube

   to make it watertight.

• The function of the single-wire seal at the plugs must be ensured.

Additional information and parts information is available in the body manufacturer portal at Technical Information in the Parts Catalog category.
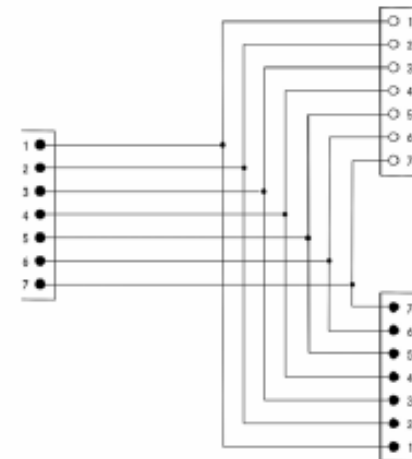
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Parameterizable special module (PSM)

- **Interface between vehicle and body**
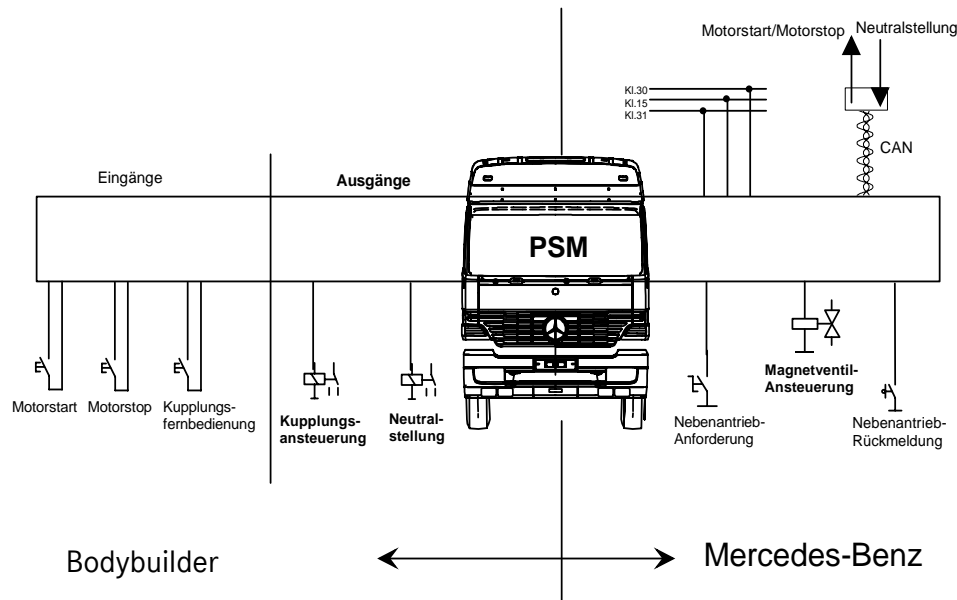
The parameterizable special module control unit (A22) is located in the upper area of the electronics compartment on the passenger-side.

Actros2 example
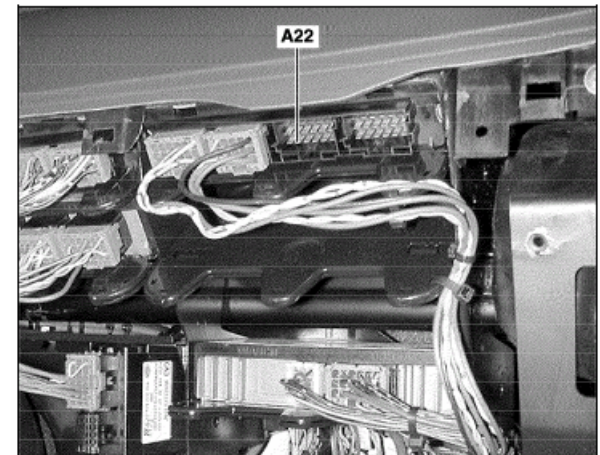
W54.21-1230-11

The following are the main applications for the PSM:

- Power take-off control system, nominal speed control system

- Engine start/stop, backup shift lock/speed limit

- Remote clutch control, retarder (Telma Fokal)

- Automatic transmission (Allison)

Parameterizable special module (PSM)

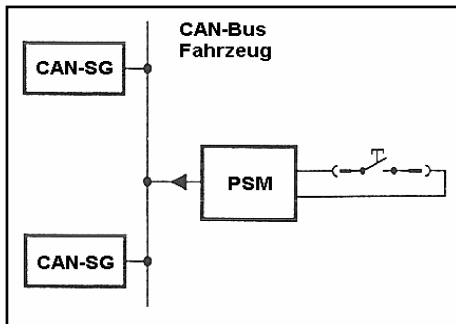- **Examples of typical applications**

Control and monitoring of
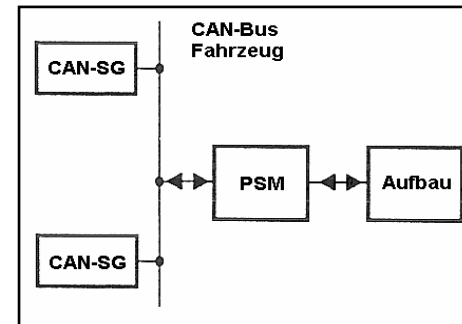various power take-offs
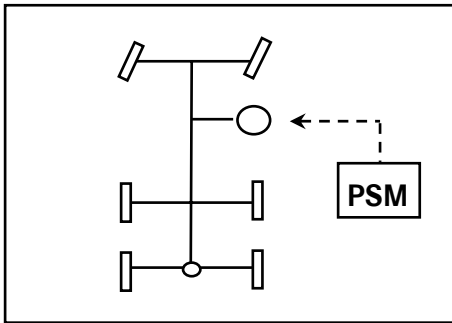
Implementation of information from vehicle CAN
for actuation of relay outputs
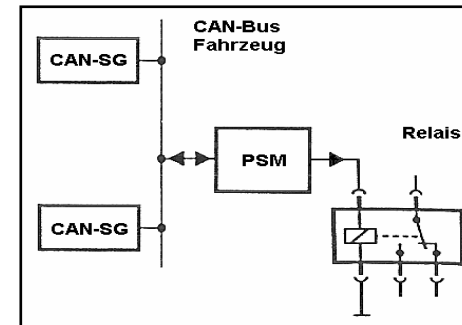
Monitoring of switching states and translation
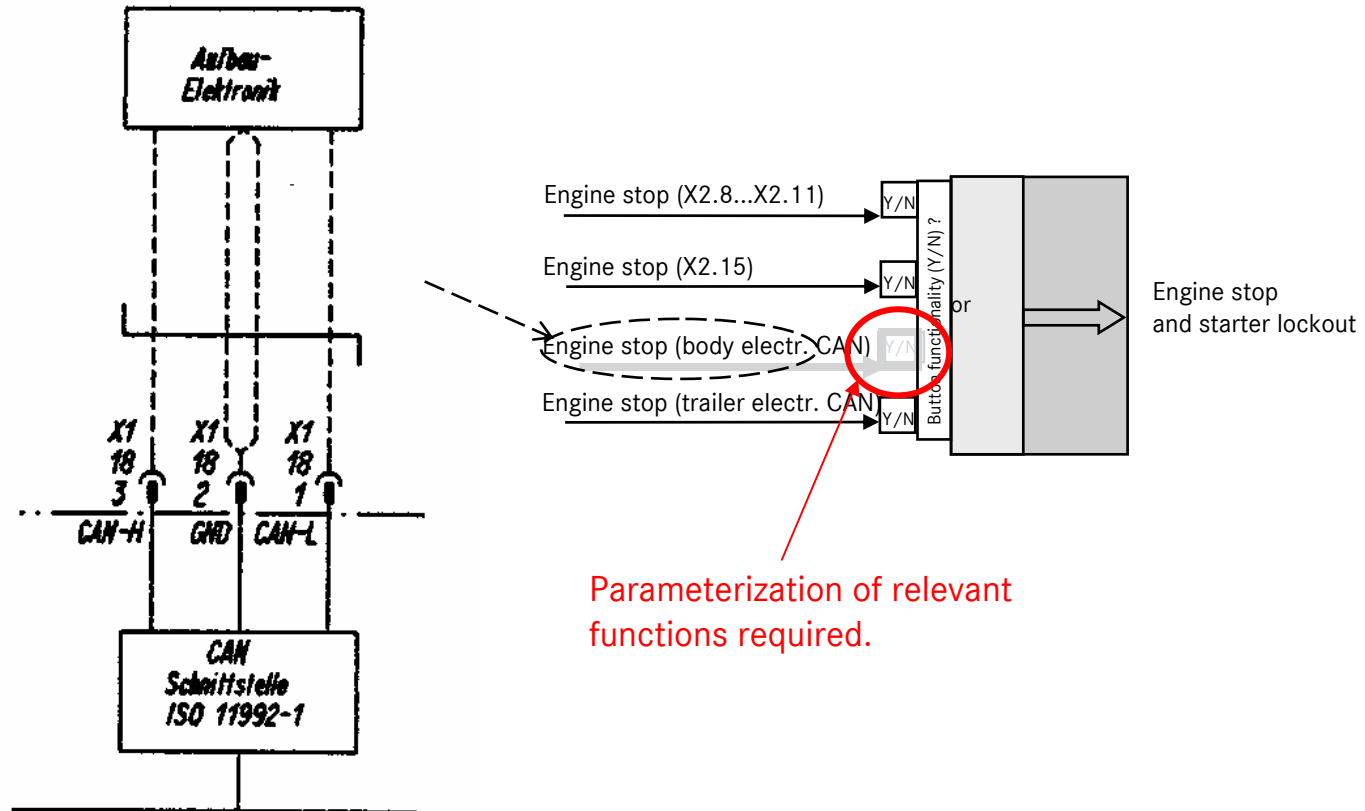into messages on the vehicle CAN

Translation of messages between vehicle
CAN bus and the body/trailer CAN

Parameterizable special module (PSM)

- Examples of engine stop over body CAN

Engine stop (X2.8...X2.11)

Engine stop (X2.15)

Engine stop (body electr. CAN)

Engine stop (trailer electr. CAN)

Engine stop and starter lockout

Parameterization of relevant functions required.

Parameterizable special module (PSM)

• **Parameter equations and data handling**

Parameter equations

Parameter equations and **additional information** are available through the **Bodybuilder Portal** in the Technical Information area under Electrics/Electronics.
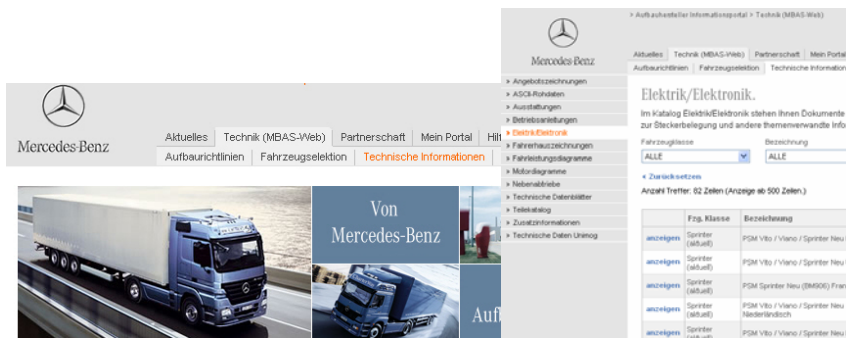
Vorwort		SN00.00-W-0001-01R
Funktionsbeschreibung		
Parametrierbares Sondermodul (PSM) Funktion		GF54.21-W-0002R
Steuergerät PSM Anordnung		GF54.21-W-5000-01R
Steuergerät PSM Aufgabe		GF54.21-W-5002-02MPB
Parametrierbares Sondermodul (PSM) Steckerbelegung Steuergerät		GF54.21-W-0002-04B
Parametrierbares Sondermodul (PSM) Technische Daten		GF54.21-W-0002-02B
Parametrierung		
Steuergerät Parametrierbares Sondermodul (PSM) parametrieren		AR54.21-W-2001C
Hinweise zur Verbaubarkeit von Nebenantrieben mit parametrierbarem Sondermodul (PSM)		AH54.21-N-0001-01A
Beispiele für logische Verknüpfungen der Eingangsbedingungen		SM54.21-W-3001-02C

Data handling for PSM

Parameter sets from the PSM can be stored on the **STAR DIAGNOSIS,** the DaimlerChrysler diagnostic system.

These parameter sets can be transferred on a **USB stick** to any **other computer** and stored in archives, or sent **by e-mail**.

Parameterizable special module (PSM)

- Body and trailer interface for Actros2/3 EM8/EM9

The **body and trailer interface** is a **communication interface** over which the body manufacturers can integrate extra electronic control systems into the vehicle's electronics.
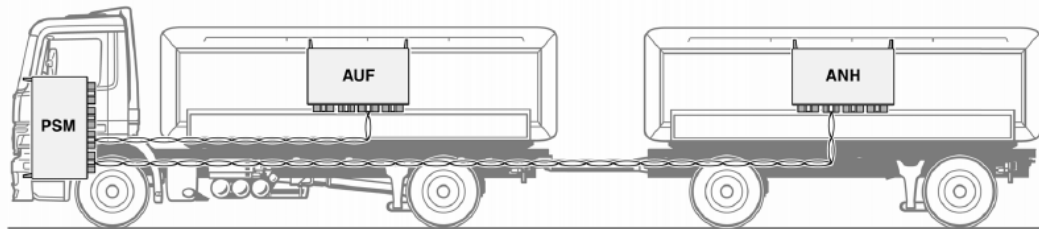
Interface code EM8:

The parameterizable special module control unit with special equipment code EM8 has a CAN interface for body and trailer electronics.
Both interfaces comply with the ISO standard 11992 (**24 V**).

Interface code EM8/EM9

The parameterizable special module control unit with special equipment code EM9 has **a CAN interface** for **body electronics** according to ISO 11898 (**5 V**) and **a CAN interface** for **trailer electronics** according to ISO 11992 (**24 V**).

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Miscellaneous

•**Actros 2 rear module innovation**

Depending on the vehicle equipment, as of production date ***12.2006 new rear module*** variants (HM)
"Release 3" with ***modified hardware*** and ***extended functions*** will be used.

New features in the rear module:

- Evaluation of fill level with MAPPS fuel level sensor (refer
  to right picture)
- Integrated functionality for 2nd NR operating unit in body
- Improved functionality of bulb failure indicator light
- Option for monitoring 2nd pair of lights
  (standing lights, brake lights, and turn signal lamps) on
  tractor vehicle.

In a replacement part case, the full version is installed.
A current comparison of the control unit and software
variant is filed in the control unit menu
of the DAS:

Version	Steuergerätenummer	Tankgeber
Vollversion	001 446 22 17	MAPPS/Reed
4x2	001 446 23 17	MAPPS
6x2 Vollluft	001 446 24 17	MAPPS
Allrad	001 446 25 17	MAPPS

Thank you very much for your attention