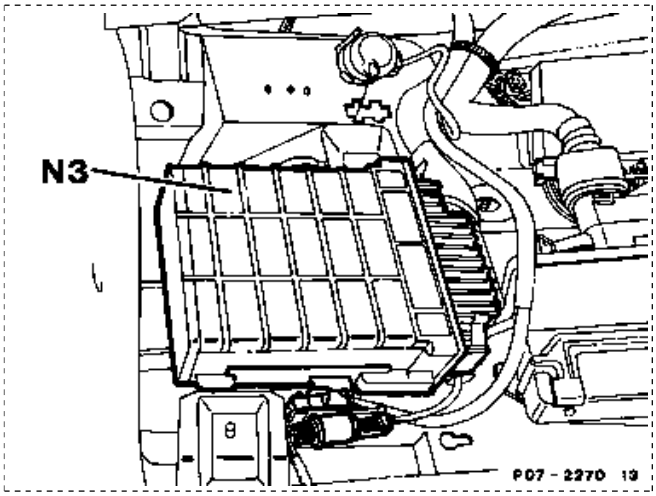
D. Functions in the KE control unit

a) General

The KE control unit (N3) analyzes the data regarding the operating state of the engine supplied by the sensors.

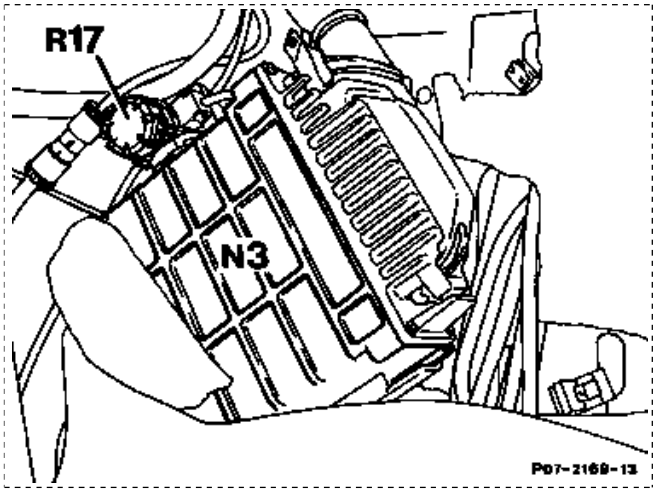
It forms from these data a control current for the electrohydraulic actuator (Y1).



Location on model 107

Location of KE control unit (see also 07.3-0015)

- Models 124, 129, 201: on right of component compartment
- Model 107: in right footwell below floor panel
- Model 126: in right footwell behind side trim panel

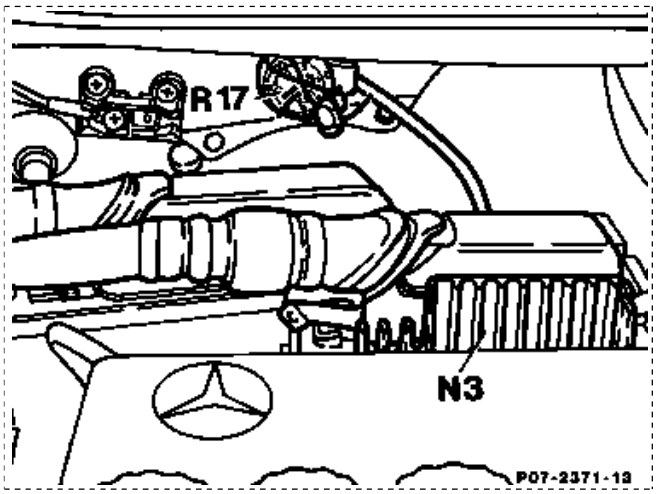


Location on model 126

⚠

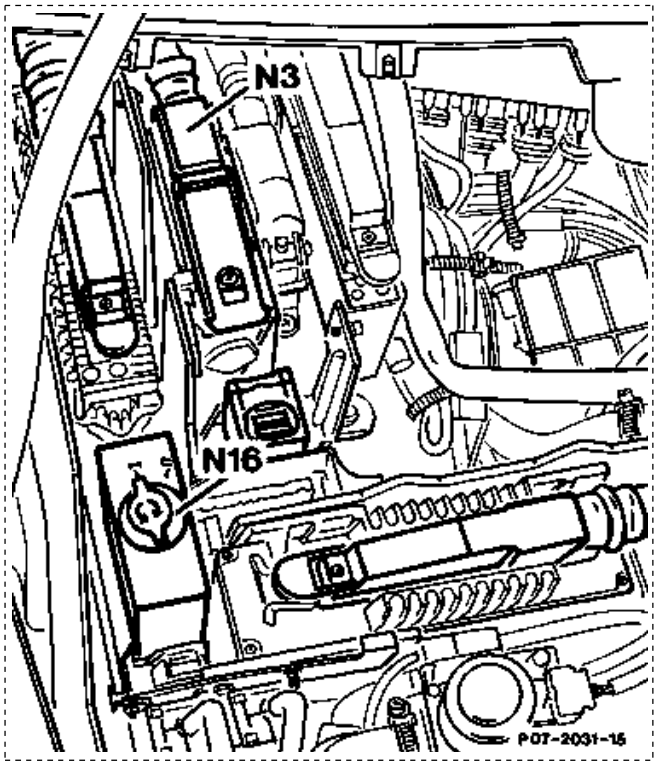
If the ignition is switched on or the engine is running, **do not unplug** coupling at KE control unit as the KE control unit may be damaged as a result of voltage or current peaks.

The influencing parameters at the KE control unit and the functions in the KE control unit differ according to the respective version (see also 07.3-0004 and 07.3-0020).



Location on models 124, 201

KE control unit (N3), model 129
Located in front right of component compartment. It has
55 connections and a metal housing to improve heat dissipation. The coupling is locked to the control unit by means of a spring clamp.



Location on model 129

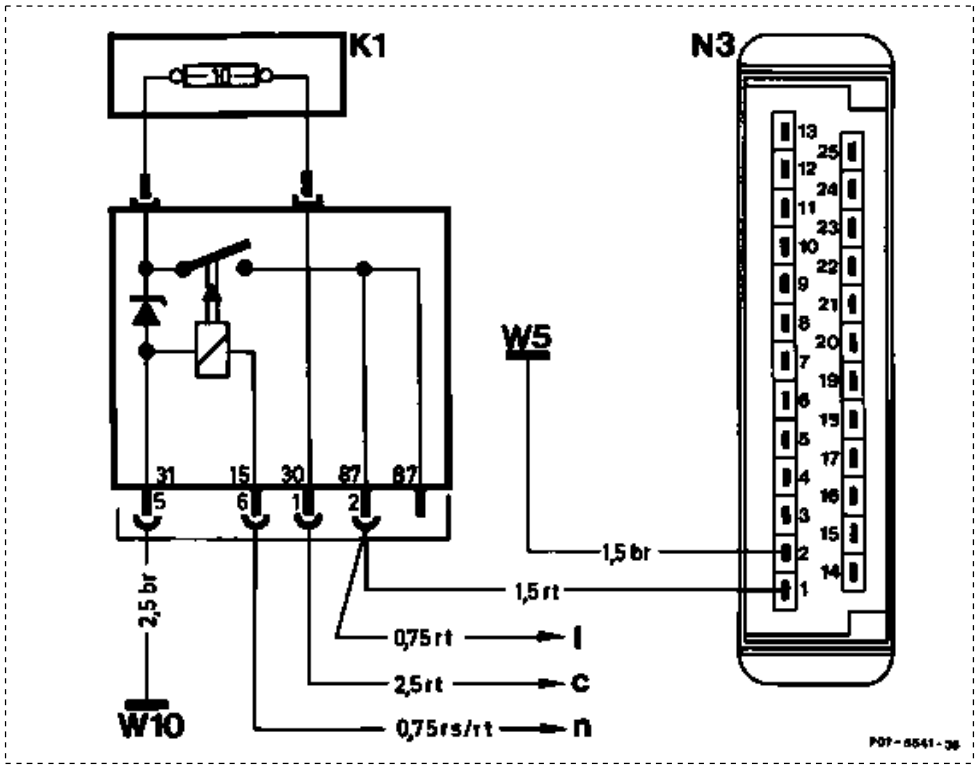
KE control unit standard version
A fuel injection programme without lambda control is stored in the KE control unit.

KE control unit KAT/RÜF version
The KE control unit has two fuel injection programmes (with/without lambda control). The respective programme is activated by the resistance trimming plug. For (AUS) (J) (USA) reference resistors are installed. For (USA) as of model year 1988 the reference resistor is integrated in the KE control unit.
When the ignition is switched on, a certain current is supplied to the electrohydraulic actuator and a certain on/off ratio is output at the lambda test output.

KE control unit KAT/without KAT version engine 102 as of 09/89
The fuel injection programme for the RÜF mode is omitted in the KE control unit.

KE control unit KAT/without KAT version
The KE control unit contains two fuel injection programmes "KAT" and "without KAT" which can be activated with the KE resistance trimming plugs (R17) "KAT" and "ECE".

b) Voltage supply, KE control unit relay (overvoltage protection)

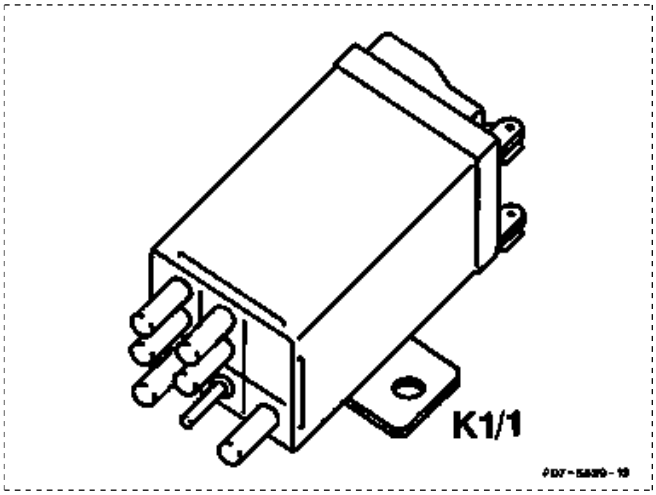


K1	Overvoltage protection relay
N3	KE control unit (25-pin coupling)
W5	Ground, engine
W10	Ground, battery
1	Other consumers e. g. idle speed adjuster
c	Terminal 30
n	Terminal 15, ignition starter switch

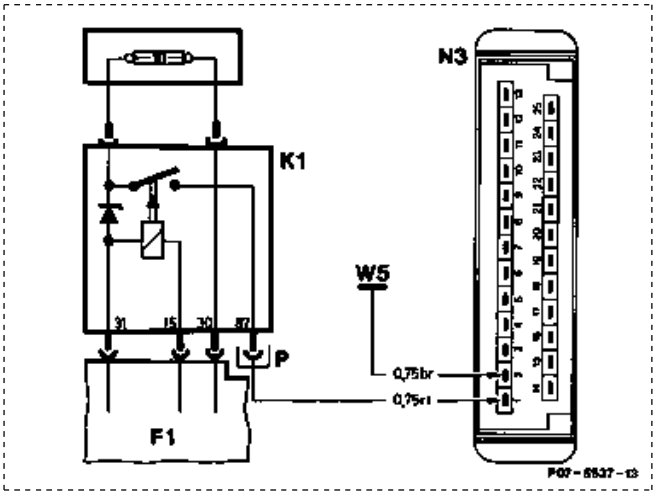
The voltage supply of the KE control unit as well as of further electronic control units in the vehicle is performed by the overvoltage protection relay.

Battery voltage exists constantly at terminal 30. A 10-ampere flat fuse prevents an overload of terminal 30.

When the ignition is switched on, the relay is actuated by the ignition starter switch via terminal 15 and the NO contact connects terminal 30 to terminal 87. Voltage is thus supplied to the KE control unit via terminal 87 (or 87E). Ground is connected via connector 2 in the case of the KE control unit with 25-pin coupling.



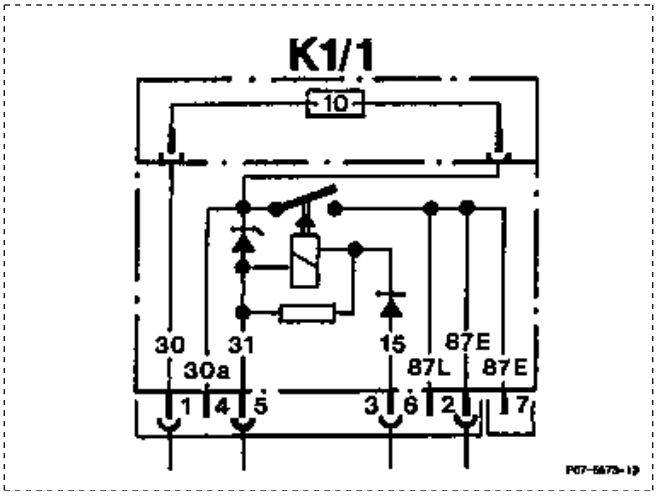
The overvoltage protection is performed by a Zener diode with a Zener voltage of 22 volts. If this voltage is reached, the Zener diode is conductive in the blocking direction and voltage peaks in excess of 22 volts are switched directly to ground. The relay thus opens its NO contact. Terminal 87 (or 87E) has no voltage.



Notes regarding version

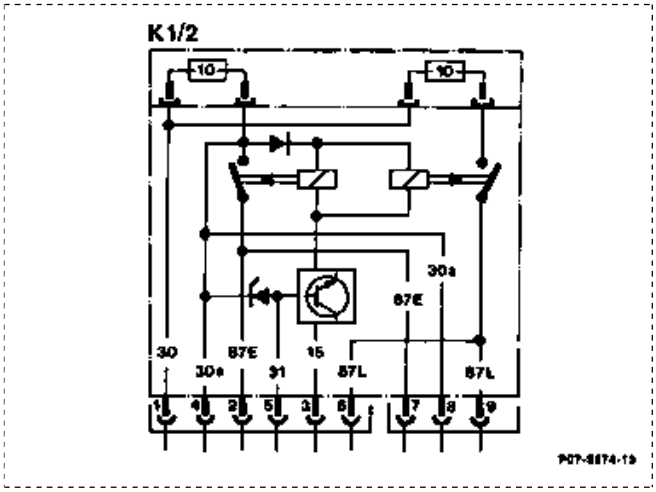
The overvoltage protection relay exists in various versions. It is designated accordingly in the wiring diagrams with K1, K1/1 or K1/2.

A 4-pin version was installed in model 201 at start of series production. This overvoltage protection relay is inserted directly into the electrical center (F1) with its own plug connection for terminal 87 (P).



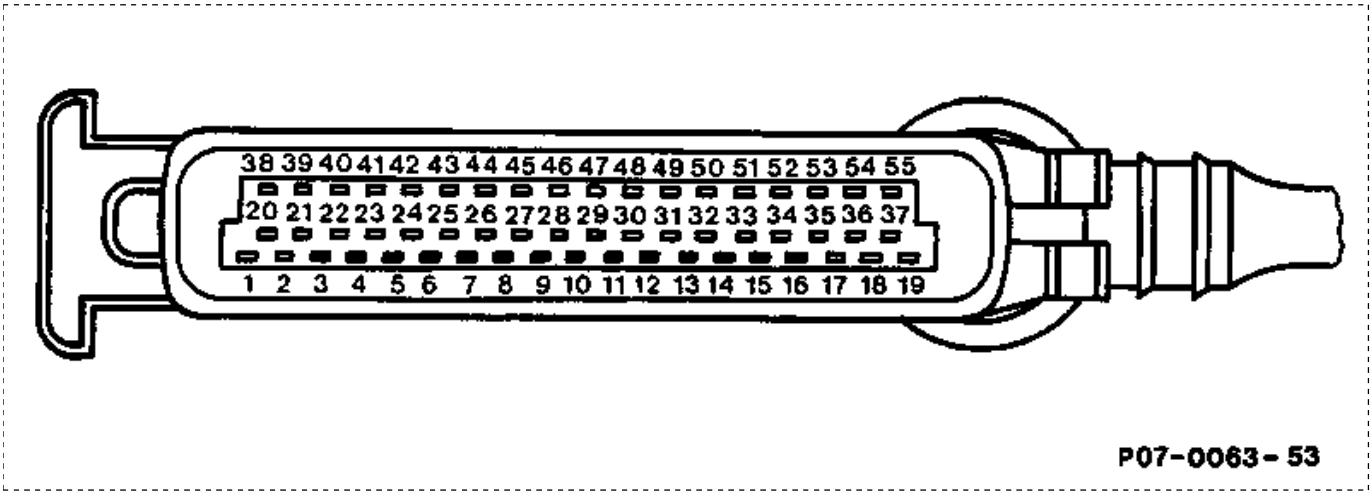
In the case of the 7-pin version, the electronic control units are supplied with voltage from terminals 87E. Terminal 87L supplies further consumers, e. g. the idle speed adjuster. The fault memories in the control units are supplied constantly with voltage via terminal 30a.

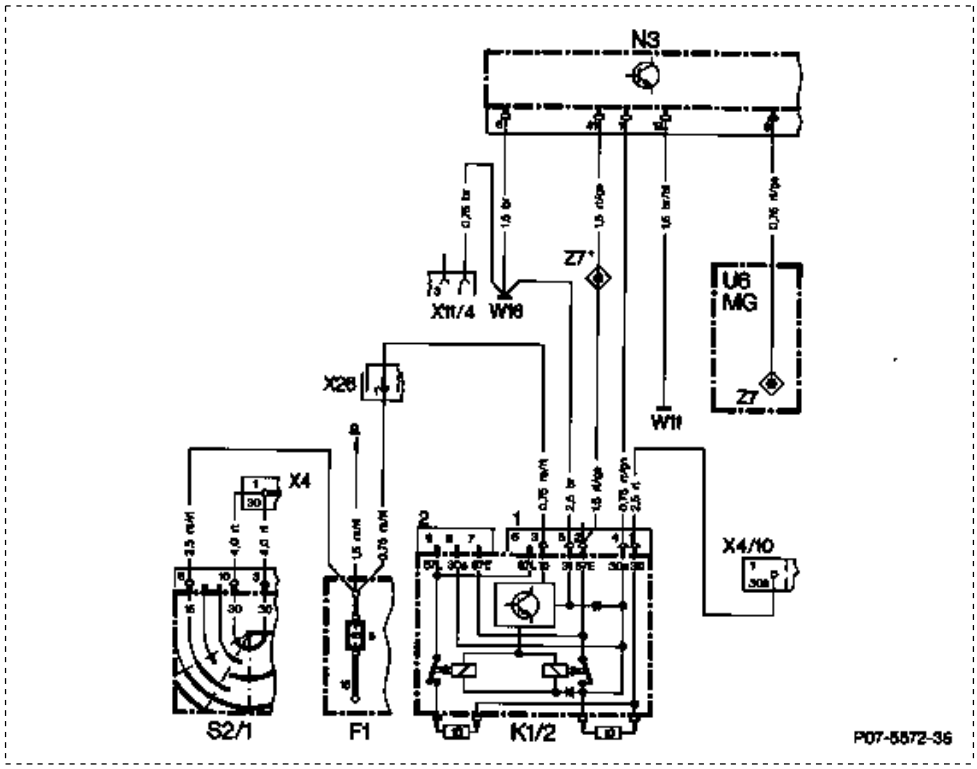
In the case of the 9-pin version, a separate relay and fuse are installed for terminal 87L.



In the case of KE control unit with 55 connections (engine 104, 119) the voltage supply is performed as follows:

1 Voltage supply terminal 30a (fault memory)
6 Ground W16 (ground for output stages)
9 Voltage supply terminal 87E (n. a. as of vehicle ident end no. 1F 002 245)
19 Ground W11 (electronics ground)
41 Voltage supply terminal 87E





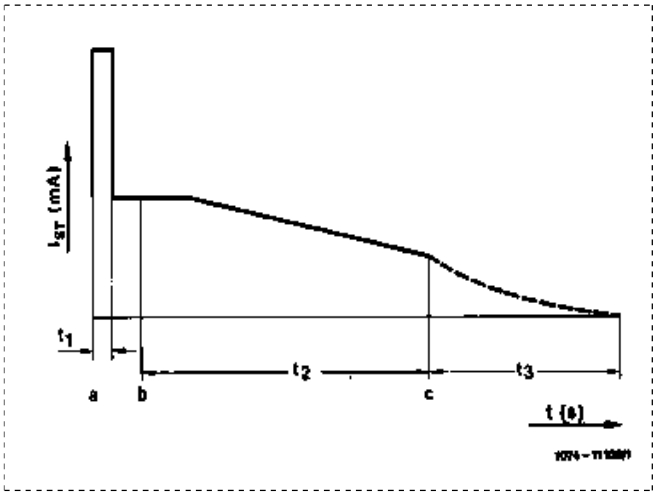
Voltage supply KE control unit (55 connections, KE 5)

F1	Fuse and relay box, fuse 9, unprotected side
K1/2	Overvoltage protection relay 87E/87L/30a (9-pin)
N3	KE control unit
S2/1	Ignition starter switch
U6	n. a. as of vehicle ident end no. 1F 002 245 (connection Z7* to Z7 deleted)
W11	Ground, engine (electric wires bolted on)
W16	Ground, component compartment
X4	Terminal block terminal 30, fuse and relay box/interior (2-pin)
X4/10	Terminal block terminal 30/30Ü/61e/87L (5-pin)
X11/4	Test coupling for diagnosis (16-pin)
X26	Plug connection, interior/engine (12-pin)
Z7	Connector sleeve terminal 87E
Z7*	Feed from overvoltage protection relay
a	Ignition coil terminal 15

c) Warming-up phase

Starting of the engine and the post-start phase (see section F "Start devices") is followed by the warming-up phase of the engine. The fuel/air mixture has to be enriched in the warming-up phase because part of the fuel precipitates at the still cold intake manifold, at the injection valves and cylinder walls.

Warming-up enrichment is thus dependent on the coolant temperature. The lower the coolant temperature, the higher the current at the electrohydraulic actuator and thus the fuel enrichment.



The coolant temperature is detected by the coolant temperature sensor (B11/2 or B11/3) and supplied to the KE control unit (see section E "Coolant temperature sensor").

On KAT versions the lambda control is enabled in the warming-up phase (e. g. from 40 °C coolant temperature). The warming-up and lambda control functions then overlap.

t1	Start enrichment (duration e. g. 2 seconds)
t2	Post-start enrichment (duration e. g. 20 seconds)
t3	Warming-up (duration depending on coolant temperature)
a	Start
b	End of start Commencement of limiting post-start enrichment
c	End of post-start enrichment Commencement of warming-up phase
I_{ST} (mA)	Current at electrohydraulic actuator

Testing warming-up base value

For the test, simulate 20 °C coolant temperature and measure the current at the electrohydraulic actuator in mA.

Depending on the engine version, pay attention to the following points:

- Test with separate plug connection for oxygen sensor signal (G3/2x2).
- Measure current level within a certain time after starting engine.
- Do not measure current level until coolant temperature at 80 °C, then compare with the value at 20 °C coolant temperature.

Warming-up control
Engine 103.984, 104, 119
Engine 103 (CH) (N) (S) (DK) (FIN) as of 1991

In the fuel injection system (KE 5) the warming-up phase is dependent not only in the coolant temperature but also on other influencing parameters (e. g. time, throttle valve position, selector lever position).

Engine 103.984
If the throttle valve is closed and the coolant temperature is 20 °C, post-start enrichment for KAT engines up to
8 seconds [8 seconds] after start 4 - 8 mA [21 - 27 mA]. After this, it is limited to the warming-up base value which 1 - 2 minutes [1 - 2 minutes] after start is between 0 and -4 mA [15 - 22 mA].

The lambda control operates in the open-loop mode up to maximum 2 minutes (at coolant start temperature of
20 °C) after start.The lambda closed-loop control is enabled thereafter.

[Figures without KAT].

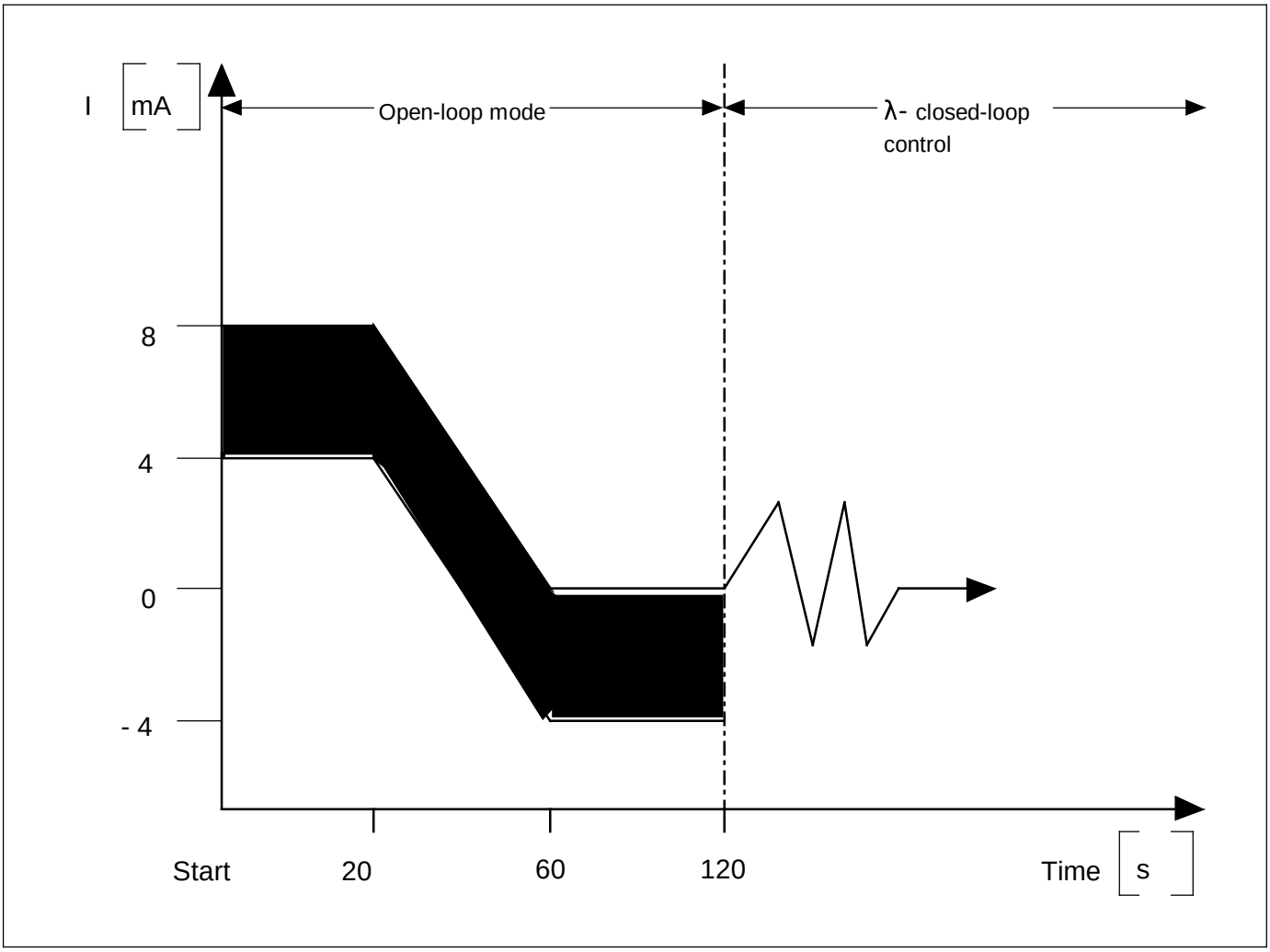


Diagram for KAT engines and +20 °C coolant start temperature (simulated)

Engine 104 up to 08/89

With the throttle valve closed and the coolant start temperature at 20 °C, post-start enrichment for KAT engines up to 8 seconds [8 seconds] after start is 1 - 3 mA [4 - 7 mA] with selector lever in position P/N and 5 - 8 mA [5 - 8 mA] with a Drive mode engaged. After this, the current at the electrohydraulic actuator is limited within 4 seconds [10 seconds] to the warming-up base value in the case of KAT engines of 0 - 1 mA [0 - 1 mA]. The warming-up base value remains constant up to a maximum of 120 seconds [120 seconds] after start (at coolant temperature of 20 °C).

[Figures without KAT]

The lambda control operates in the open-loop mode for up to maximum 2 minutes after start (at coolant start temperature of 20 °C), depending on the coolant temperature. Following this, the lambda closed-loop control is enabled.

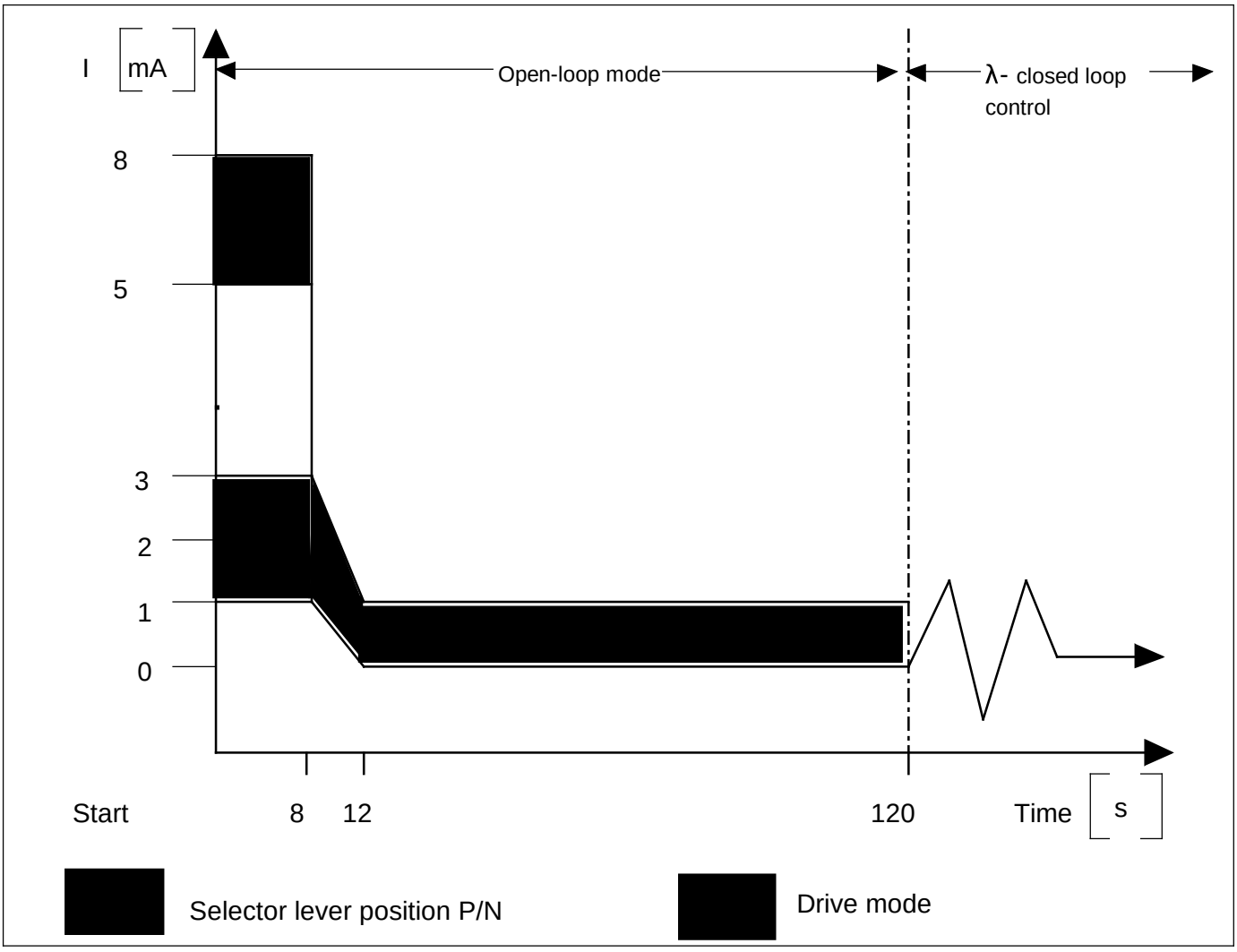


Diagram for KAT engines and 20 °C coolant start temperature (simulated).

Engine 104 as of 09/89

With the throttle valve closed and the coolant start temperature at 20 °C, the post-start enrichment up to 8 seconds [8 seconds] after start is 3 - 5 mA [4 - 7 mA] with the selector lever in position P/N or with manual transmission in Neutral and 5 - 8 mA [5 - 8 mA] with selector lever in Drive mode. Following this, the current at the electrohydraulic actuator is limited within 6 seconds [8 seconds] to the warming-up base value of
0 - 1 mA [0 - 1 mA]. The warming-up base value remains constant up to a maximum of
110 seconds [120 seconds] after start (at coolant temperature of 20 °C).
[Figures without KAT]

The lambda control is enabled once post-start enrichment is terminated (a maximum of
110 seconds at +20 °C coolant temperature) and a coolant temperature of 50 °C is reached.

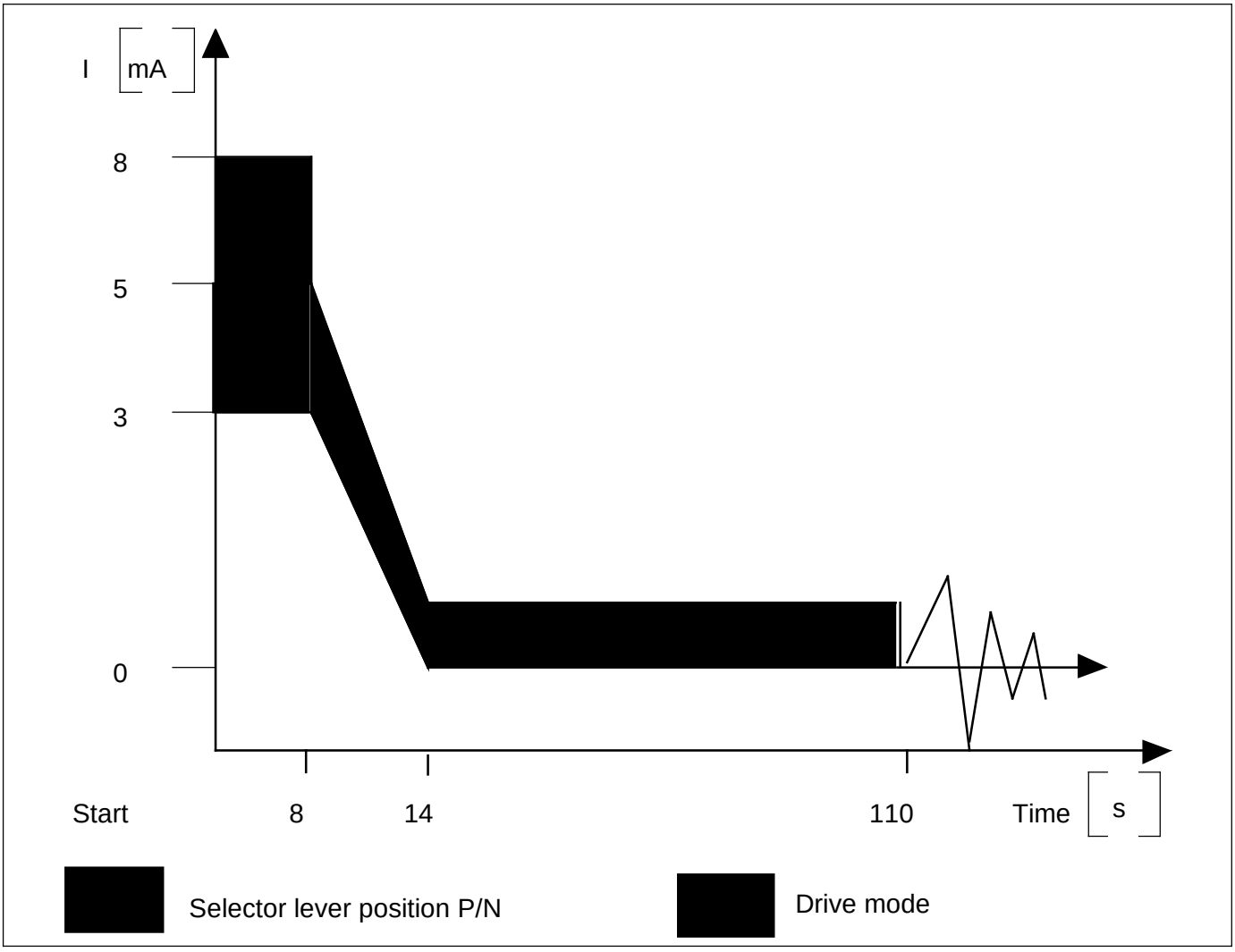


Diagram for KAT engines and 20 °C coolant start temperature (simulated).

Engine 119

With the throttle valve closed and a coolant start temperature of 20 °C, post-start enrichment for KAT engines up to 15 seconds [15 seconds] after start is
5 - 8 mA, [8 - 13 mA] with selector lever in position P/N and 18 - 25 mA [24 - 31 mA] with Drive mode engaged in the case of KAT engines. Following this, the current at the electrohydraulic actuator is limited within 2 minutes [2 minutes] after start to the warming-up base value in the case of KAT engines of 0 ±1 mA [0 to+4 mA].
The limiting time is dependent on the start temperature (105 seconds in the case of coolant temperature of
20 °C).

[Figures without KAT]

The lambda control is enabled once the post-start enrichment is completed (a maximum of 120 seconds in the case of coolant temperature of +20 °C) and a coolant temperature of 55 °C is reached.

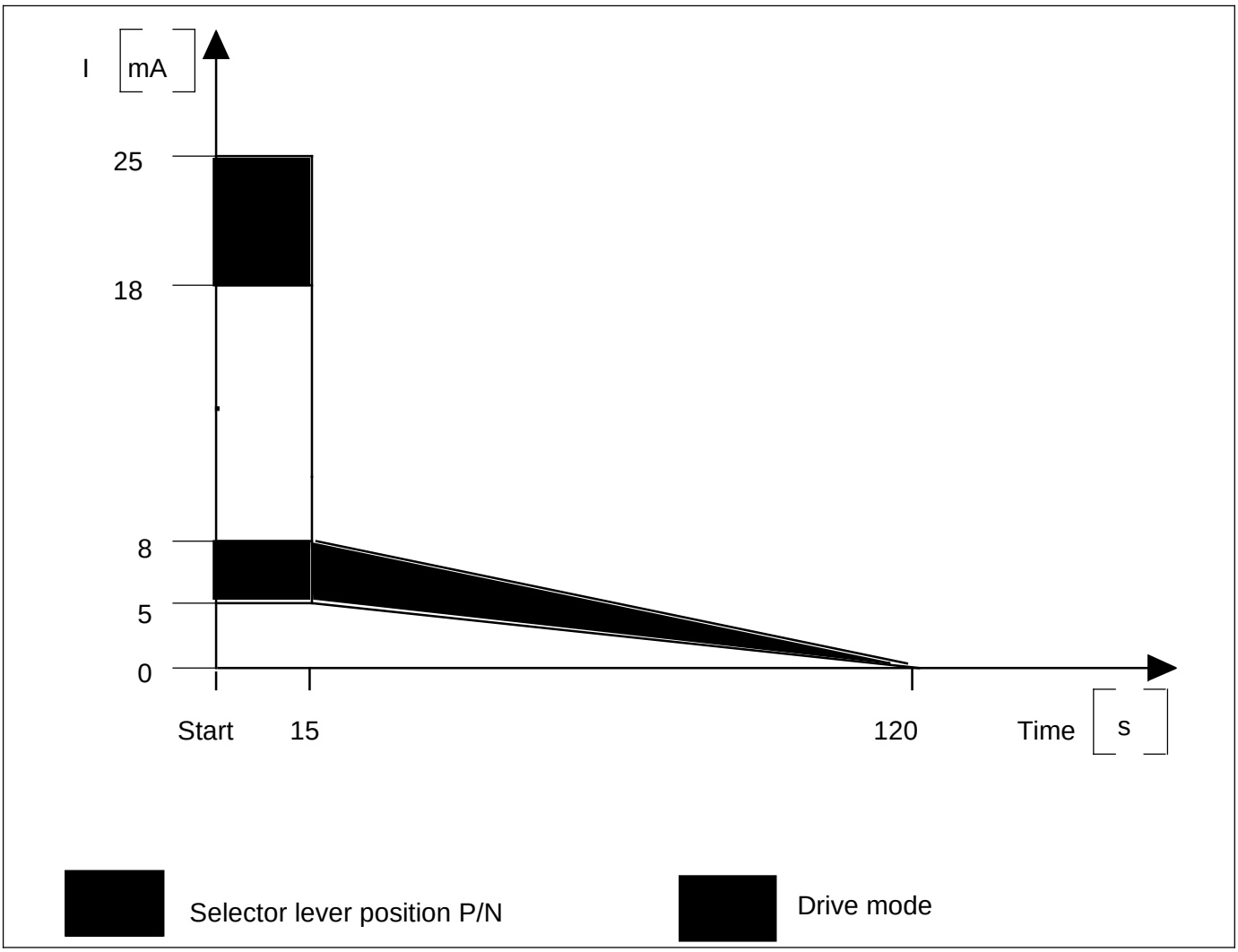
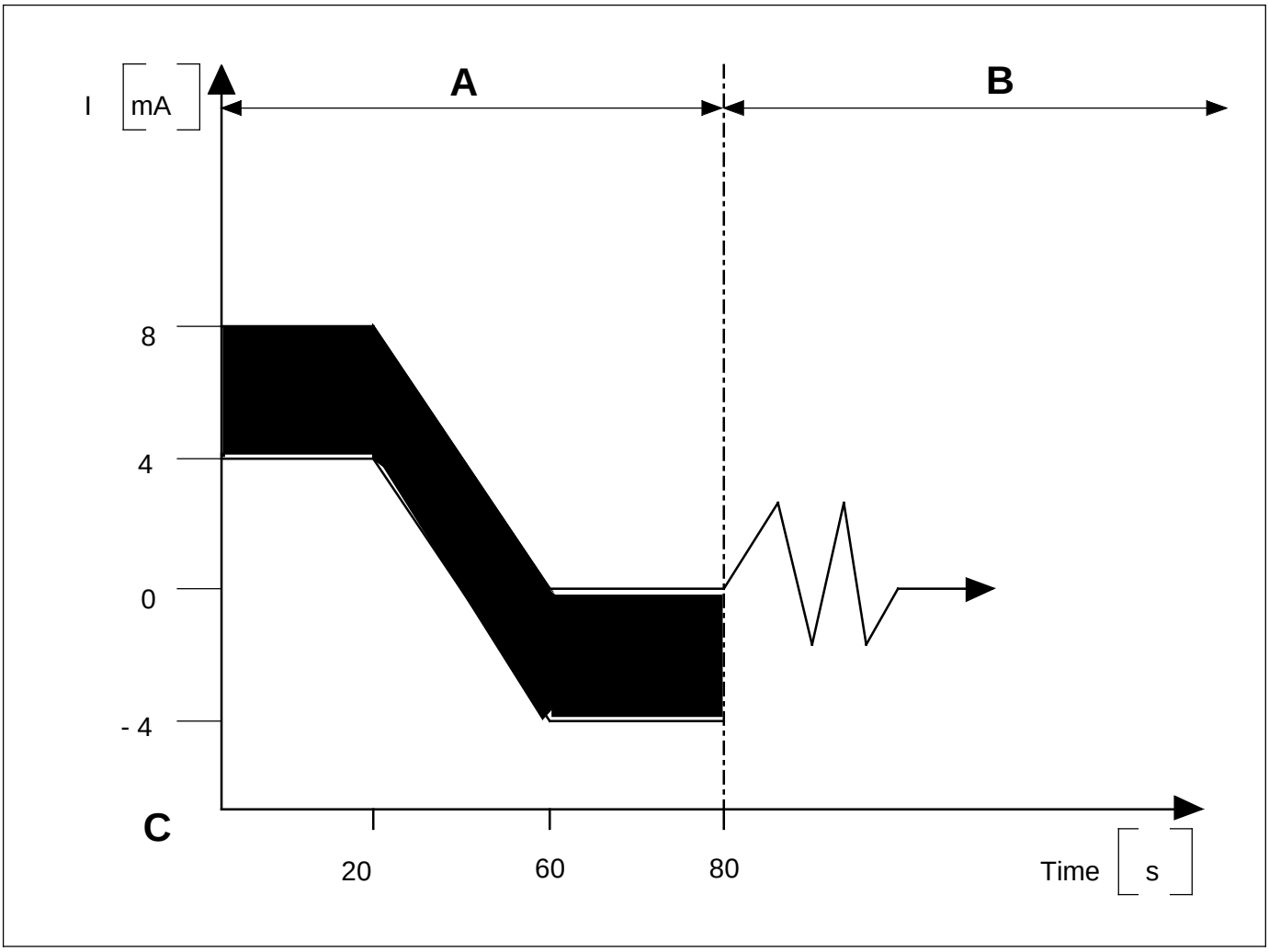


Diagram for KAT engines and 20 °C coolant start temperature (simulated).

Engine 103 (CH) (N) (S) (DK) (FIN) **as of 1991**
With the throttle valve closed and a coolant temperature of +20 °C, post-start enrichment up to 20 seconds after start is 4 - 8 mA. Following this, the current is limited to the warming-up base value which is between
0 and -4 mA 60 - 80 seconds after start.

The lambda control operates in the open-loop mode up to a maximum of 2 minutes (in the case of coolant start temperature of +20 °C) after start. Following this, the lambda closed-loop control is enabled.



A Open-loop mode
B Lambda closed-loop control
C Start

d) Acceleration enrichment

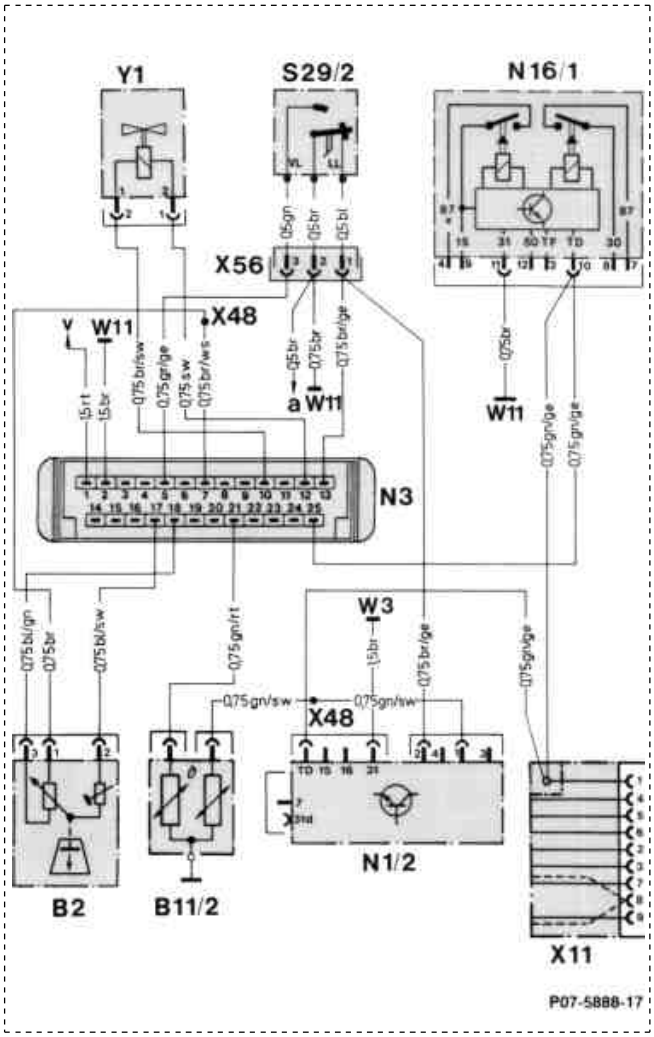
If the throttle valve is opened rapidly for accelerating, this briefly produces a leaner fuel/ air mixture. The mixture must be briefly enriched accordingly in order to achieve smooth pickup without jerking during acceleration.

The acceleration enrichment is dependent on the signal from the air flow sensor position indicator (B2) (see section E "Air flow sensor position indicator"). It detects the position and movement of the air flow sensor plate (opening rate).

The extent and duration of the enrichment is dependent on engine load and speed. A high enrichment is performed at high engine load and low change in rpm. Slight enrichment is performed in the reverse case.

Acceleration enrichment is dependent on the coolant temperature. When the engine is cold, higher enrichment is necessary because of fuel condensation on the cold parts of the engine. Depending on engine version, acceleration enrichment is inhibited from a coolant temperature of 80 °C.

When the engine is idling, acceleration enrichment is inhibited by the idle speed contact in the throttle valve switch or by the microswitch.



Wiring diagram of acceleration enrichment
Example engine 102.982 KAT/RÜF

B2	Air flow sensor position indicator
B11/2	Coolant temperature sensor
N1/2	Electronic ignition (EZL) control unit
N3	KE injection system control unit
N16/1	Fuel pump relay with start valve actuation
S29/2	Throttle valve switch, full load/idle speed recognition
W3	Ground, front left wheelhouse (at ignition coil)
W11	Ground, battery (electric cable bolted on)
X11	Diagnosis socket/terminal block, terminal TD
X48	Connector sleeve (solder connector in wiring harness)
X56	Plug connection, throttle valve switch
Y1	Electrohydraulic actuator
a	Intake air temperature sensor, contact 2
v	Overvoltage protection, contact 2, terminal 87

e) Part load mixture adaptation

This function is only active on engines in Standard or RÜF version. At part load the prime consideration is to achieve low fuel consumption and good emission levels.
Part load mixture adaptation is only active when the engine is at normal operating temperature (from approx. 60 °C coolant temperature). The KE control unit detects the momentary load state of the engine from the air flow sensor position indicator. In conjunction with coolant temperature and engine speed, the KE control unit determines the current at the actuator and thus the composition of the mixture in the part load range. Depending on engine version, a slightly leaner mixture is then produced in most cases.

f) Full load enrichment

Maximum engine torque is demanded when the throttle valve is fully open (full load contact in throttle valve switch closed). The fuel/air mixture must be enriched for this purpose.

In order to enrich the mixture, the KE control unit supplies a current to the electrohydraulic actuator within a specified engine speed range. This engine speed range differs according to engine version. The level of the current is dependent on engine speed.

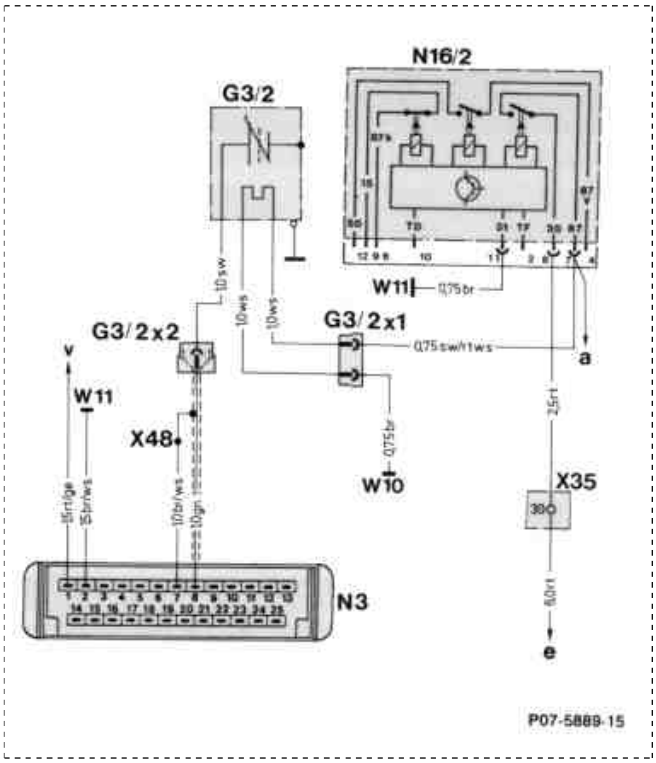
On KAT vehicles the lambda closed-loop control is not operational at full load (open-loop mode).

g) Lambda close-loop control

The control loop formed with the lambda probe enables impermissible variations in the air/fuel mixture to be detected and corrected.

In the event of a variation, the KE control unit corrects the quantity of fuel injected by means of the electrohydraulic actuator. This enables the quantity of fuel to be so exactly metered as to achieve an air/fuel mixture which differs from λ=1 only within very narrow limits in all operating states (see Group 14, section "Lambda control").

Wiring diagram of lambda control
Example engine 102.962 KAT/RÜF



G3/2	Heated oxygen sensor
G3/2x1	Plug connection, oxygen sensor heating coil
G3/2x2	Plug connection, oxygen sensor signal
N3	KE control unit
N16/2	Fuel pump relay with start valve actuation, kickdown cutoff and engine speed limiting
W10	Ground, battery
W11	Ground, engine (electric cable bolted on)
X35	Terminal block engine, terminal 30/terminal 61 (battery)
X48	Connector sleeve (soldered connector in harness)
a	Fuel pump
e	Terminal block, terminal 30, fuse and relay box
v	Overvoltage protection, contact 2, terminal 87

h) Deceleration fuel cutoff

As a result of deceleration fuel cutoff, fuel injection is interrupted in the deceleration mode (e. g. when travelling downhill, when braking and when coasting).
This results in reduced fuel consumption - also when driving in cities.
As no fuel is combusted when deceleration fuel cutoff is active, no exhaust gases are produced.

The KE control unit is supplied with the following information in order to control deceleration fuel cutoff.

- "Throttle valve closed" signal from the decel fuel cutoff microswitch (S27/2) or idle speed contact in the throttle valve switch (S29/2).
- Engine speed
  - Decel fuel cutoff operating if e. g. 3000/ min has been exceeded once.
  - Activation speed for decel fuel cutoff, e. g. engine speed above 1500/min.
  - Reactivation speed of combustion following decel fuel cutoff, e. g. without AC compressor at 1000/min and with AC compressor at 1200/min; depending on the version, the reactivation speed may also depend on the engine speed pattern during decel fuel cutoff.
- Coolant temperature
  No decel fuel cutoff is performed when the engine is cold, depending on the version the coolant temperature must be above e. g. +40 °C.

- Tempomat cruise control
  The KE control unit inhibits decel fuel cutoff during cruise control operation as follows:
  KE control unit without road speed signal:
  - On a number of engines 102 (KE 1 and 2) the cable from the decel fuel cutoff microswitch (S27/2) is looped via the decel fuel cutoff/Tempomat cruise control relay (K12) and the plug connection of the KE injection system/

  Tempomat cruise control (X33) (see Repair Instructions "Cruise control system").
  - The "Tempomat ON" signal is passed from the Tempomat cruise control unit (N4), contact 5 via the Tempomat plug connection (X33) to the KE control unit, contact 6.

  KE control unit with road speed signal (indefinite production breakpoint as of approx. 09/88, engines 116, 117 as of start of production).
  - Tempomat OFF is detected indirectly via the road speed signal for cruise control mode is not possible unless speed is approx. 40 km/h or higher.

If the conditions for decel fuel cutoff exist, the KE control unit alters the direction of the current to the electrohydraulic actuator (approx. -60 mA). As a result, the fuel supply to the injection valves is interrupted (see section C "Electronic mixture adaptation").

Decel fuel cutoff is cancelled again once:
- the throttle valve is opened again
  or
- engine speed drops below a certain value (reactivation speed), e. g. 1000/min.

When the accelerator pedal is depressed, the decel fuel cutoff microswitch (S27/2) opens before the throttle valve operates and decel fuel cutoff is interrupted before the throttle valve opens. This prevents any cut-in surge when combustion recommences.

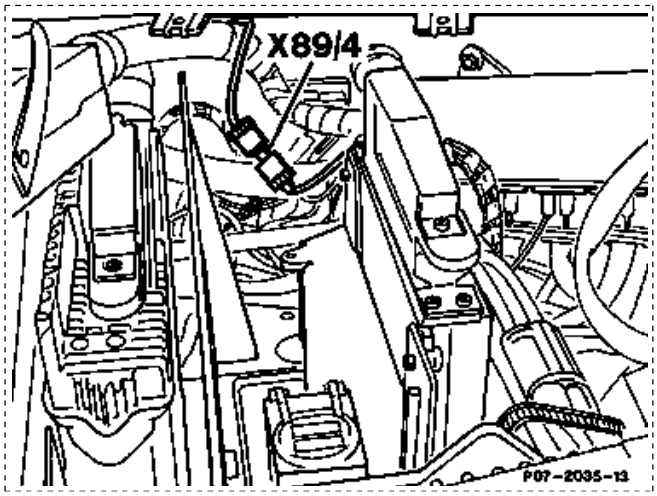
A number of KE control units output a certain on/ off ratio in the case of decel fuel cutoff:

KE control unit	On/off ratio readout with decel fuel cutoff
Bosch	50%
VDO	95%

Engines 103, 104 with ASR

The decel fuel cutoff microswitch (S27/2) is not fitted to vehicles with ASR. The cable is tied back in the wiring harness. The signal for decel fuel cutoff is then formed by the position sensor (R25) and supplied via the electronic accelerator pedal control unit to the KE control unit.

Model 129: The separation point between the control units is the plug connection (X89/4).



The operation of the decel fuel cutoff on all engines is basically the same although differences are possible in respect of specific engine versions. A number of examples are given below:

Engine 102.910	Decel fuel cutoff operating once engine speed above 1500/min and decel fuel cutoff microswitch (S27/2) closed.
Engine 102.96/98 KAT/RÜF as of 09/88	Decel fuel cutoff also with cruise control mode.
Engine 102.96/98 KAT as of 09/89	Decel fuel cutoff is operational once coolant temperature is above 40 °C and engine speed exceeds 3000/min. The on/off ratio readout with decel fuel cutoff is 95 % or 50 %, respectively.
Engine 102.990	Decel fuel cutoff operational above coolant temperature of 45 °C. Engine speed of 2100/min in the case of manual transmission, 1500/min for automatic transmission must be exceeded to activate decel fuel cutoff. Combustion recommences at 1600/min with manual transmission, at 1200/min with automatic transmission. Decel fuel cutoff also in cruise control mode.
Engine 116, 117	Combustion recommences at different engine speeds. If rapid drop in rpm, combustion recommences at higher engine speed than with slow drop in rpm. Following slow drop in rpm, combustion recommences at approx. 1300/min. No decel fuel cutoff below 20 km/h, below 1300/min and when selector lever in position P and N.
Engine 116, 117 KAT increased output	Engine speed exceed 1600/min. Combustion recommences at 1100/min. Lambda control operates in open-loop mode up to 800/min. Open-loop mode is dependent on engine speed and time. Lambda closed-loop control restored after 10 s or when 800/min reached. No decel fuel cutoff below 20 km/h.

i) Intake air mixture adaptation

The intake air temperature is detected by the intake air temperature sensor (B17/2). It is positioned at the air cleaner or at its intake pipe (see section E "Intake air temperature sensor (B17/2)").

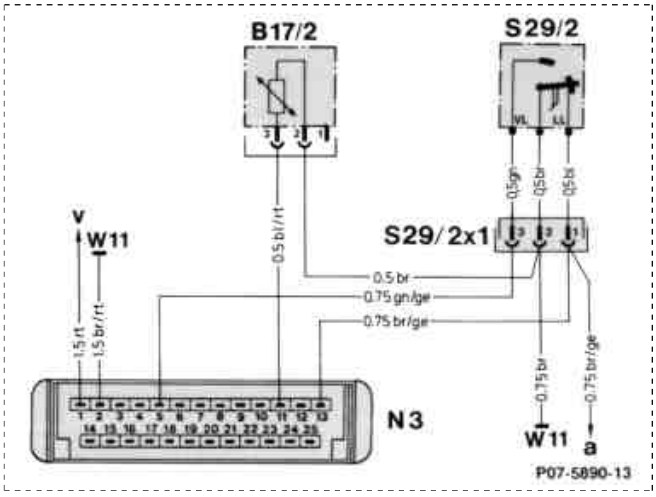
Mixture adaptation is performed as a function of the intake air temperature in the case of:

Engines 102, 103, 116, 117

On all KAT and RÜF versions (KE 3) the temperature signal is fed to the 25-pin KE control unit, contact 11.

Engine 102.910/96/98 as of 09/89

The temperature signal of the intake air temperature sensor (B17/2) for the KE control unit is omitted.



Example engine 102.982 RÜF/KAT

Engines 102, 103, 117, 117 (AUS) (J) (USA)

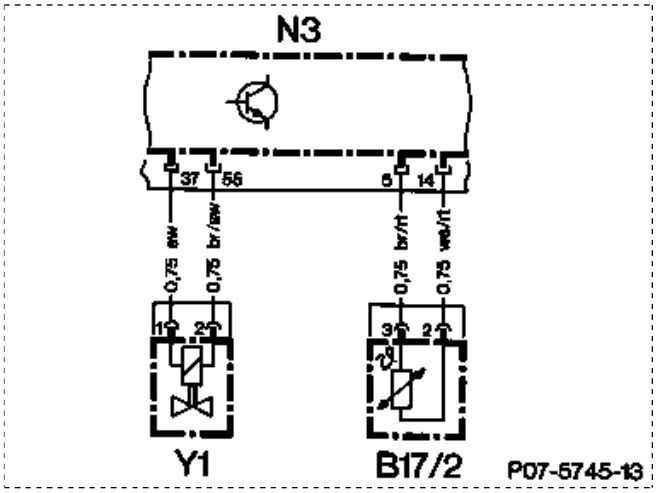
No mixture adaptation as a function of intake air temperature is performed on these national versions. Contact 11 at the 25-pin KE control unit is assigned to the altitude sensor signal.

B17/2 Intake air temperature sensor
N3 KE control unit
S29/2 Throttle valve switch, full load/idle speed recognition
S29/x1 Plug connection, throttle valve switch
W11 Ground, battery (electric cable bolted on)
a EZL ignition control unit
v Overvoltage protection, contact 2, terminal 87

Engines 104, 119

On all basic and national versions (KE 5) the temperature signal from the intake air temperature sensor (B17/2) is detected in the 55-pin KE control unit between contacts 5 and 14.

Example engine 104 KAT



B17/2 Intake air temperature sensor
N3 KE control unit
Y1 Electrohydraulic actuator

An additional mixture enrichment is performed if the intake air is cold. The colder the intake air, the greater the mixture enrichment. The following temperature ranges apply:

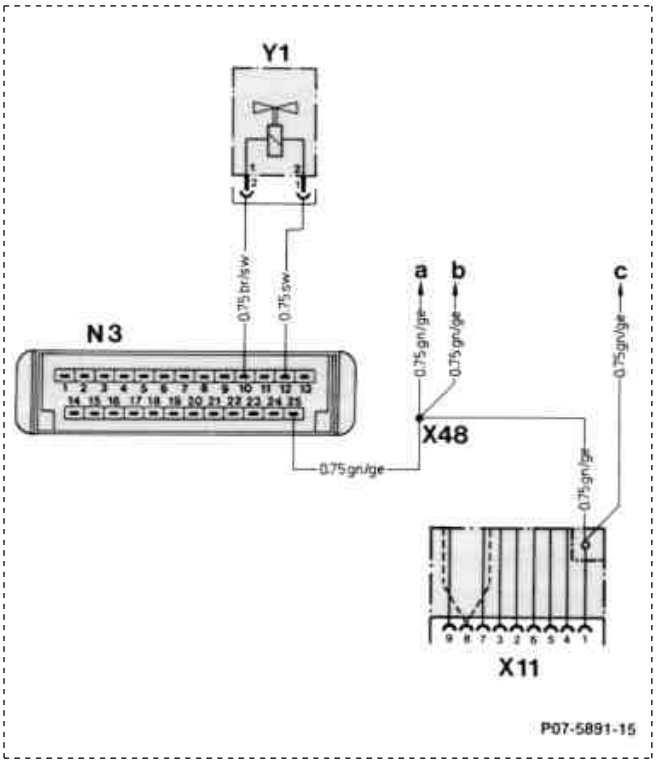
Engine	Enrichment at
102.96 (up to 08/88) 102.98 103 104	-30 °C up to 0 °C
102.96 (09/88 - 09/89) 102.99	-30 °C up to +5 °C
116 117 119	-30 °C up to +15 °C

j) Engine speed governing

Maximum engine speed can be governed by means of the:

- fuel pump relay or engine systems control unit by switching off the electric fuel pump (see section E "Fuel pump relay" or "Engine systems control unit").
- the KE control unit by interrupting the fuel supply to the injection valves.

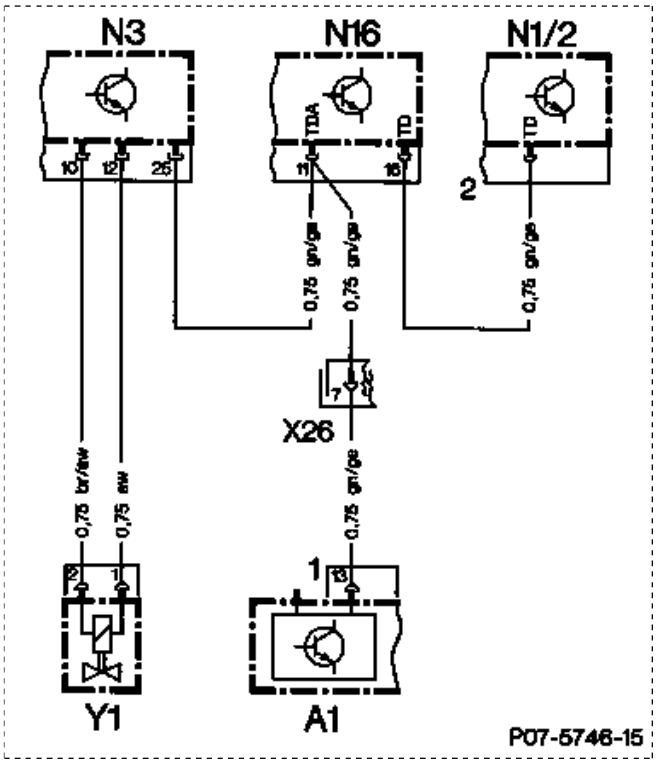
The KE control unit detects maximum engine speed from the number of TD, TN speed pulses or from the short-circuit-proof TDA, TNA speed pulses. This produces a change in the direction of the current to the electrohydraulic actuator. Remaining operation corresponds to deceleration fuel cutoff.



Example engine 102.982 KAT/RÜF

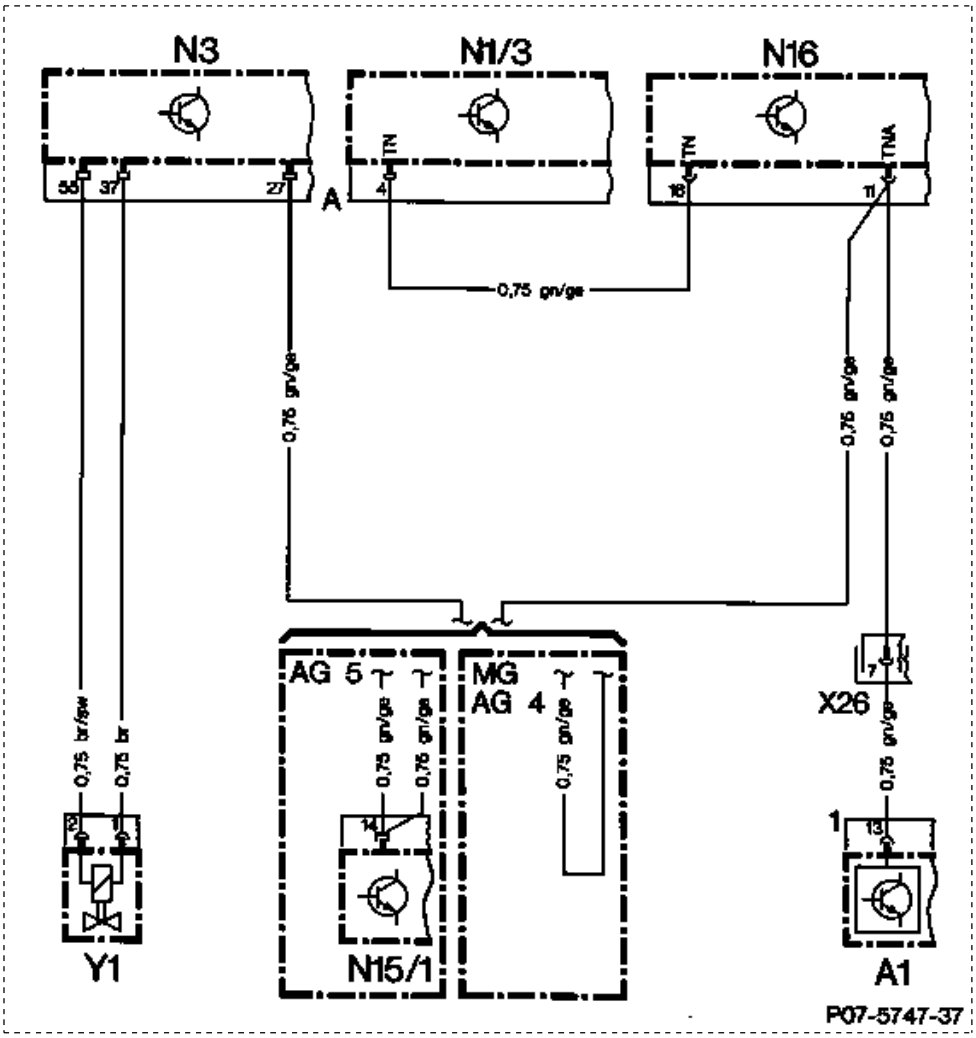
N3	KE control unit
X11	Diagnostic socket/terminal block terminal TD
X48	Connector sleeve (soldered connector in harness)
Y1	Electrohydraulic actuator
a	Fuel pump relay, contact 10, terminal TD
b	AC compressor relay, contact 2, terminal TD
c	EZL ignition control unit, terminal TD

Example engine 103 in model 129



A1 Instrument cluster
N1/2 EZL ignition control unit
N3 KE control unit
N16 Engine systems control unit (MAS)
X26 Plug connection, interior/engine (12-pin)
Y1 Electrohydraulic actuator

Example engine 104 in model 129



A1 Instrument cluster
N1/3 EZL/AKR ignition control unit
N3 KE control unit (55-pin)
N15/1 5-speed automatic transmission control unit
N16 Engine systems control unit (MAS)
X26 Plug connection, interior/engine (12-pin)
Y1 Electrohydraulic actuator
MG Manual transmission

AG 4 4-speed automatic transmission
AG 5 5-speed automatic transmission

k) Road speed signal

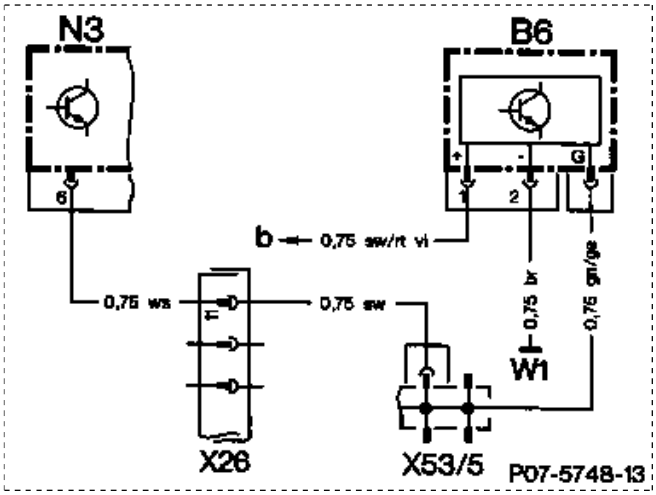
Engine 102 as of 09/88
Engine 103 as of 09/87
The road speed signal is supplied to the KE control unit, contact 6.

The road speed signal inhibits the idle speed control above a speed of approx. 1.4 km/h which improves the handling when the vehicle is coasting.
Provision of the road speed signal enables the Tempomat cruise control signal to be omitted (no cruise control mode possible below approx. 40 km/h).

Engines 116, 117
The road speed signal is supplied to the KE control unit, contact 24. Deceleration fuel cutoff is inhibited below
20 km/h.

Engines 104, 119
The road speed signal is supplied to contact 29 of the 55-pin KE control unit. For wiring diagram of road speed signal see Wiring Diagrams, Model 129, Group 00.

The road speed signal inhibits deceleration fuel cutoff below 20 km/h, influences regeneration of the active charcoal filter and of the maximum speed control.

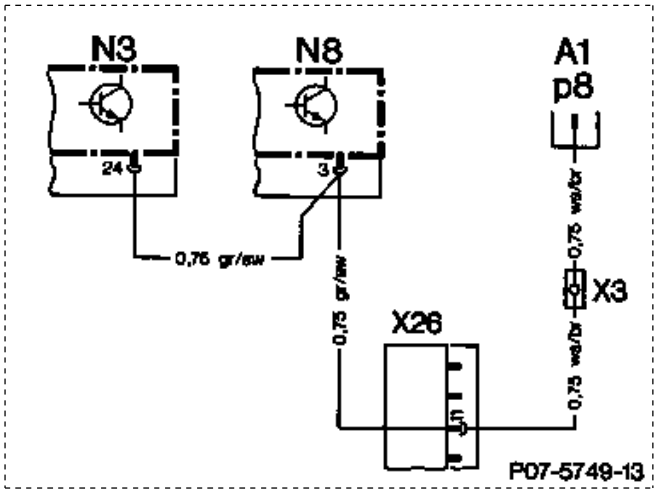


Example model 124

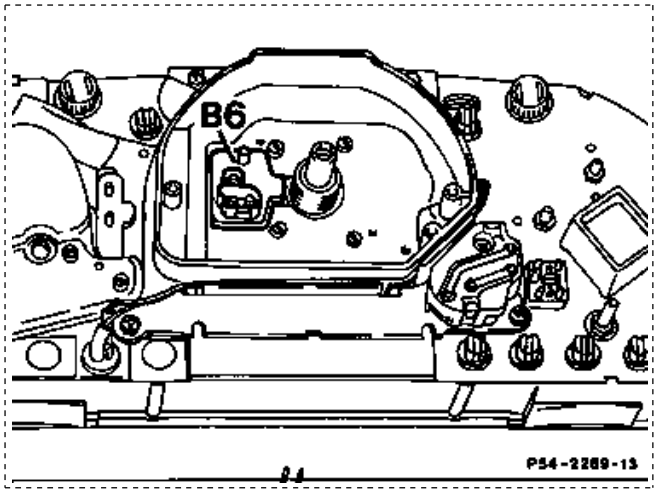
B6	Hall-effect road speed sensor
N3	KE control unit
W1	Main ground (right footwell)
X26	Plug connection, interior/engine (12-pin)
X53/5	Multipoint plug connection, Hall-effect sensor only with optional equipment (e. g. outside temperature display)
b	Stop lamp switch, terminal 15

Example model 107 with engines 116, 117

A1p8 Electronic speedometer
N3 KE control unit
N8 Idle speed control unit
K3 Electronic speedometer terminal block
X26 Plug connection, interior/engine (12-pin)

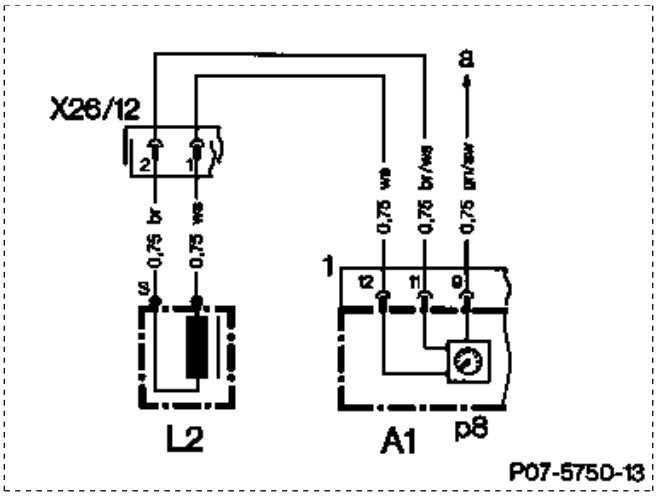


Models 124, 201
The Hall-effect sensor (B6) at the speedometer produces the road speed signal.



Models 107, 126, 129
The road speed signal is supplied by the electronic speedometer (A1p8). The inductive road speed sensor (L2) at the transmission actuates the electronic speedometer (A1p8).

Depending on equipment version, the road speed signal is required for further functions: Electronic accelerator pedal; Tempomat cruise control; 5-speed automatic transmission; automatic heater, temperature or climate control; soft top operation (model 129); idle speed control (engines 116, 117); outside temperature display.



Example model 129

A1p8	Electronic speedometer
L2	Inductive road speed sensor, transmission
X26/12	Plug connection, interior/transmission (6-pin)
a	Road speed signal

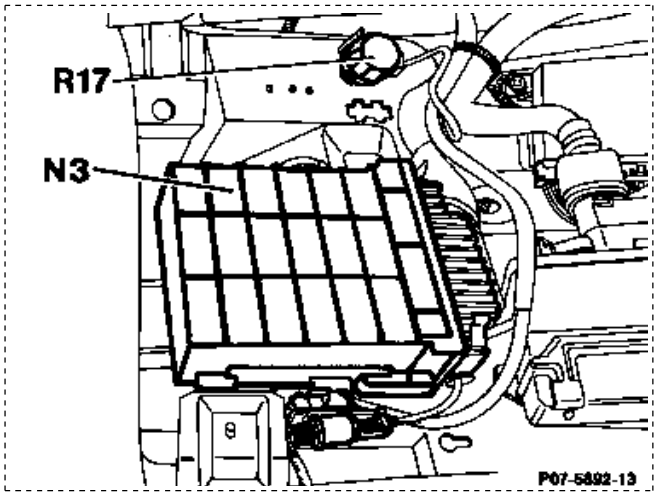
If the following complaint is received "Jerking when vehicle coasting", test the road speed signal. On/off ratio of 60 % output by the KE control unit or fault stored.

(USA) 1988: The KE control units do not recognize a faulty road speed signal.

l) KE resistance trimming plug

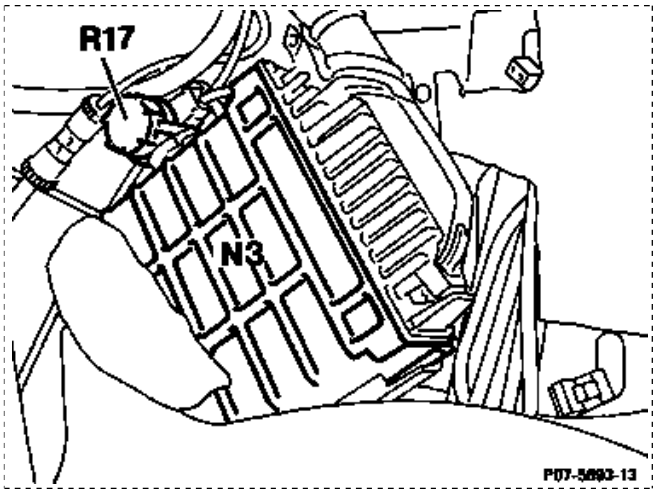
The KE resistance trimming plug (R17) is located at the KE control unit (N3).

- Models 124, 129, 201: right of component compartment
- Model 107: right footwell below floor panel
- Model 126: right footwell behind side trim panel

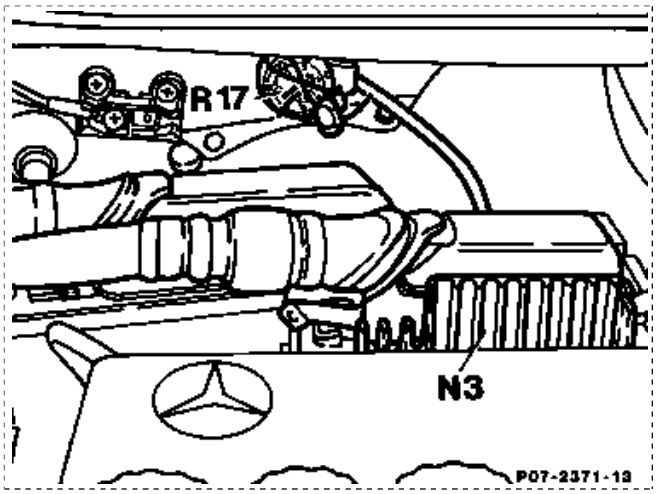


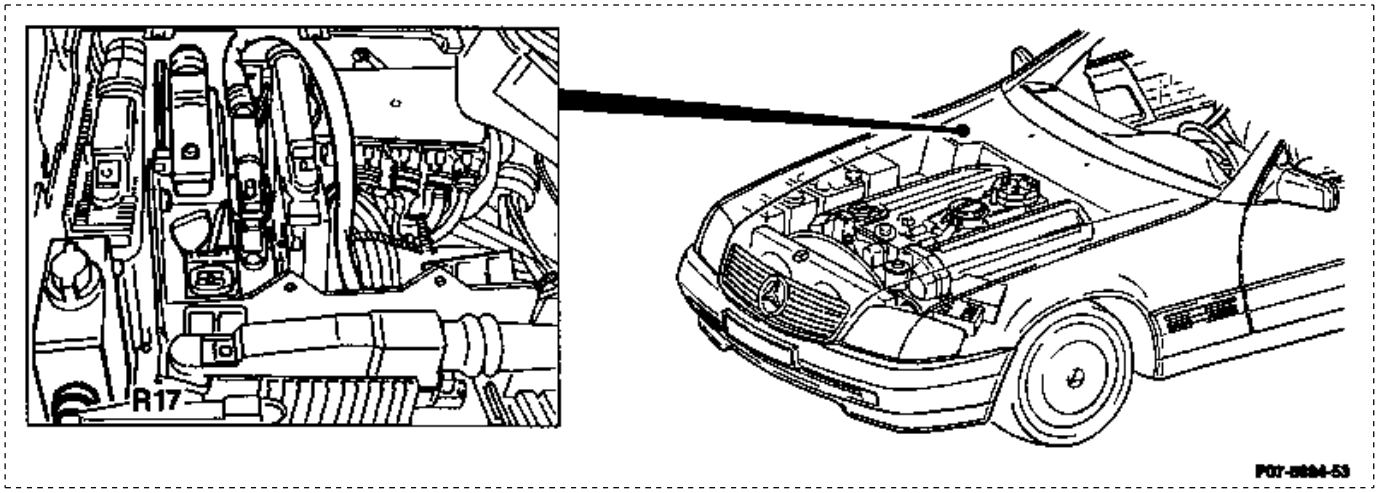
Location on model 107

Location on model 126



Location on models 124, 201





The KE resistance trimming plug (R17) influences the KE control unit:

- Operating mode

With/without lambda closed-loop control is determined by exchanging the KE resistance trimming plug on KE control units in KAT/RÜF version. A certain current exists at the electrohydraulic actuator when the ignition is switched on, depending on the operating mode.

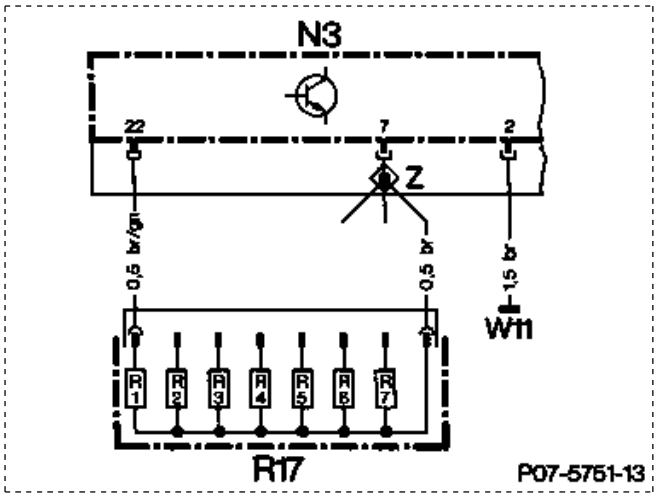
- Mixture map
  If complaints are received, the system can be tuned in 7 stages. The KE resistance trimming plug is plugged in the other way round for this purpose.

Note

Altering position only permissible if "Testing, adjusting engine" has been performed and driving faults continue to occur.

The KE resistance trimming plug must be sealed tamper-proof.

The 25-pin KE control unit (engines 102, 103, 116, 117) recognizes the resistance between contact 22 and contact 7 (ground); the 55-pin KE control unit (engines 104, 119) between contact 33 and contact 49.



N3 25-pin KE control unit
R17 KE resistance trimming plug
W11 Ground, engine (electric wires bolted on)
Z Connector sleeve (soldered connector in harness)
Note: Ground of connector pin 7 at KE control unit is connected internally to engine ground, connector pin 2.

Resistance trimming plug with green inscription "KAT"

- Engines in basic version KAT.

The KE control unit KAT/RÜF version has two fuel injection programmes (with/without lambda control). The programme with lambda control is activated by the "KAT" resistance trimming plug.

Engine 102 as of 09/89

The KE control unit KAT/without KAT version has one fuel injection programme with lambda control. The "KAT" resistance trimming plug cannot be exchanged.

The resistance trimming plug is installed and sealed tamper-proof in position 1 in the original state.

If complaints are received, a tuning of the mixture map can be performed in 7 stages.

Position No.	Resistance Ω±10%	Complaint
1	953	None (original state)
2	1270	- Slight pickup faults after start >20 °C - Engines 116, 117 as of 09/87 and engine 119: not assigned
3	1620	- Pickup faults after start >20 °C - Engines 116, 117 as of 09/87 and engine 119: not assigned
4	2260	Slight pickup faults in warming-up phase
5	3320	Poor throttle response when cold
6	5360	Poor throttle response and pickup in warming-up phase
7	11500	Very poor throttle response when cold Driving faults in warming-up phase

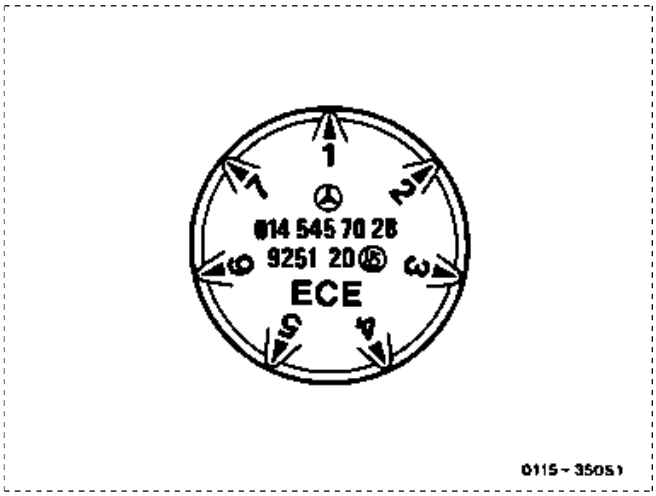
Resistance trimming plug with white inscription "ECE"

- Engines in basic version RÜF
- Engine 117.968 Standard 220 kW

The KE control unit KAT/RÜF version has two fuel injection programmes (with/without lambda control). The programme without lambda control is activated by the "ECE" resistance trimming plug.

The resistance trimming plug is installed in position 1 in original state.

If complaints are received, tuning of the mixture map can be performed in 7 stages.



Position No.	Resistance Ω±10%	Complaint
1	51	None (original state)
2	105	Excessive part load consumption when engine at operating temperature
3	169	Pickup faults when engine at operating temperature
4	249	Slight pickup faults in warming-up phase
5	348	Poor throttle response when cold
6	442	Poor throttle response and pickup faults in warming-up phase
7	590	Very poor throttle response when cold Driving faults in warming-up phase

Resistance trimming plug with white inscription "KE E6"

- Engine 103.980 Standard

The resistance trimming plug is installed in position 1 in the original state.
If complaints are received, tuning of the mixture map can be performed in 7 stages.

Position No.	Resistance Ω±10%	Complaint
1	0	None (original state)
2	487	Excessive part load consumption when engine at operating temperature
3	953	Pickup faults when engine at operating temperature
4	1620	Slight pickup faults in warming-up phase
5	2610	Poor throttle response when cold
6	4420	Poor throttle response and pickup faults in warming-up phase
7	8660	Very poor throttle response when cold Driving faults in warming-up phase

National versions (AUS) (J) (USA)
A 2-pin connector with reference resistor (0 Ω) is integrated in the wiring harness.

(USA) as of 1988
The reference resistor is integrated in the KE control unit.

(AUS) (J) (USA) model 129
The reference resistor is integrated in the KE control unit.

m) Transmission shift point retard of automatic transmission

To enable the catalytic converter to reach its operating temperature more rapidly, the 2→3 upshift in the automatic transmission is retarded. This means the gearshift is performed at a slightly higher vehicle speed. The retarded upshift is activated for not more than 80 seconds after each engine start.

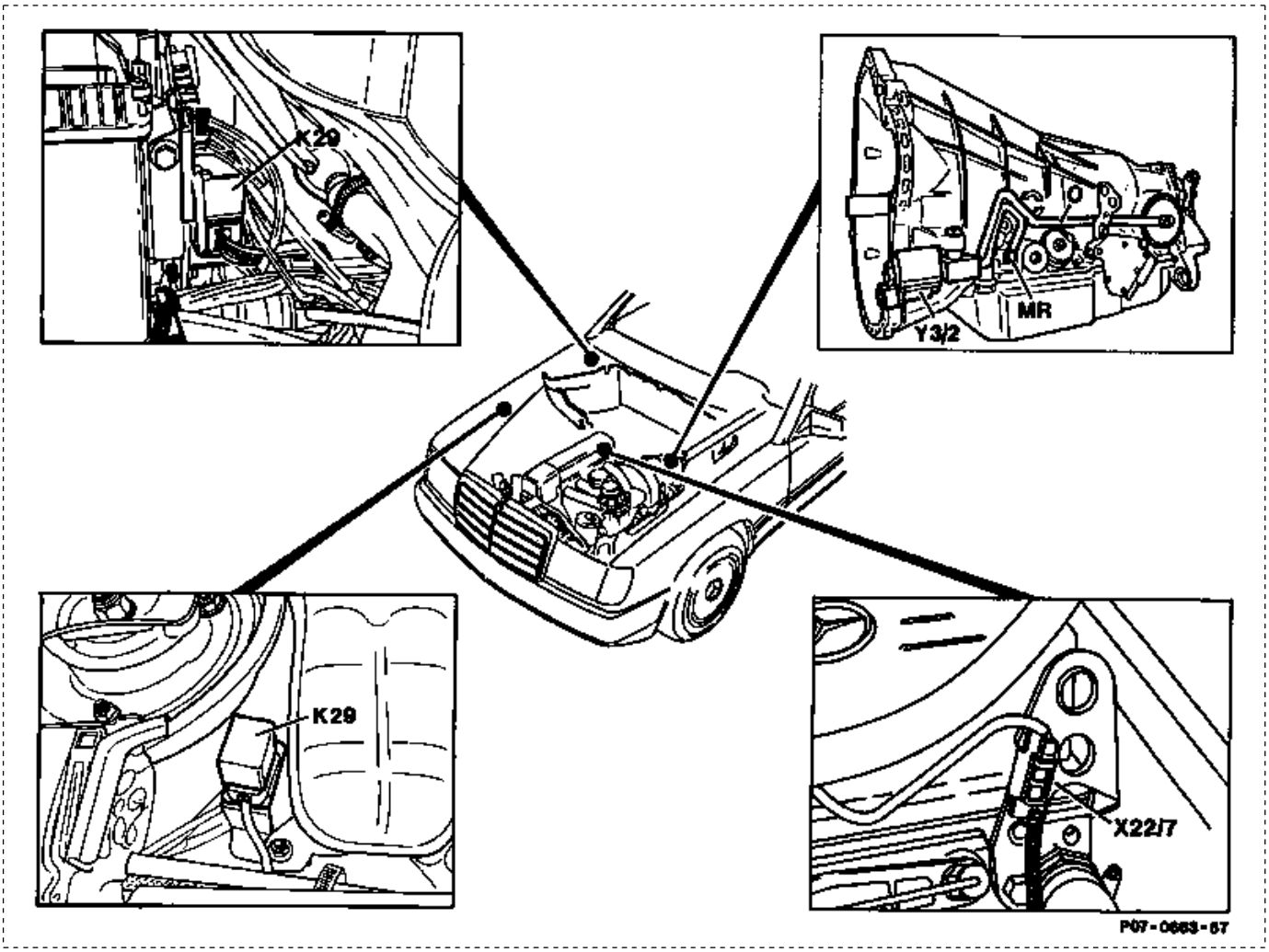
Further preconditions are:

- Coolant temperature approx. 0 °C - max. 50 °C
- Road speed >10 km/h and <48 km/h

The figures stated for activation are average values which may differ upward or downward depending on engine version.

-Shift point retard by means of solenoid valve up to 05/91

Engine 102.96/98
Engine 104 KAT
Engine 103 (CH) (N) (S) (DK) (FIN)
Engine 119 (CH) (N) (S) (DK) (FIN)



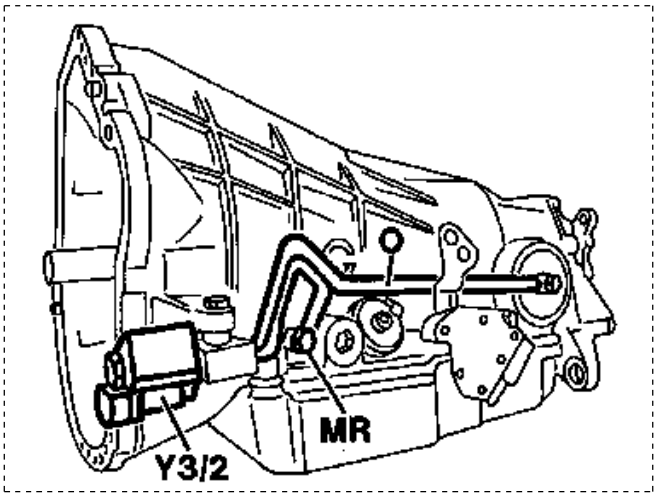
K29 Transmission shift point retard relay
Model 124: Right of component compartment
Model 129: Fuse and relay box, code letter E
Model 201: Right wheelhouse

Note: on engine 103 (CH) (N) (S) (DK) (FIN) K29 is replaced by K17/3 (air injection/ transmission shift point retard relay)

X22/7 Plug connection, shift point retard valve (1-pin)
Y3/2 Shift point retard solenoid valve

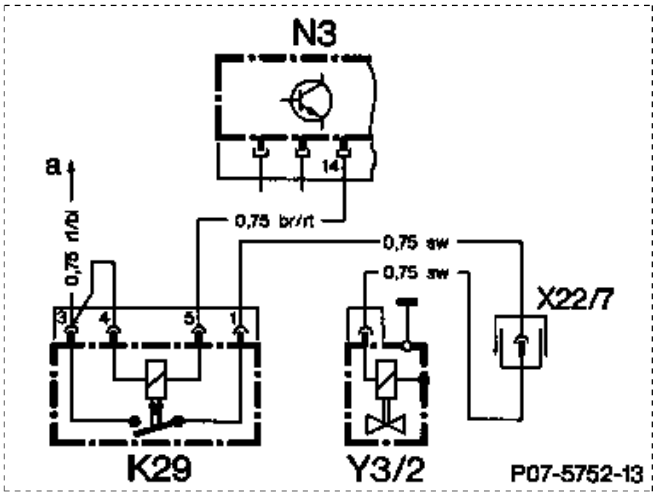
Function

The transmission shift point retard relay (K29) is actuated by the KE control unit by means of a ground signal. The shift point retard solenoid valve (Y3/2) is energized as a result of which the 2→3 upshift is performed at a higher road speed. For this purpose, the governor pressure is lowered by means of a pressure oil line at the governor pressure test connection (MR). If the conditions are met, the solenoid valve is deenergized and the governor pressure is fully restored.



O	Oil sump drain
MR	Governor pressure test connection
Y3/2	Shift point retard switchover valve

Example model 201



N3	KE control unit
K29	Transmission shift point retard relay
X22/7	Plug connection, transmission shift point retard valve (1-pin)
Y3/2	Transmission shift point retard solenoid valve/ switchover valve
a	Overvoltage protection relay, terminal 87L

Engine 119 KAT

On vehicles with engine 119 basic version KAT, the transmission shift point retard is controlled hydraulically by a memory spring in the control valve housing.

Engine 103 only (CH) (N) (S) (DK) (FIN)

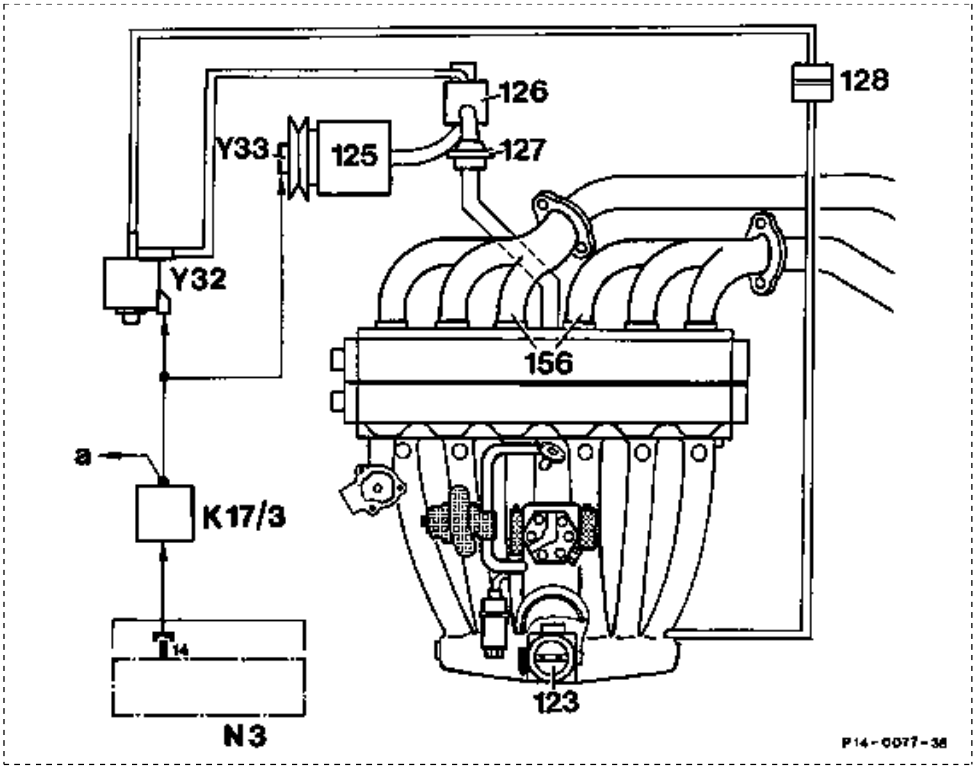
Air injection and transmission shift point retard are operated in parallel by means of the air injection/transmission shift point retard relay (K17/3). The air injection/transmission shift point retard relay (K17/3) is actuated by the KE injection system control unit (N3), contact 14.

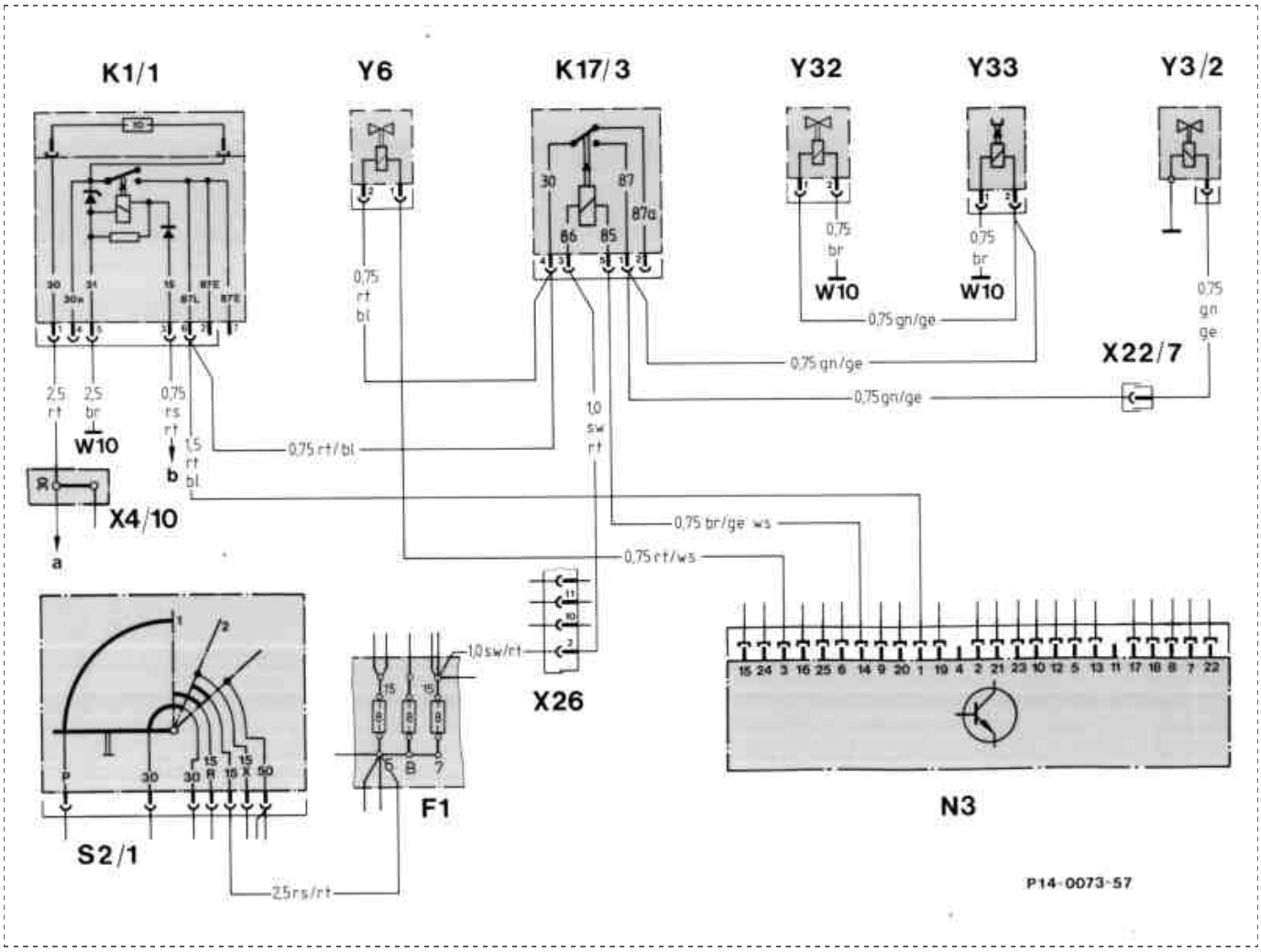
Transmission shift point retard operates only under the following conditions:

- Coolant temperature between +10 - 40 °C for not more than 80 seconds after each start.
- Engine speed <3500/min.

Function diagram of air injection/transmission shift point retard

K17/3	Air injection/transmission shift point retard relay
N3	KE injection system control unit
Y32	Air pump switchover valve
Y33	Air pump electromagnetic clutch
a	To shift point retard solenoid valve (Y3/2)
123	Throttle valve body
125	Air pump
126	Air cut-off valve
127	Non-return valve (injection air)
128	Non-return valve (vacuum)
156	Exhaust manifold

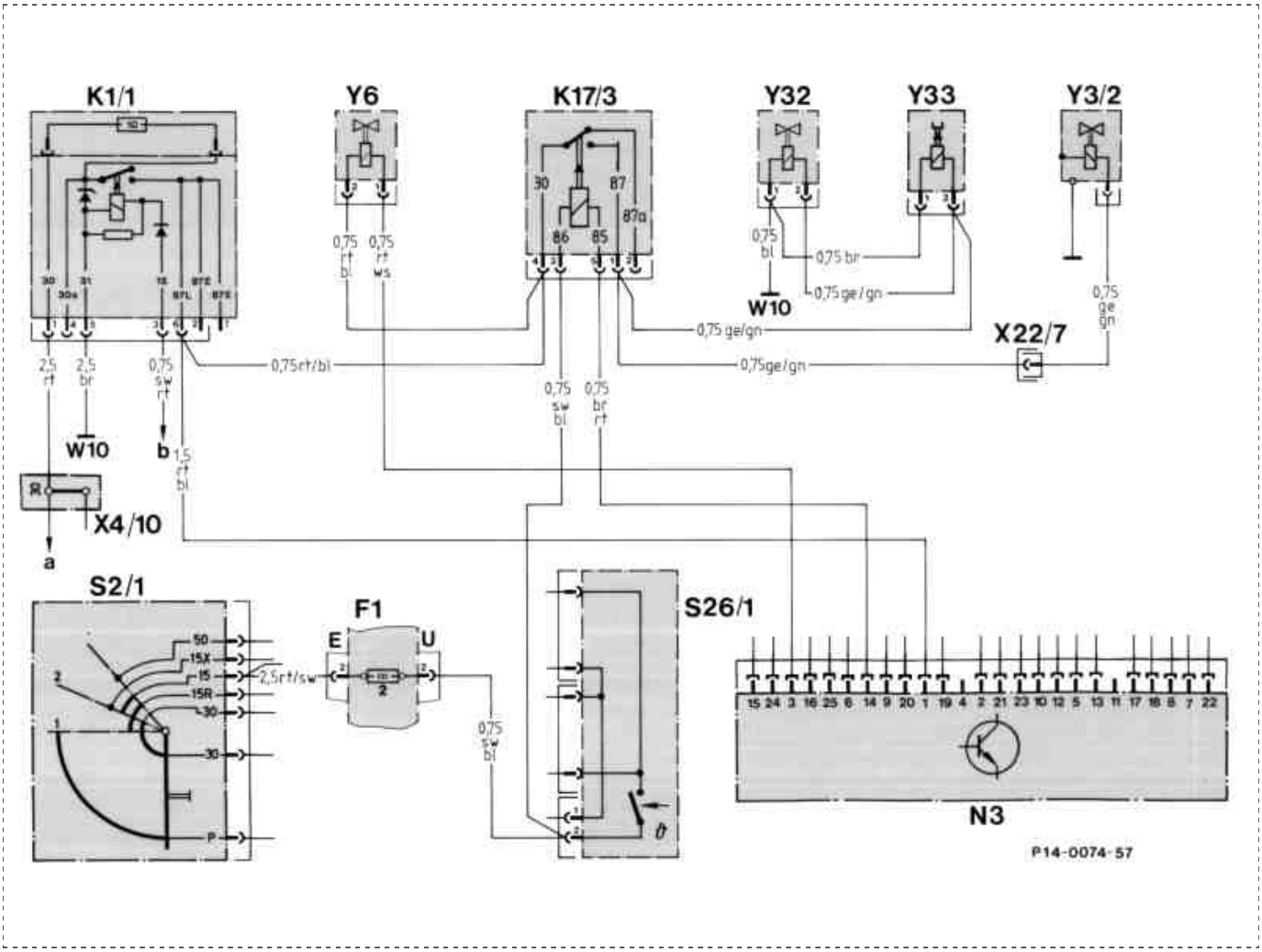




Wiring diagram transmission shift point retard

Engine 103 in model 201 (CH) (N) (S) (DK) (FIN)

F1	Electrical center
K1/1	Overvoltage protection relay 87E (7-pin)
K17/3	Air injection/transmission shift point retard relay
N3	KE injection system control unit
S2/1	Ignition starter switch
W10	Ground, battery
X4/10	Terminal block, terminal 30/terminal 61 (battery)
X22/7	Plug connection, shift point retard valve (1-pin)
X26	Plug connection, interior/engine
Y3/2	Shift point retard solenoid valve
Y6	Idle speed adjuster
Y32	Air pump switchover valve
Y33	Air pump electromagnetic clutch
a	To battery (G1)
b	To fuel pump relay, terminal 15



Wiring diagram transmission shift point retard
Engine 103 in model 124 (CH) (N) (S) (DK) (FIN)

F1	Fuse and relay box	X22/7	Plug connection, shift point retard valve (1-pin)
K1/1	Overvoltage protection relay 87E (7-pin)	Y3/2	Shift point retard solenoid valve
K17/3	Air injection/transmission shift point retard relay	Y6	Idle speed adjuster
N3	KE injection system control unit	Y32	Air pump switchover valve
S2/1	Ignition starter switch	Y33	Air pump electromagnetic clutch
S26/1	Thermo switch - heating/washer system	a	To battery (G1)
W10	Ground, battery	b	To fuel pump relay, terminal 15
X4/10	Terminal block, terminal 30/terminal 61 (battery)		

-Pneumatic shift point retard, as of 06/91

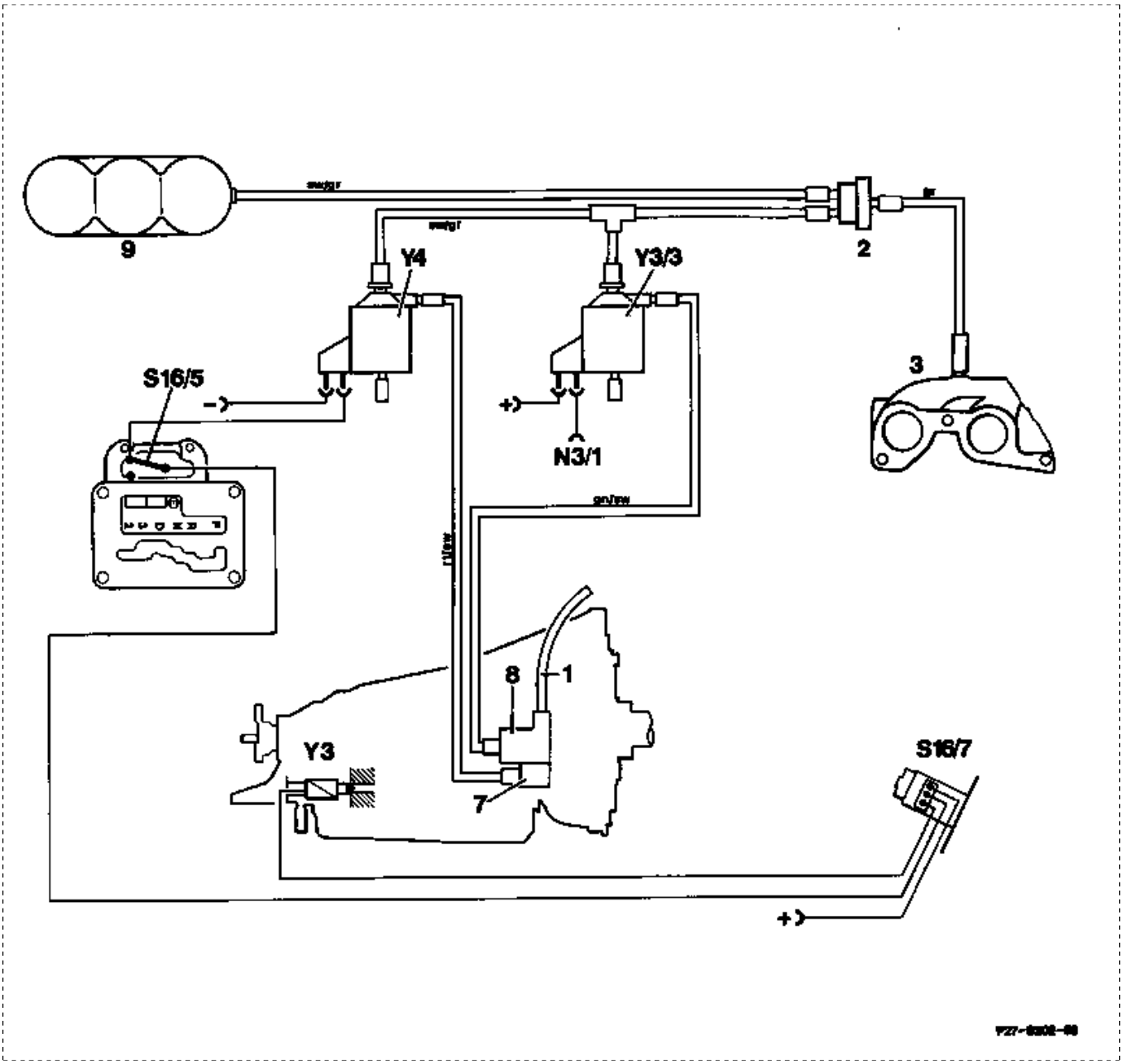
The previous shift point retard by means of the solenoid valve in the governor pressure system is discontinued, with the exception of vehicles with engine 103 (CH) (DK) (N) (S) (FIN).

All other vehicles with catalytic converter are fitted with a pneumatically operated shift point retard which acts on the control pressure valve in the valve body housing.

Installation survey

Model	Engine	Version				
		Basic version KAT (CH) (DK) (N) (S) (FIN)	(AUS)	(GB)	(J)	(USA)
124	104	X	X	X	X	X
129	104	X	X	X	-	X
129	119	X [1)]	X	X	X	X
201	102	X	-	-	-	X

[1)] Except basic version KAT, shift point retard performed by a memory spring in valve body housing.

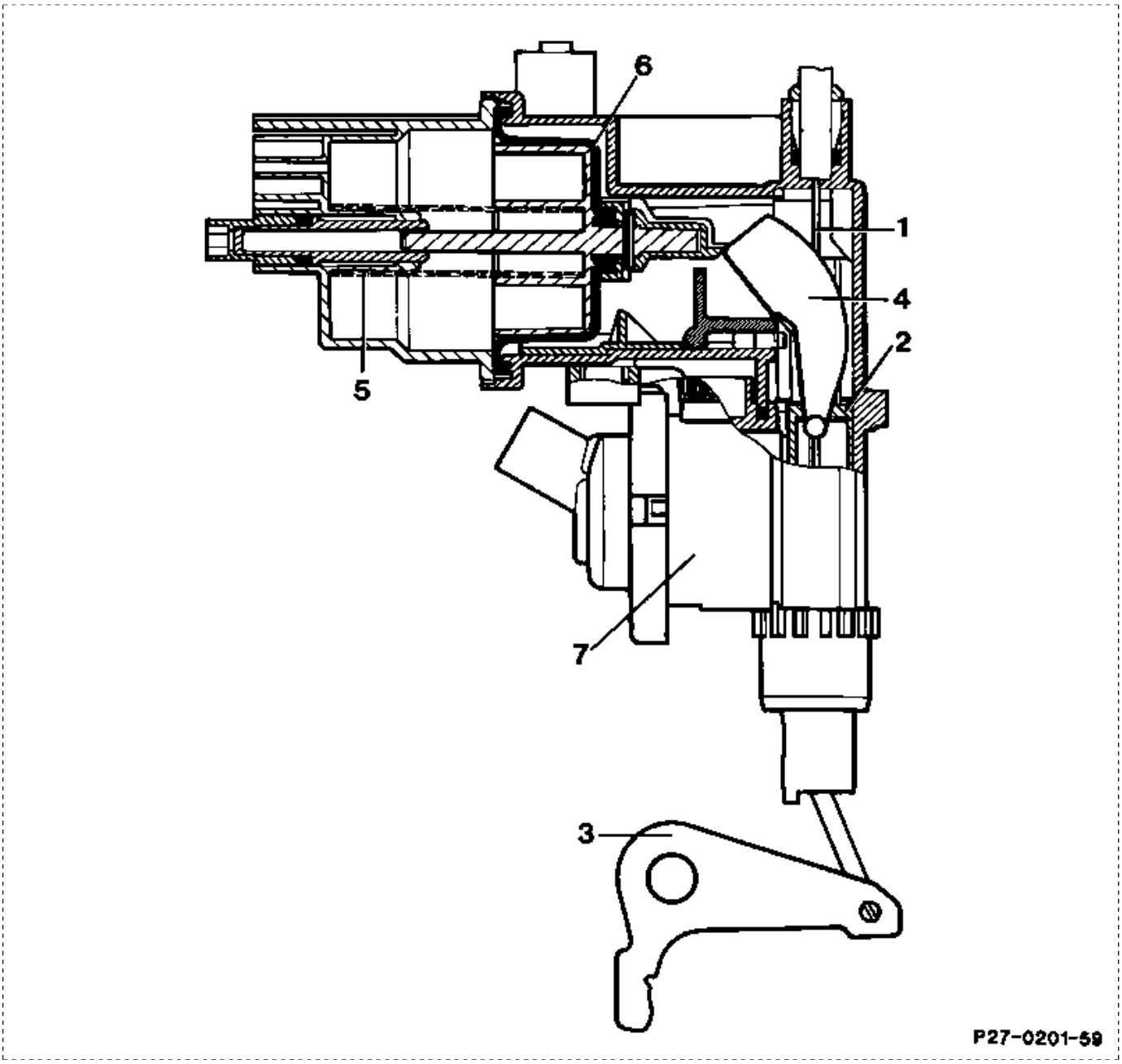


N3/1	LH or KE control unit (N3)	1	Control pressure Bowden cable
S16/5	Driving mode switch (2nd mode)	2	Non-return valve
S16/7	Kickdown switch	3	Intake manifold
Y3	Kickdown solenoid valve	7	S and E mode vacuum element
Y3/3	Shift point retard switchover valve	8	Shift point retard vacuum element
Y4	Driving mode switchover valve (2nd mode)	9	Vacuum reservoir

Function

The LH control unit (N3/1) or KE control unit (N3) actuates the shift point retard switchover valve (Y3/3) with ground dependent on coolant temperature, road speed and time. The vacuum element (8) in the control pressure cable is then supplied with vacuum via the switchover valve.

The vacuum element for shift point retard (8) is located in the control pressure cable above the vacuum element (7) for the 2nd driving mode. The conditions for shift point retard remain unaltered.



1	Control pressure cable	5	Spring
2	Slide valve	6	Diaphragm
3	Bell crank	7	S and E mode vacuum element
4	Rocker arm		

Operation of vacuum element (8)

The vacuum pulls the diaphragm (6) to the left against the force of the spring (5). The slide valve (2) is thus moved up with the rocker arm (4) irrespective of the position of the control pressure cable (1).

The slide valve (2) then operates the control pressure valve via a connecting rod and the bell crank (3).

n) Camshaft adjustment (inlet camshaft), engines 104, 119

When the engine is running, the camshaft adjuster advances the inlet camshaft hydraulically/mechanically by 34° crank angle and then retards it. The camshaft adjuster is operated by the KE control unit via the camshaft actuators (Y49). Two camshaft adjusters and camshaft actuators (Y49/1 and Y49/2) are fitted to engine 119.

The adjustment is dependent on engine load and speed. The camshaft adjustment is not operational at a coolant temperature below +15 °C on engine 104 and +20 °C on engine 119.

Adjustment range with increase in engine speed

Adjustment range	Selector lever in Drive mode and low engine load		Selector lever in P/N and manual transmission
	Engine 104	Engine 119	only engine 104
Retarded	Idle speed up to 1700/min	Idle speed up to 2000/min	Idle speed up to 2000/min
Advanced	1700/min - 5000/min	2000 - 4700/min	2000/min - 5000/min
Retarded	n >5000/min	n >4700/min	n >5000/min

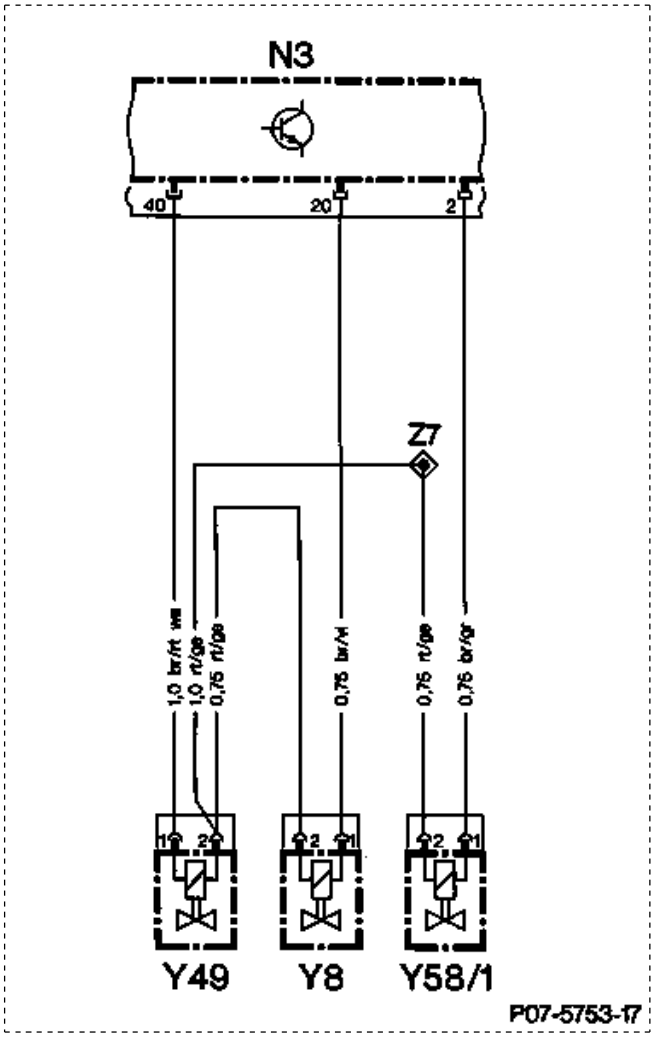
Adjustment range with reduction in engine speed

Retarded	Stall speed up to 4900/min	Stall speed up to 4400/min	Stall speed up to 4900/min
Advanced	4900/min - 1200/min	4400/min - 1700/min	4900/min - 1700/min
Retarded	n <1200/min	n <1700/min	n <1700/min

Camshaft adjustment has the following effects on combustion:

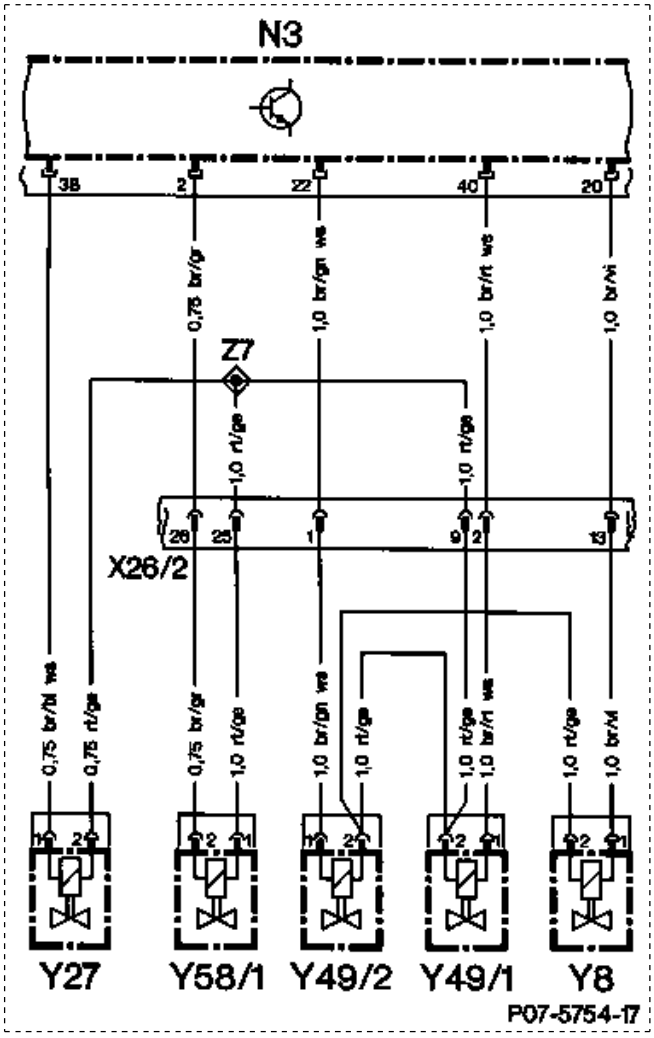
Retarded in lower engine speed range	Idling improved Reduced residual gas quantity Smaller valve overlap
Advanced in mid engine speed range	Increased torque Reduced fresh gas losses

Retarded in upper engine speed range	Inlet valves open and close later Cylinder charge improved (turbo effect)



Wiring diagram engine 104

N3	KE control unit
Y8	Start valve
Y49	Adjustable camshaft timing actuator
Y58/1	Regeneration switchover valve
Z7	Feed from overvoltage protection relay, terminal 87E



Wiring diagram engine 119

N3	KE control unit
X26/2	Plug connection, engine separation point (30-pin)
Y8	Start valve
Y27	Exhaust gas recirculation switchover valve
Y49/1	Left adjustable camshaft timing actuator
Y49/2	Right adjustable camshaft timing actuator
Y58/1	Regeneration switchover valve
Z7	Feed from overvoltage protection relay, terminal 87E

o) Maximum speed control, engines 104, 119

Engine 104

When a speed of 250 km/h is exceeded, the current and the electrohydraulic actuator is continuously limited to
-10 mA. As a result, the fuel supply to the injection valves is reduced. At the same time, the signal is passed along the data line to the ignition control unit, which results in ignition timing being retarded to 15° crank angle before TDC. If vehicle speed is still >250 km/h, the inlet camshaft is advanced, which results in a further reduction in engine speed and vehicle speed.

Engine 119
If a speed of 250 km/h is exceeded at full throttle, first of all the two inlet camshafts are advanced, which results in a reduction in torque. The actual governing is performed via the current at the electrohydraulic actuator (Y1) of the KE injection system, as a result of which a sufficiently lean fuel/air mixture is produced, depending on aerodynamic drag (incline, backwind or headwind) to achieve a steady-state maximum speed of v=250 km/h.

If the control function fails because of a fault in the KE electronic circuitry, the power supply to the fuel pumps is switched off by the engine systems control unit (N16). The engine systems control unit (N16) is supplied with a road speed signal from the ABS control unit for this purpose.

Note re engine 117.968
On engine 117.968 maximum speed is governed via the ignition system, see Group 15.

p) Data interchange of KE control unit and EZL/AKR ignition control unit engines 104, 119

Data interchange is a constant sequence of information blocks and is interrupted only in the event of faults and output of the stored faults.

The following information is exchanged along the data line:

- The intake air temperature is analyzed in the KE control unit and passed to the EZL/ AKR ignition control unit.
- The pressure conditions in the intake manifold are passed by the pressure sensor in the EZL/AKR ignition control unit to the KE control unit. Differences in absolute pressure, e. g. for altitude correction, are also taken into account.
- The values of both NTC elements (KE or EZL/AKR) in the coolant temperature sensor are compared. If implausible variations occur, a substitute temperature is selected. In the case of minor variations between the one coolant temperature sensor and the other, e. g. KE 90 °C and EZL 70 °C, the EZL/AKR ignition control unit always continues operating with the higher temperature level.
- The "maximum speed control operating" signal is passed by the KE control unit to the EZL/AKR ignition control unit.
- Faults detected in the KE control unit and in the EZL/AKR ignition control unit are exchanged.
- If the idle speed contact is closed and the idle speed adjuster faulty (high engine speed), the idle speed emergency running curve is selected in the EZL/AKR ignition control unit. This achieves the latest possible ignition timing point and counteracts a rise in engine speed.
- Allocation of EZL/AKR ignition control unit to KE control unit and vice versa. Incorrect allocation is stored as a fault.

q) Idle speed control

For detailed description of the various systems see section "Idle speed devices".

Engines 102, 103, 104, 119
The idle speed control function is integrated in the KE control unit. The idle speed adjuster is actuated by the KE control unit.

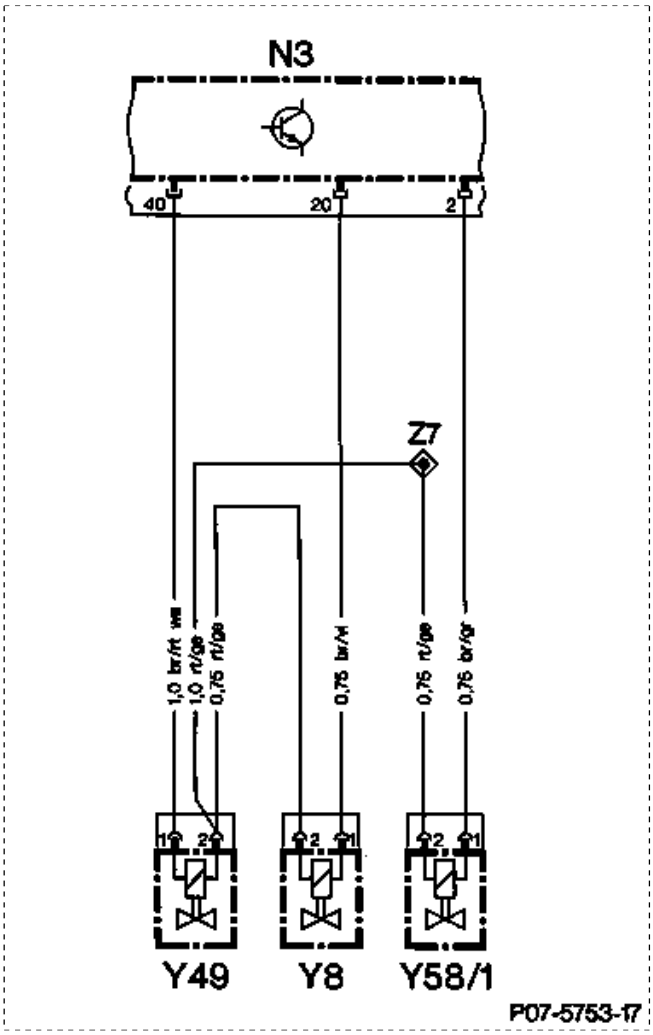
Engines 104, 119
If an open circuit in the wiring, a short-circuit or a mechanical fault of the idle speed adjuster or an open circuit in the KE↔EZL/AKR data line is detected, the actuation to the idle speed adjuster is switched off. Following this, ignition timing is retarded in such a manner as to produce only an insignificant increase in idle speed.

Engines 116, 117
The idle speed adjuster is actuated by the separate control unit of the idle speed control.

Note re engine 102
For engine 102.961 Standard and 102.962 Standard without air conditioner see section G "Idle speed stabilization".

r) Start valve actuation, engines 104, 119

Actuation of the start valve is performed by the KE control unit on engine 104 up to a coolant temperature of 70 °C and on engine 119 up to a coolant temperature of +15 °C. The current to the start valve is limited to 1.2 A. The actuation to the start valve is performed in accordance with a characteristic curve which produces a pulsed injection of the start valve.



Wiring diagram engine 104

N3	KE control unit
Y8	Start valve
Y49	Adjustable camshaft timing actuator
Y58/1	Regeneration switchover valve
Z7	Feed from overvoltage protection relay, terminal 87E

s) Actuation and diagnosis of oxygen sensor heater, engines 104, 119

The KE control unit supplies a control signal for the oxygen sensor heater to the engine systems control unit (N16) which then controls the oxygen sensor heater. The engine systems control unit (N16) supplies an information signal regarding the oxygen sensor heater current (feedback) to the KE control unit for diagnosis purposes.

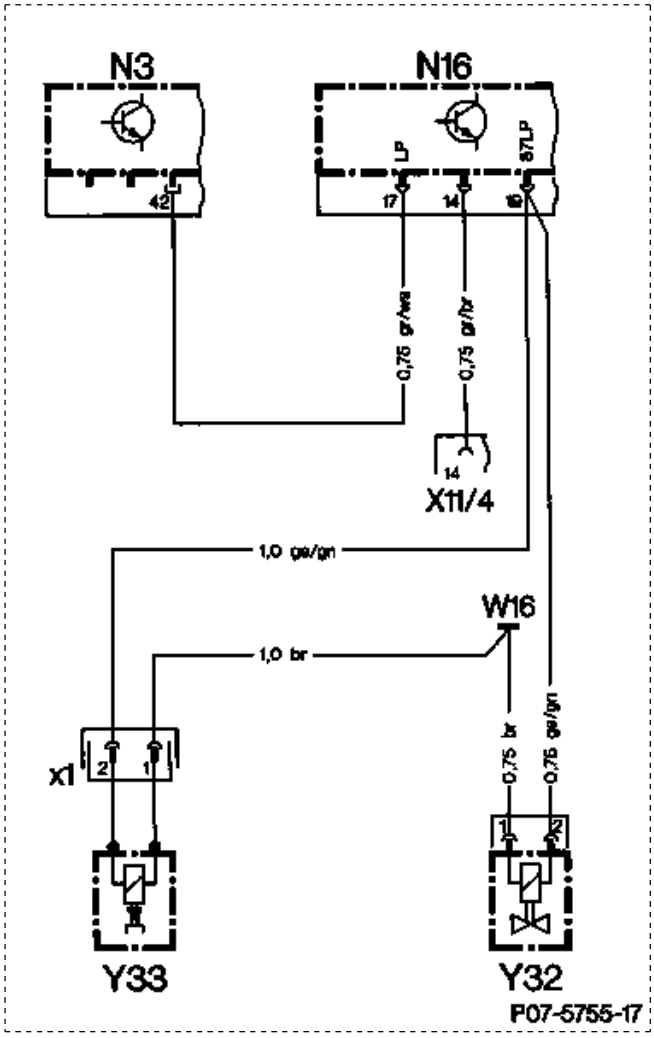
t) Air injection

Note
For air injection system see also Group 14.

Engine 103 (CH) (DK) (N) (S) (FIN)
The KE control unit (N3) supplies a control signal to the air injection/transmission shift point retard relay (K17/3).

Engines 103.984, 104, 119
The magnetic clutch of the air pump is actuated by a signal supplied by the KE control unit (N3), dependent on coolant start temperature, via the engine systems control unit (N16). Air injection is performed at a coolant start temperature between +10 °C and +40 °C. Air injection is switched off at full throttle or at an engine speed above 3000/ min in the case of engine 104 or above 2500/min in the case of engine 119. Following an engine start at approx. +20 °C the air pump runs for about 2 minutes (for as long as the lambda control is in the open-loop mode).

Engines 104, 119
Air injection system check
The diagnostics of the KE control unit checks the operation of the entire system.
If the engine is at normal operating temperature, lambda control operating, engine idling and vehicle stationary, the air pump is actuated once after each engine start for
5 seconds. It is possible to determine from the oxygen sensor signal whether air injection is operating. If a fault is detected, it is stored in the fault memory of the KE control unit. If any of the preconditions (e. g. engine idling) alters before 5 seconds have elapsed, the check is aborted.

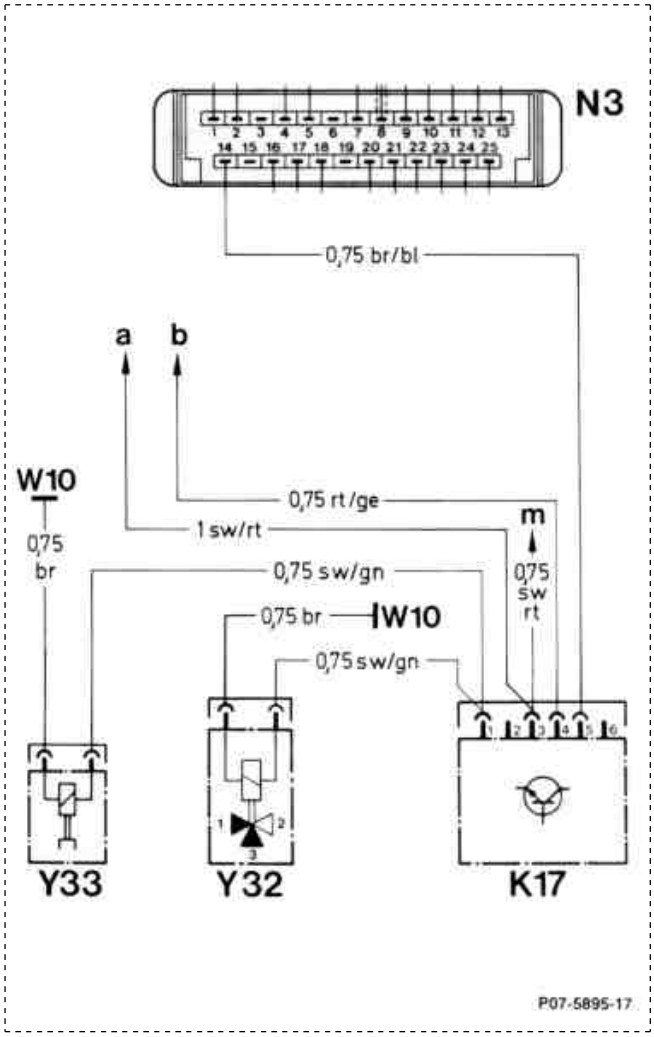


Example engine 104

N3	KE control unit
N16	Engine systems control unit (MAS)
W16	Ground, component compartment
X11/4	Test coupling for diagnosis, pulse readout (16-pin)
Y32	Air pump switchover valve
Y33	Air pump electromagnetic clutch
Y33x1	Plug connection, air pump electromagnetic clutch

Engines 116, 117

The KE control unit (N3) supplies a control signal to the air injection relay (K17). As a result of this, the air pump electromagnetic clutch (Y33) and the air pump switchover valve (Y32) are actuated simultaneously.



Example engine 117.968

N3	KE control unit
K17	Air injection relay
W10	Ground, battery
Y32	Air pump switchover valve
Y33	Air pump electromagnetic clutch
a	Fuse and relay box, fuse 5, terminal 15
b	Overvoltage protection relay, terminal 87
m	Auxiliary fan relay

u) Exhaust gas recirculation

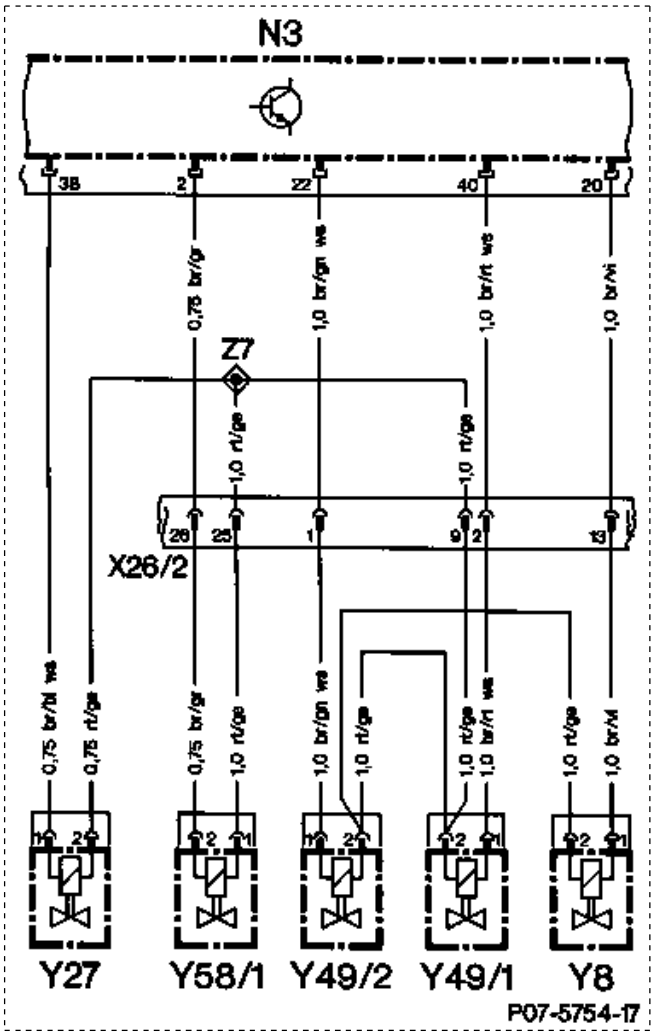
Engine 119

The exhaust gas recirculation electric switchover valve (Y27) is actuated by the KE control unit in the following operating states:

- Coolant temperature >65 °C
- Potentiometer voltage at air flow sensor >2 V
- Full load contact open
- Idle speed contact open

Exhaust gas recirculation system check

The diagnostics of the KE control unit checks operation of the entire system. During deceleration fuel cutoff, the exhaust gas recirculation switchover valve is actuated for 3 seconds. It is possible to determine from the intake manifold pressure signal which is measured by the EZL/AKR ignition control unit whether exhaust gas recirculation is operating. If a fault is detected, it is stored in the fault memory of the KE control unit. If the deceleration phase is <3 seconds, the test is aborted.

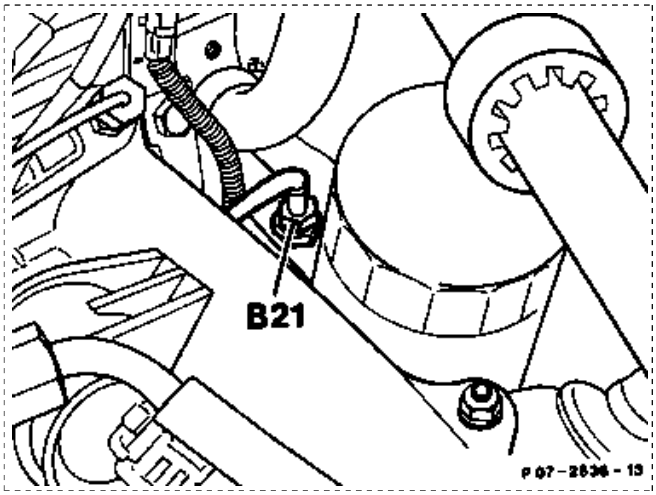


Wiring diagram engine 119

N3	KE control unit
X26/2	Plug connection, engine separation point (30-pin)
Y8	Start valve
Y27	Exhaust gas recirculation switchover valve
Y49/1	Left adjustable camshaft timing actuator
Y49/2	Right adjustable camshaft timing actuator
Y58/1	Regeneration switchover valve
Z7	Feed from overvoltage protection relay, terminal 87E

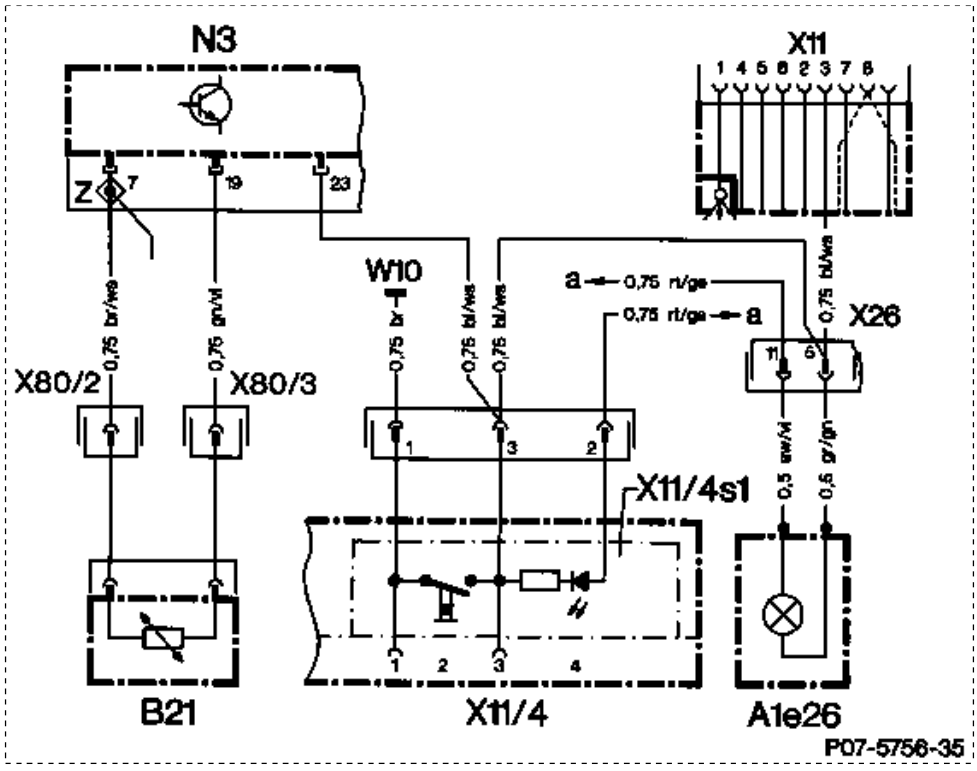
(USA) California
On Board Diagnosis System

A temperature sensor (B21) is installed in the exhaust gas recirculation line on vehicles with on board diagnosis system. The temperature of the recirculated exhaust gases is detected by the temperature sensor. If the exhaust gas temperature drops below approx. 120 °C when driving, no exhaust gas recirculation is performed. This is detected as a fault by the KE control unit, stored at the CHECK ENGINE indicator lamp actuated.



Engine 102
B21 Exhaust gas recirculation temperature sensor

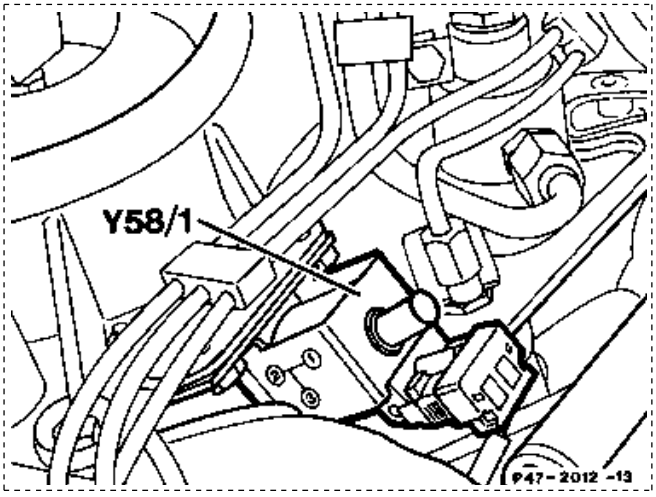
Example engine 117.968 (USA)
California 1988



A1e26	CHECK ENGINE indicator lamp
B21	Exhaust gas recirculation temperature sensor
N3	KE control unit
X11	Diagnostic socket/ terminal block, terminal TD
X11/4	Test coupling for diagnosis, pulse readout (8-pin)
X11/4s1	Pushbutton switch with LED
X80/2	Plug connection, exhaust gas recirculation temperature sensor (reference ground)
X80/3	Plug connection, exhaust gas recirculation temperature sensor (KE signal)
Z	Connector sleeve (soldered connector in harness) terminal 31
a	Overvoltage protection relay, terminal 87E

v) Active charcoal filter regeneration, engines 104, 119

The regeneration switchover valve (Y58/1) is actuated by a ground signal supplied by the KE control unit, contact 2. Fuel vapours are extracted from the active charcoal filter (regenerated) (see Group 47-0200).

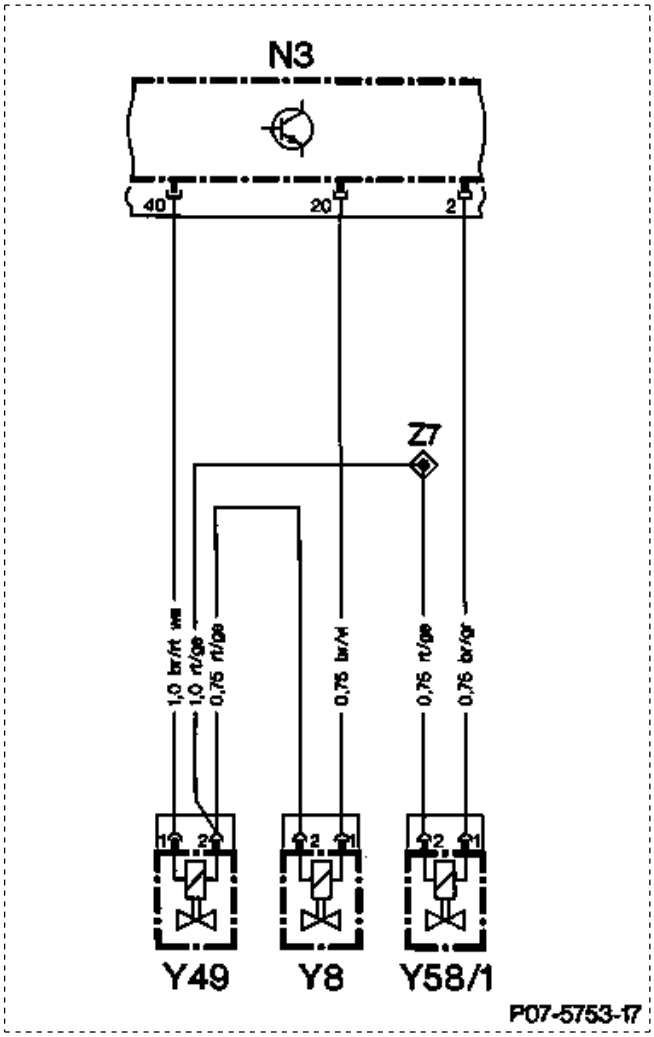


Example engine 119

Y58/1 Regeneration switchover valve

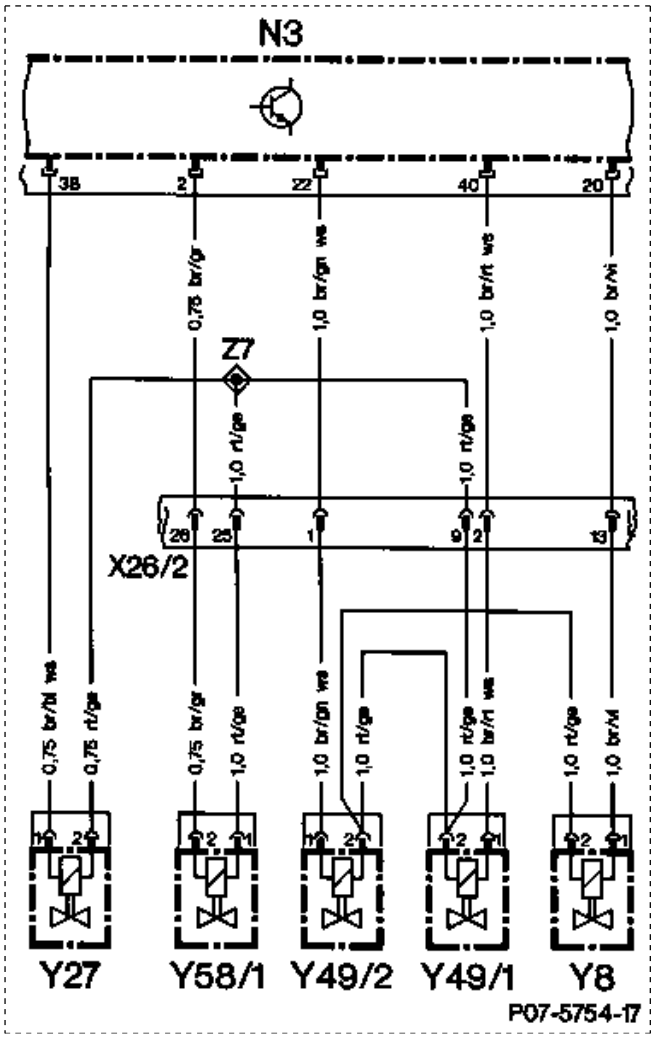
Conditions for actuation of regeneration switchover valve (Y58/1):

Idle speed contact open	Coolant temperature above +70 °C (above +80 °C for engine 104 as of 09/89)
Idle speed contact closed	Coolant temperature above +95 °C (above +100 °C for engine 104 as of 09/89) or intake air temperature above 55 °C and vehicle speed below 5 km/h



Wiring diagram engine 104

N3	KE control unit
Y8	Start valve
Y49	Adjustable camshaft timing actuator
Y58/1	Regeneration switchover valve
Z7	Feed from overvoltage protection relay, terminal 87E



Wiring diagram engine 119

N3	KE control unit
X26/2	Plug connection, engine separation point (30-pin)
Y8	Start valve
X27	Exhaust gas recirculation switchover valve
Y49/1	Left adjustable camshaft timing actuator
Y49/2	Right adjustable camshaft timing actuator
Y58/1	Regeneration switchover valve
Z7	Feed from overvoltage protection relay, terminal 87E

w) Altitude correction

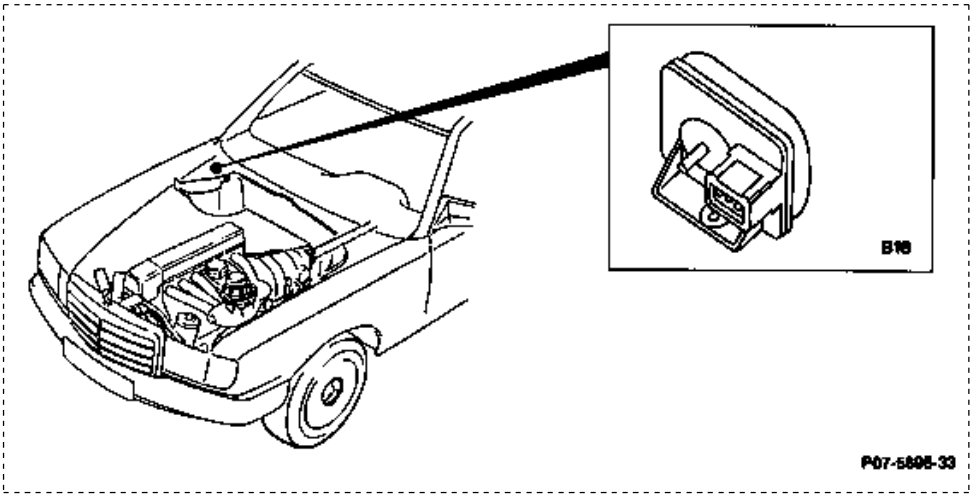
The low air density in higher locations necessitates a leaner fuel/air mixture. The volume flow measured with the air flow sensor corresponds to a lower air mass as a consequence of the low air density. This difference is corrected in order to avoid a too rich mixture with excessive fuel consumption and increased pollutant emissions.

Engines 102,103,116,117 (AUS) (J) (USA)

Location of altitude sensor (B18)

Model 124, 201: Right of component compartment.

Model 107, 126: Right footwell.

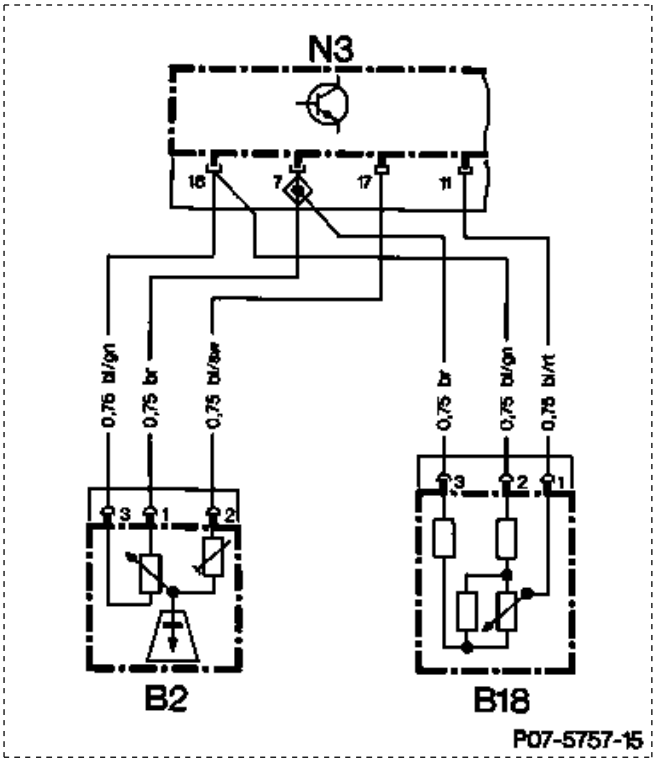


Example model 124, 201

B18 Altitude sensor

The altitude sensor (B18) is actuated with a constant voltage parallel to the air flow sensor position indicator (B2) and supplies a voltage signal to the KE control unit, contact 11.

Note
The KE intake air temperature sensor (B17/2) is not fitted on vehicles with altitude sensor.



N3 KE control unit
B2 Air flow sensor position indicator
B18 Altitude sensor

Voltage levels of sensor for altitude correction (B18)

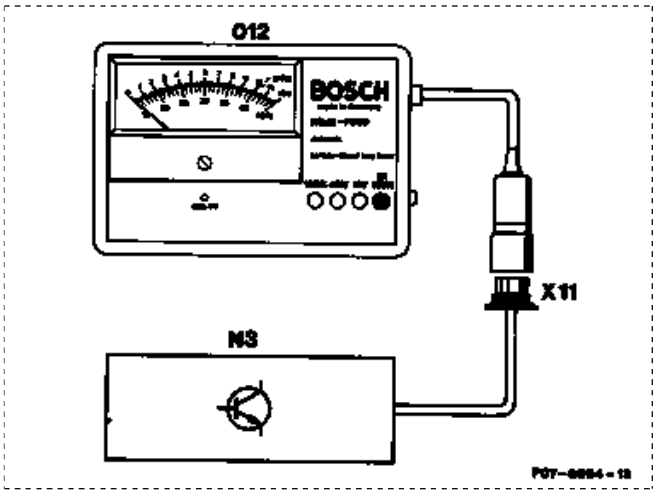
Height above MSL in meters	Air pressure p absolute/mbar	Voltage at contact 11 (to ground) in volts
0	1013	4±1
1000	899	3±1
2000	795	2±1

Engines 104,119
The pressure conditions in the intake manifold are detected by the pressure sensor in the EZL/ AKR ignition control unit and passed along the data line to the KE control unit. The absolute pressure is taken into account for the altitude correction.

x) Fault recognition by KE control unit

Fault diagnosis by means of on/off ratio
Engine 102 as of approx. 04/86
Engine 103 as of approx. 03/86
Engine 104, 119 as of start of production
Engine 116, 117 as of approx. 12/85

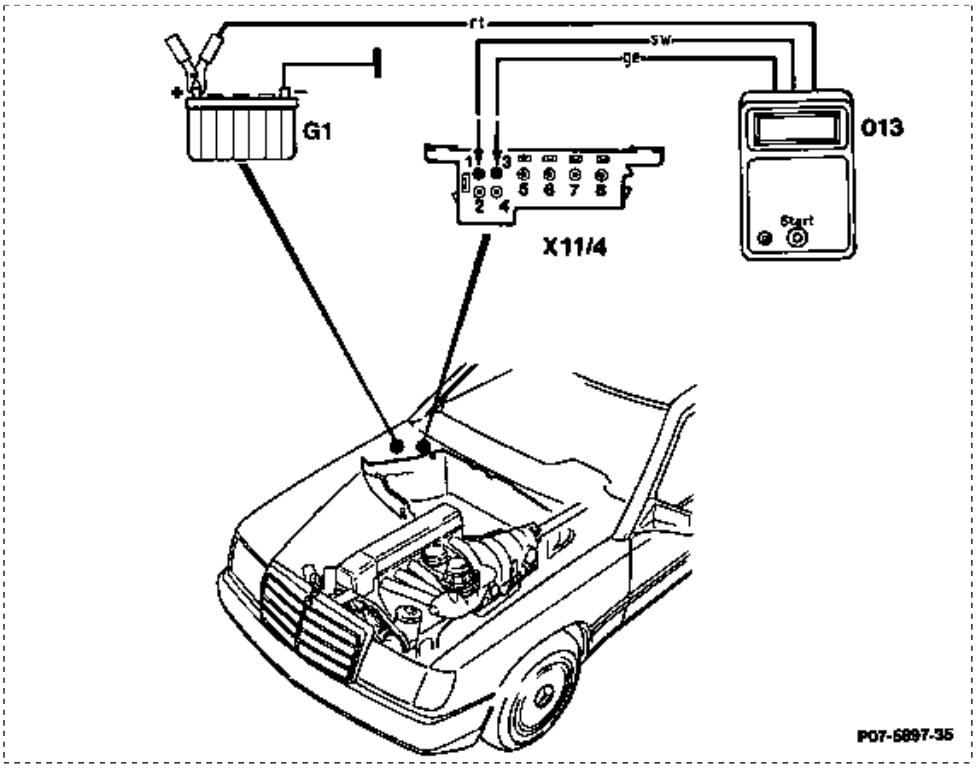
The KE control unit (N3) enables various components of the KE injection system to be tested. The on/off ratio can be read at the test output in the diagnostic socket (X11) with the lambda control tester (012). The on/off ratio provides information regarding possible causes of faults. Only faults which exist at that moment and are detected are displayed. A certain on/off ratio is allocated to each fault. Output of fault messages has priority over the output of the lambda control signal. If the lambda closed-loop control is not operational (e. g. oxygen sensor temperature too low), the reading is 50 % (open-loop mode/constant readout). If the lambda closed-loop control is operating, the readout fluctuates around an average value. If several faults occur simultaneously, the fault which corresponds to the lowest on/off ratio is always displayed. This process is continued until all the faults have been rectified. An allocation of on/off ratio and possible cause of fault is provided in the respective test programme (07.3-121).



Fault memory

Engine 102.96/98 as of 09/89
Engine 103, only (J) (USA) as of 1990
Engine 104, 119

When the engine is running, faults which occur and are recognized (e. g. open circuit, short-circuit and implausible values) are stored in the KE control unit. Loose contacts are also recognized as faults and stored. The stored faults can be read at the test coupling for diagnosis (X11/4) with the pulse counter. A condition is that the battery has not been disconnected in the meantime otherwise the stored faults have been erased.



G1 Battery

X11/4 Test coupling for diagnosis
Engines 102, 103, 116, 117: 8-pin version
Engines 104, 119: 16-pin version

013 Pulse counter

⚠
When dealing with engine running complaints, always read the fault memory and note any faults before performing repairs.

This ensures that a distinction can be made between faults which have in fact occurred and "simulated faults" as faults are stored when performing test operations with the engine running which may result from a simulation or from a disconnected cable. After completing test operations, the fault memory must be erased.
For pulse output and fault table see Repair Instructions for engines 102, 103, 116, 117 or Diagnosis Manual Engine for engines 104, 119.

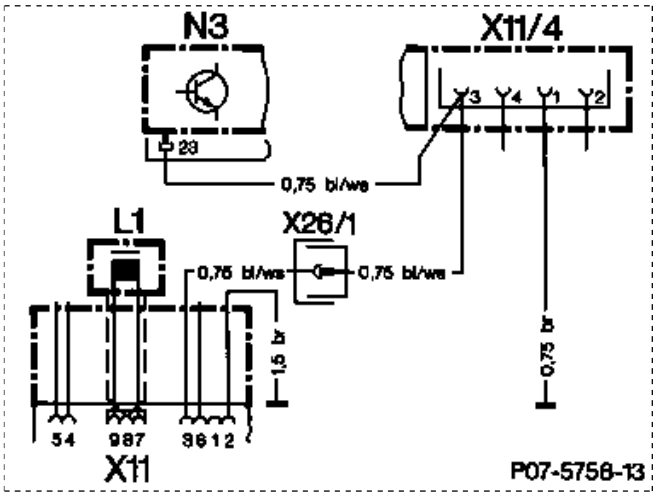
The KE control unit supplies to contact 23 not only the on/off ratio (lambda test signal) but in addition the pulse signal for the fault memory. The on/off ratio is output on a priority basis (except USA). The start button on the pulse counter must be pressed in order to initiate pulse output of the fault memory.

National version USA

The pulse signal of the fault memory is output on a priority basis. If faults are stored, the "CHECK ENGINE" indicator lamp lights up. In order to recognize faults by means of the on/off ratio or for adjusting the lambda control, the KE control unit must first of all be switched over to on/off ratio output. This is done with the pulse counter. On the California version switchover can also be performed at the switch of the test coupling for diagnosis (X11/4).

National version USA California

See in addition the section "On Board Diagnosis System".

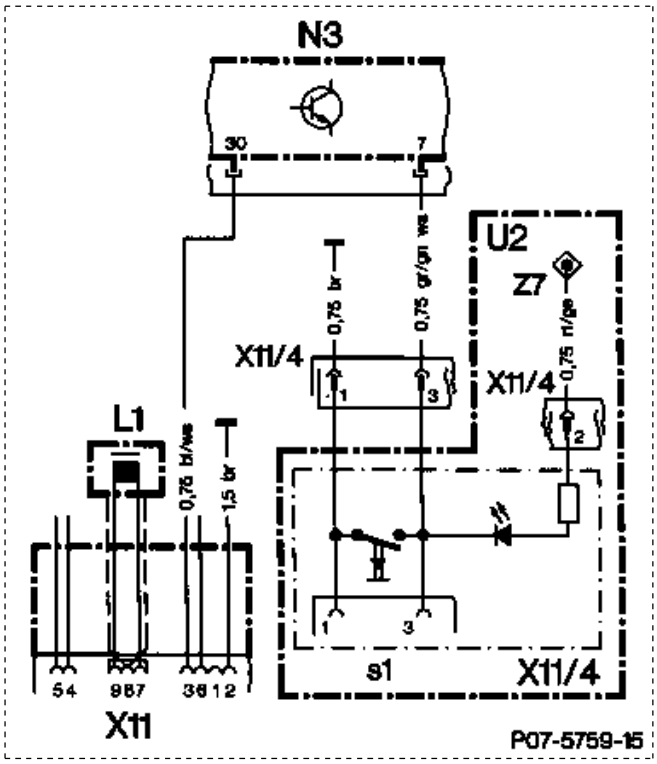


Engines 102, 103, 116, 117

N3	KE control unit (25-pin)
L1	TDC sensor
X11	Diagnostic socket/terminal block terminal TD
X26/1	Only model 201: Plug connection, headlamp harness (1-pin)
X11/4	Test coupling for diagnosis, pulse readout (8-pin, contact 3)

Engines 104, 119

The KE control unit (55-pin) supplies the on/off ratio (lambda test signal) to contact 30. The pulse output of the fault memory is performed at contact 7. It is not necessary to switch over between on/off ratio output or pulse output.



Engines 104, 119

N3	KE control unit (55-pin)
L1	TDC sensor
U2	Valid for California
X11	Diagnostic socket/terminal block terminal TD
X11/4	Test coupling for diagnosis, pulse readout (16-pin, contact 3)
X11/4s1	Switch with LED, California
Z7	Connector sleeve, terminal 87E Feed from overvoltage protection relay

Measuring on/off ratio with ignition on

Engines 104, 119

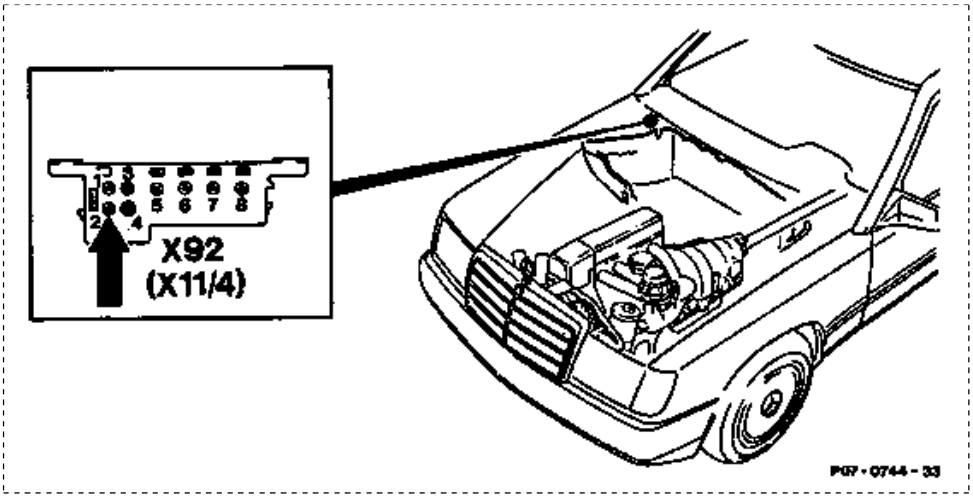
The KE control unit features this 3rd possibility of detecting and outputting faults which have occurred in the system. With the ignition switched on, the input signals to the KE control unit are tested in the static state of the components. The faults are not stored and can only be displayed immediately (i. e. only if the fault exists at that moment) by measuring the on/off ratio at the diagnostic socket (X11). This output mode can also be used for a rapid check of the signals monitored in this case. For measuring on/off ratio and fault table see Diagnosis Manual Engine.

On Board Diagnosis System

(USA) California as of 1988

All the components of the KE injection system and of the exhaust gas recirculation system which effect exhaust emissions are monitored by the KE control unit. Malfunctions resulting from an open circuit in the wiring or failure of one of these components are signalled by the "CHECK ENGINE" indicator lamp in the instrument cluster and simultaneously stored in the KE control unit.

The test coupling for diagnosis (X92 or X11/4) is fitted with a pushbutton switch (2, arrow) and an LED (4) for "on board diagnosis".



The test coupling for diagnosis is located on the right of the component compartment panel (model 107 on left wheelhouse panel). The 8-pin version is replaced by a 16-pin version on engines 104, 119.

If the pushbutton switch (ignition: **ON**) is operated for between 2 and 4 seconds, the flash pulse output is initiated and the fault path indicated by the number of flashes.

After completion of the flash pulse output, the LED shows a steady light. If the pushbutton switch is again pressed for between 2 and 4 seconds, any further fault path can be displayed. If no further fault is recognized, the KE control unit switches over to on/off ratio output.

Erasing flash pulses

Once a fault has been rectified without the KE control unit having been disconnected, the flash pulse output displayed must be erased as follows:

- With the flash pulse output displayed, operate pushbutton switch for 6 - 8 seconds after a waiting period of 2 seconds.
- LED flashes once, stored fault is erased.

Each displayed flash pulse output must be erased individually.

Note

Pushbutton switch and LED have been developed to enable customers and non-MB dealers to locate the fault path as specified by legislation with "on board means". A pulse counter has been developed for DB workshop personnel which indicates the stored fault(s) by means of a digital display (see pulse output at test coupling for diagnosis).

On/off ratio output

The output for the on/off ratio is not performed until after the KE control unit has been programmed to on/off ratio output. Otherwise, with the engine running, the readout is at 0 % or 85 % if the "CHECK ENGINE" indicator lamp comes on.

To test the lambda control, the control unit is switched over to on/off ratio output by pressing the pushbutton switch (see Op. No. 07.3-105 or 07.3-110).

⚠

When dealing with engine running complaints, the fault memory should be read and the faults noted as part of Op. No. 07-1100 before performing repairs. This ensures that a distinction can be made between faults which have in fact occurred and "simulated faults" as faults are stored when performing test operations with the engine running which may result from a simulation or a disconnected cable.

After completing test operations the fault memory must be erased.

y) Emergency running (plausibility)

The signals supplied by the peripheral components to the KE control unit are continuously analyzed. If the composition of the signals is no longer logical, a substitute value (emergency running property) is formed automatically for the non-plausible signal by the electronic control.

If, for example, a rapid change in temperature is simulated - engine at normal operating temperature and coupling of coolant temperature sensor then unplugged, the microprocessor in the control unit compares the momentary temperature with the stored temperature. The control unit detects open circuit (short-circuit) and programmes emergency running mode. The control unit does not detect a slow change in the characteristic curve (characteristic curve drift).