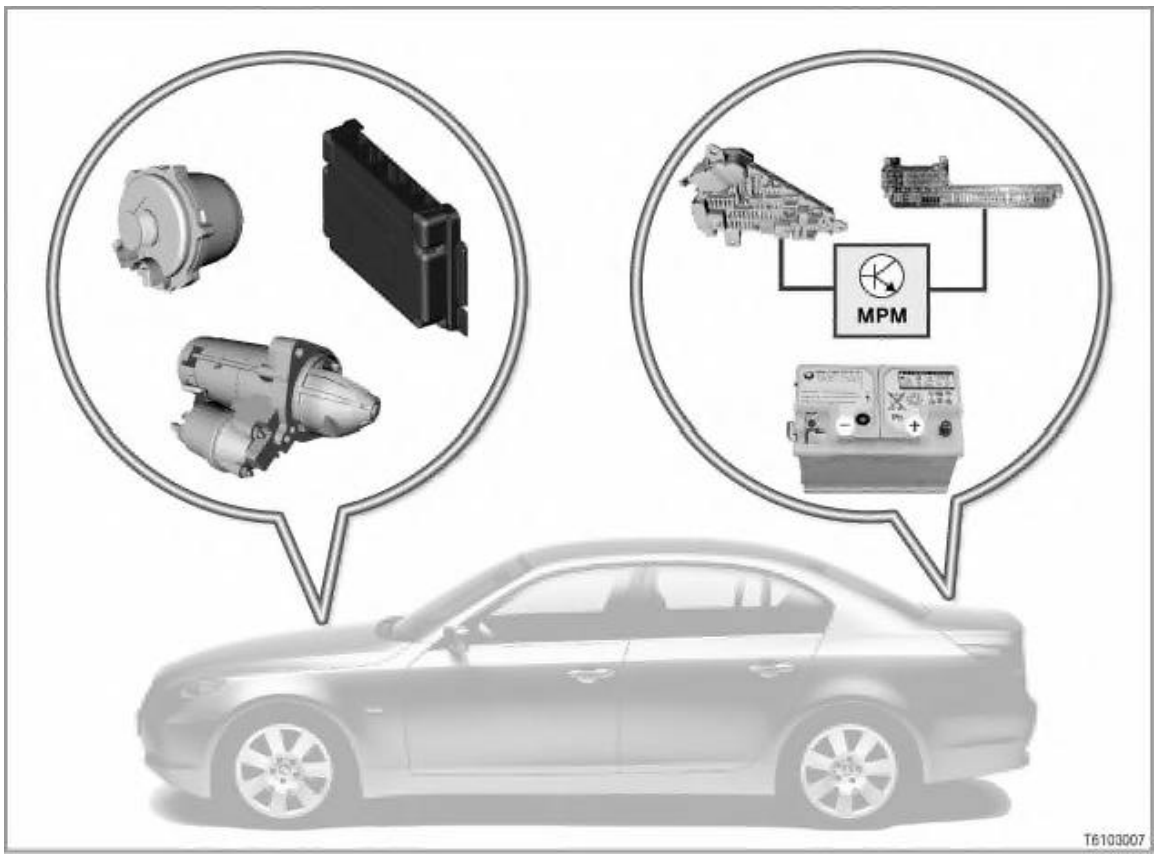
Power supply

E60, E61, E63, E64



Introduction

The power supply on the BMW 5- and 6-Series is similar to that on the E65. However, the 5- and 6-Series do not have the power module from the E65. A network of hardware and software assumes the role of energy management. The energy management system monitors and controls the vehicle's energy requirements, both during a journey and when stationary.
The energy management system comprises the functions of the electric energy management system and the power management functions contained therein.
[system overview ...]

From 09/2005, the vehicle electrical system has been modified. No **byteflight** data bus
This modification means that some control units are discontinued and that some control unit functions are integrated into new control units.
The new body gateway module (KGM) supersedes the safety and gateway module (SGM) previously fitted, the door modules and the micro-power module.
[for more information, please refer to SI Technology (SBT) 61 02 05 143]

The most important components and functions of the electric energy management system are:

- The intelligent battery sensor (IBS) for continuous measurement of the battery's values.
- The software of the power management system in the digital engine electronics (DME) or digital diesel electronics and the intelligent battery sensor.
- The terminal 30g relay, which is actuated by the Car Access System (CAS).
- The micro-power module (MPM), which is located between the front and rear power distributors. As from 09/2005,

MPM function is integrated into the body-gateway module (KGM)

Advantages for the power supply are:

- Precise identification of the battery charge state (SoC: "State of Charge") and battery condition (SoH: "State of Health") by the power management.
- IBS designed for use with different assembly groups.
- Reduced off-load current: the consumers on terminal 30g are switched off in a defined manner by the terminal 30g relay.
- A defined connection between the aluminium front end and the steel bodywork with the GRAV earth point in the engine compartment.
  The GRAV earth point improves the vehicle's electromagnetic compatibility (EMC).
- Greater headroom in the rear seat area. The routing of the battery cables in the outer area allows the seats and carpets in the rear of the vehicle to be installed with reduced height.

Brief description of components

- **IBS: Intelligent battery sensor**

  The IBS is a mechatronic, intelligent battery sensor with its own microcontroller.
  The IBS continuously monitors the battery's:

  - terminal voltage
  - charge current
  - discharge current
  - Acid temperature

  [more ...]

- **MPM: Micro-power module**

  As from 09/2005, MPM function is integrated into the body-gateway module (KGM)
  When the vehicle is at rest, the MPM switches individual consumers off, if:

  - off-load current is high when the charge state is critical
  - undervoltage occurs
  - too many "wake-up" circuits are activated in the K-CAN
  - the vehicle fails to go into sleep mode

  the micro-power module is connected to the K-CAN.
  [more ...]

- **Rear power distributor with terminal 30g relay**

  The rear power distributor is installed on the right-hand side of the luggage compartment. The rear power distributor is connected to the positive terminal of the battery, the front power distributor and the external-start support point. The micro-power module (MPM) is supplied with power from the rear power distributor.
  [more ...]

- **Terminal 30g relay**

  The terminal 30g relay is actuated by the Car Access System (CAS) and prevents increased off-load current by switching off individual consumers.
  [more ...]

- **Power distributor, front**

  The front power distributor is connected to the rear power distributor. The CAS, the starter motor and the KGM are connected to the front power distributor. The body gateway module (KGM) is supplied with power from the front power distributor.

- **Battery cables in outer floor area**

  The battery cable must be monitored on vehicles where the battery cable is installed on the underbody parallel to the

fuel line. Depending on the type of vehicle, the battery cable is made from copper or aluminium and insulated with plastic. The insulation is mantled with low-impedance metal braiding. The metal braiding is the monitoring wire. The battery cable is then covered with a second insulation layer made from plastic. This is the external insulation layer.

A connection line is provided at both ends of the monitoring line.

>up to 09/2005:
The battery cables are monitored by the passive safety system ASE (advanced safety electronics) via satellites in the B-pillars. The end of the monitoring wire leads to the left-hand B-pillar satellite. The other end of the monitoring wire leads to the right-hand B-pillar satellite.

>from 09/2005:
The ASE is superseded by the ACSM (''Advanced Crash Safety Module'', usually referred to as the ''crash safety module'').
The battery cable is monitored by the crash safety module. Both ends of the monitoring wire are connected to the crash safety module.

- **Battery**
  The battery is installed on the right-hand side of the luggage compartment. The battery condition is continuously monitored by the IBS.
  [more ...]

- **Starting-aid terminal**

  The starting-aid terminal in the engine compartment is extension of the positive terminal of the battery to an easily accessible point.
  [more ...]

- **Ignition starter switch / START/STOP button**

  >Up to 09/2005:
  The ignition starter switch is located on the right-hand side of the steering column. The ignition starter switch is directly connected to the Car Access System.

  > from 09/2005:
  The ignition starter switch is superseded by the START/STOP button and the insert compartment for the remote control.
  [for more information, please refer to SI Technology (SBT) 61 03 03 019]

- **CAS: Car access system**

  The CAS includes the following functions:

  - Terminal control
  - Electronic vehicle immobiliser (EWS)
  - Evaluation of radio signals from remote control

  The CAS is directly connected to ignition starter switch or insert compartment by wires. The DME / DDE and the starter motor are connected to the CAS. The CAS is part of the K-CAN bus network.

  [for further information, please refer to SI Technology (SBT) 61 03 03 019]

- **DME or DDE: Digital engine electronics or digital diesel electronics**

  The DME/DDE is the engine control unit. The DME/DDE contains the electronic immobiliser (EWS). The DME/DDE is also used as a secondary (backup) data store. The DME/DDE is connected to the powertrain CAN (PT-CAN) data bus to allow it to communicate with other control units in the vehicle.

- **Starter relay**

  The starter relay switches the battery voltage to the starter motor, when

  - >up to 09/2005:

    The ignition starter switch is in switch position 2,

    >from 09/2005:

    The appropriate terminal is activated with the START/STOP button

- The CAS receives the correct information and transmits this to the DME / DDE via the K-CAN
- The electronic immobiliser (EWS) actuates the starter relay

- **Starter motor**

  >up to 09/2005:

  Battery voltage is fed to the starter motor via the starter relay to start the engine when the ignition starter switch is turned to position 2.

  >from 09/2005

  The START/STOP button can be used to switch the terminals in sequence (0, R, 15, R, 0).

- **Alternator**
  When the engine is running, the alternator generates a variable charge voltage for battery charging. The power management system influences the variable charge voltage, depending on temperature and current, by causing the DME or DDE to increase the engine speed.

- **Earth point on lightweight aluminium front end**

  The earth point on the lightweight aluminium front end (GRAV) is the place where steel body has its earth connection. [more ...]

System functions

The power supply system comprises the following functions:

- Electric energy management
- Power management
- Variable charge voltage
- Idle-speed increase
- Reduction of load peaks
- Consumer shutdown
- Off-load current monitoring
- Terminal 30g relay

Electric energy management
The electric energy management monitors and controls the vehicle's energy requirements. The monitoring and control functions are performed by the interconnection of various components. The energy management links functions, signals and maps for generating and outputting control signals.

- Components of the energy management system:
  - Battery
  - Intelligent battery sensor (IBS)
  - Bit-serial data interface (BSD)
  - DME or DDE
  - Engine
  - Power management (microcontroller)
  - Micro-power module (MPM)
    From 09/2005, MPM function is integrated into the body-gateway module (KGM)
  - Alternator
  - Terminal 30g relay
  - Consumers on terminal 30/terminal 30g
- Function/systems involved in energy management:

  - Power management
  - Car Access System (CAS)
- Signals/characteristic curves in energy management system:
  - Current flow to consumers
  - Increased idling speed
  - Battery charge current
  - Nominal value for charge voltage
  - Reduced fuel consumption
  - Terminal 15 wake-up wire

Power management

The power management is on the one hand part of the electrical energy management system. Power management is software stored in the DME or DDE and in the intelligent battery sensor that is used for controlling the vehicle's energy requirements.

Power management comprises the functions controlled by the software in the DME / DDE and in the IBS:

- Variable charge voltage for the battery by adapting the charge voltage from the alternator to that required by the battery
- Increased idling speed to boost the alternator's output
- Reduction of load peaks through power reduction when the vehicle's electrical system is unable to provide the energy needed (vehicle electrical system deficiency)
- Auxiliary consumers switched off via CAN messages when engine has reached its limit of starting capability
- Off-load current monitoring

Power management links the input signals with the characteristic curves stored in an EPROM (Erasable Programmable Read-Only Memory) and generates the output signals to control energy requirements.

- Power management components:
  - DME or DDE
  - EPROM
  - Microcontroller

- Power management input signals:
  - Battery voltage (U)
  - Current (I ±)
  - Temperature (T)

- Characteristic curves
  - Battery voltage (U)
  - Current (I ±)
  - Temperature (T)

- Output signals
  - Idle-speed control
  - Nominal value for charging voltage
  - Auxiliary consumer shutdown
  - Load peak reduction

Power management registers the battery charge state and the battery condition.

- **Battery charge balance**
  The charge balance of the battery is determined by the charge quantity flowing into and out of the battery. Two counters are provided in the power management to give a running balance of the battery's charge state. One of the counters counts the charge quantity taken up by the battery. Another counter counts the charge quantity discharged from the battery. At the factory, the counters are calibrated for the battery fitted. The IBS transmits the data to power management in the DME / DDE. Data is transmitted via the bitserial data interface (BSD).
  The difference between the two charge levels is the battery charge state (SoC: "State of Charge"). Following an engine shutdown, the power management computes the current battery charge state for the next engine start.
- **Battery condition**
  The battery condition (SoH: "State of Health") is derived from the drop in battery voltage and the current drawn during engine start. These data are measured by the IBS during the starting procedure. The average value of the starting current in the start phase and the value of the voltage dip are transmitted to the DME / DDE via the bit-serial data interface (BSD). The starting procedure is indicated to the IBS by currents greater than 200 ampères (A). The "engine running" signal is output by the DME / DDE as soon as the engine starts.
  The power management system calculates the battery's internal resistance from the average value of the starting current and the value of the voltage dip. Conclusions about the battery's condition can be drawn from its internal resistance.

Variable charging voltage
The variable charging voltage for the battery ensures that an optimal battery charge state is maintained, even in unfavourable driving situations. Unfavourable driving situations are, e.g. city traffic and driving in congested traffic.

The charging voltage varies, depending on

- Battery temperature and
- Consumer current.

Battery temperature
The temperature-dependent adjustment of the battery charging voltage prevents an undesirable increase of the battery temperature during recharging.
Moreover, the battery temperature remains lower, even at higher ambient temperatures. This reduces the amount of gas generated during charging and the amount of distilled water consumed.

Consumer current
The level of consumer current is measured by the IBS and transmitted to the power management via the bit-serial data interface (BSD). From this, the power management derives the charging voltage level to be generated by the alternator. This charging voltage nominal value, as derived by the power management, determines the level of the charging voltage generated by the alternator. This determines the battery charge current, which in turn influences the battery charging process, and ultimately the vehicle's consumer current.

Idling speed increase
The idling speed of the engine is raised by the DME / DDE to 750 rpm if the specified battery charging voltage level is not achieved.
The idling speed is raised when

- the alternator is at full capacity

  and

- the battery charge state is too low.

Load peak reduction
If the charge state of the battery does not improve, even after the idling speed has been increased, the peak load in the vehicle electrical system is reduced. The peak load reduction is achieved by the following actions:

- Pulsing the load with pulse width modulation (PWM) signals
  In this process, consumers (e.g. the electric auxiliary heater) are switched on and off for defined times.
  To pulse the electric auxiliary heater, the power management outputs a PWM signal in the DME / DDE, depending on the energy available. The PWM signal contains the information for the maximum switch-on power available for the electric auxiliary heater. The frequency of the PWM signal is fixed at 160 Hertz (Hz).
- Power draw reduced to a certain percentage.
- Individual consumers are switched off in extreme situations when the power reduction achieved through pulsing and reduced consumption is insufficient.

The load on the vehicle electrical system is reduced according to the table:

Priority of consumers	**Power reduction**	**Control unit**
Heated rear window	Pulsing	IHKA
Seat heating	level 2	SM
Seat heating	50 %	SM
Active seat	Off	SM
Heater blower	75 %	IHKA
Steering wheel heating	Pulsing	SZL
Heater blower	50 %	IHKA
Mirror heating	Off	TM >from 09/2005: KGM
Heated rear window	Off	IHKA
Seat heating	Off	SM
Steering wheel heating	Off	SZL
Active seat ventilation	Off	SM
Heater blower	25 %	IHKA

Consumer shutoff

Consumers are switched off according to different criteria and are split into the following categories:

- Convenience consumers
  - Heated rear window
  - Seat heating
  - Steering wheel heating

  The convenience consumers are automatically switched off when the engine is switched off. The convenience consumers can only be switched on again after the engine has been restarted.

- Legally prescribed auxiliary consumers
  - Parking lights
  - Hazard warning lights

  Legally prescribed auxiliary consumers must still be operational when the engine has been switched off, as long as this is possible. These auxiliary consumers are not deactivated, even if the battery's limit of starting capability has been reached.

- Auxiliary consumers

- independent heating
- Independent ventilation
- Communications components
  - Displays
  - Terminal 30g
  - Telematic services

The auxiliary consumers listed can still be switched on after the engine has been switched off. The auxiliary consumers are automatically switched off when the battery reaches its limit of starting capability. A CAN message from the DME / DDE prompts the shutdown.

- System-related run-on
  - Electric radiator fan

System-related run-on components can remain operational for a certain time after the engine has been switched off.

Off-load current monitoring

If the vehicle is out of use (from 68 minutes after terminal R OFF) and the battery current exceeds 80 milliampères (mA) (default setting), a fault memory entry is stored in the DME / DDE.

Terminal 30g relay

The terminal 30g relay prevents a higher off-load current, e.g. one caused by a defective consumer, with a predefined consumer shutoff. The terminal 30g relay is actuated by the CAS. The "g" indicates that terminal 30g is an active terminal.

The connections that are switched on and off through the terminal 30g relay are shown on the system circuit diagram. [system overview ...]

Notes for service staff

Service staff should note the following points:

- General information: [more ...]
- Diagnosis: [more ...]
- Encoding/programming:[more ...]

Subject to change.

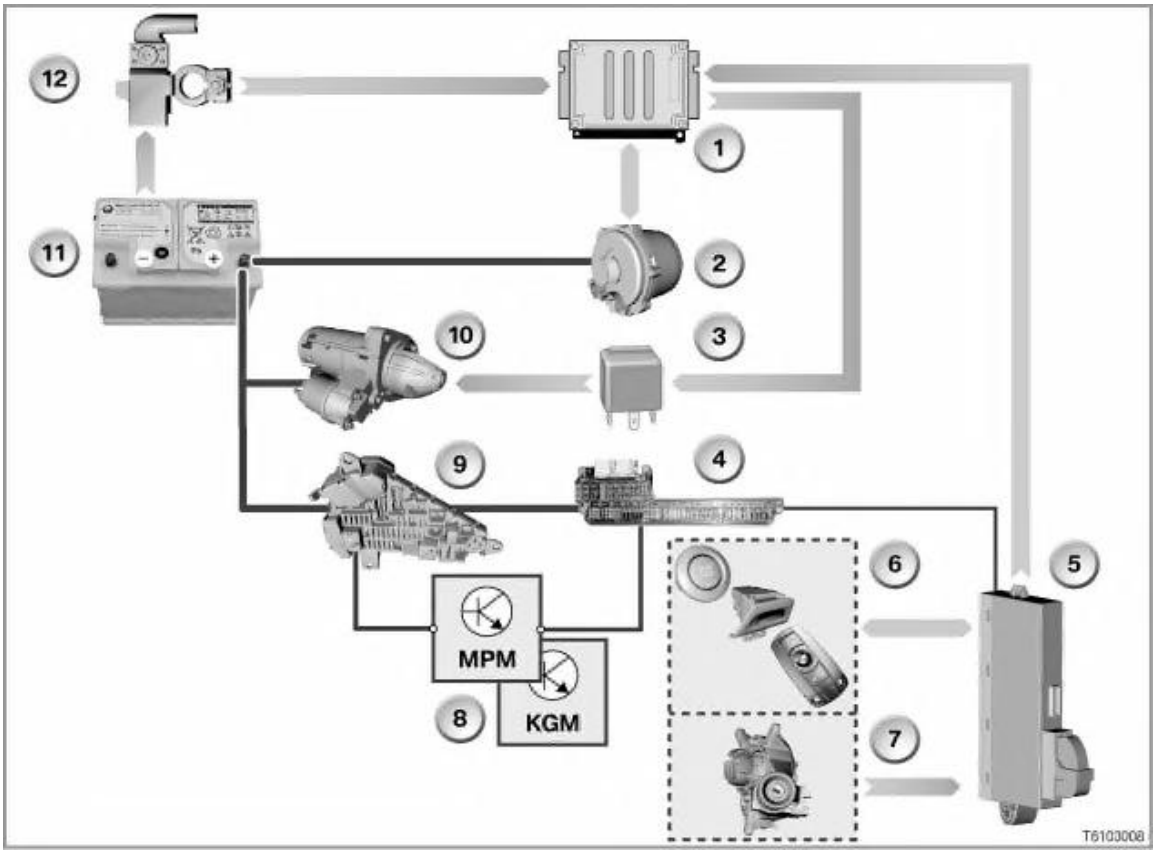
Power supply, system overview: E60, E61, E63, E64

This system overview comprises the following overviews:

- Inputs/outputs (power supply for 6-cylinder engine version)
- Principle of electrical energy management
- Principle of power management
- System circuit diagram (power supply for 6-cylinder engine version) until 09/2005
- Overview of control unit on terminal 30g until 09/2005
- Overview of control unit on terminal 30g-f until 09/2005
- System circuit diagram (power supply for 6-cylinder engine version) from 09/2005
- Overview of control unit on terminal 30g from 09/2005
- Overview of control unit on terminal 30g-f from 09/2005
- Earth points (left-hand drive vehicles)

- Inputs/outputs

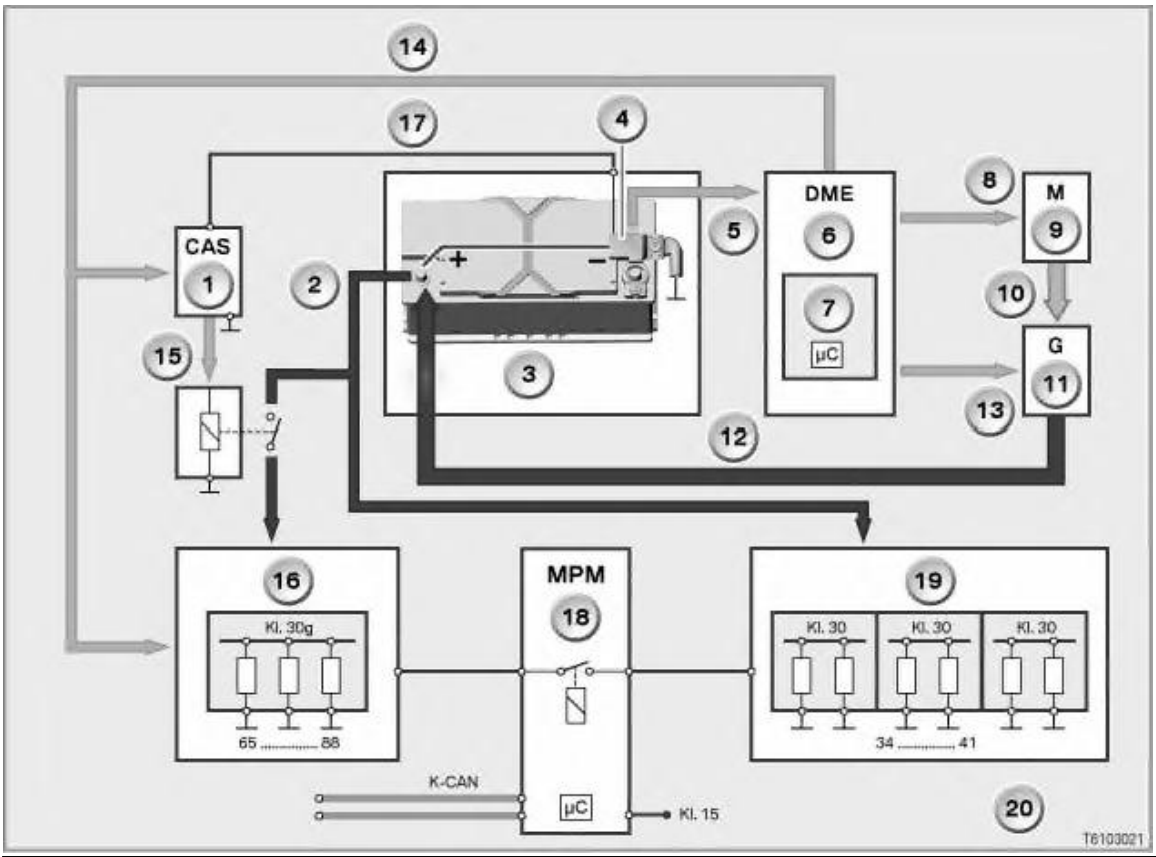
Power supply for 6-cylinder engine version



Item	Description	Item	Description
1	Digital engine electronics (DME)	2	Alternator
3	Starter relay	4	Power distributor, front
5	Car Access System (CAS)	6	>from 09/2005: START/STOP button with insert compartment and remote control
7	>Until 09/2005: Ignition starter switch	8	

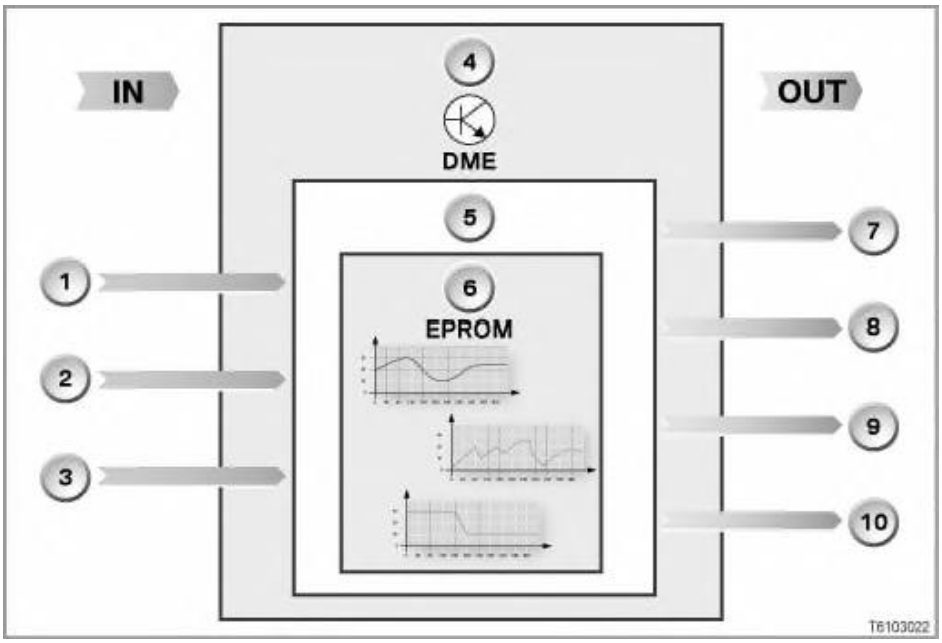
			>Until 09/2005: Micro-power module (MPM) > From 09/2005: Body-gateway module The MPM function is integrated into the KGM.
9	Rear power distributor with terminal 30g relay	10	Starter motor
11	Battery	12	Intelligent battery sensor (IBS)

- Principle of electrical energy management



Item	Description	Item	Description
1	Car Access System (CAS)	2	Current flow to consumers
3	Battery	4	Intelligent battery sensor (IBS)
5	Bit-serial data interface (BSD)	6	Digital engine electronics (DME)
7	Power management	8	Increased idling speed
9	Engine	10	Mechanical energy (alternator drive)
11	Alternator	12	Battery charge current
13	Nominal value for charge voltage	14	Consumer shutdown
15	Terminal 30g relay	16	Rear power distributor, consumers on terminal 30g
17	Terminal 15 wake-up wire	18	>up to 09/2005: Micro-power module (MPM) >from 09/2005: Body gateway module (KGM) The MPM function is integrated into the KGM.
19	Power distributor, front	20	Electric energy management
K-CAN	Body controller area network	Kl. 15	Terminal 15, ignition lock position 2

- Principle of power management

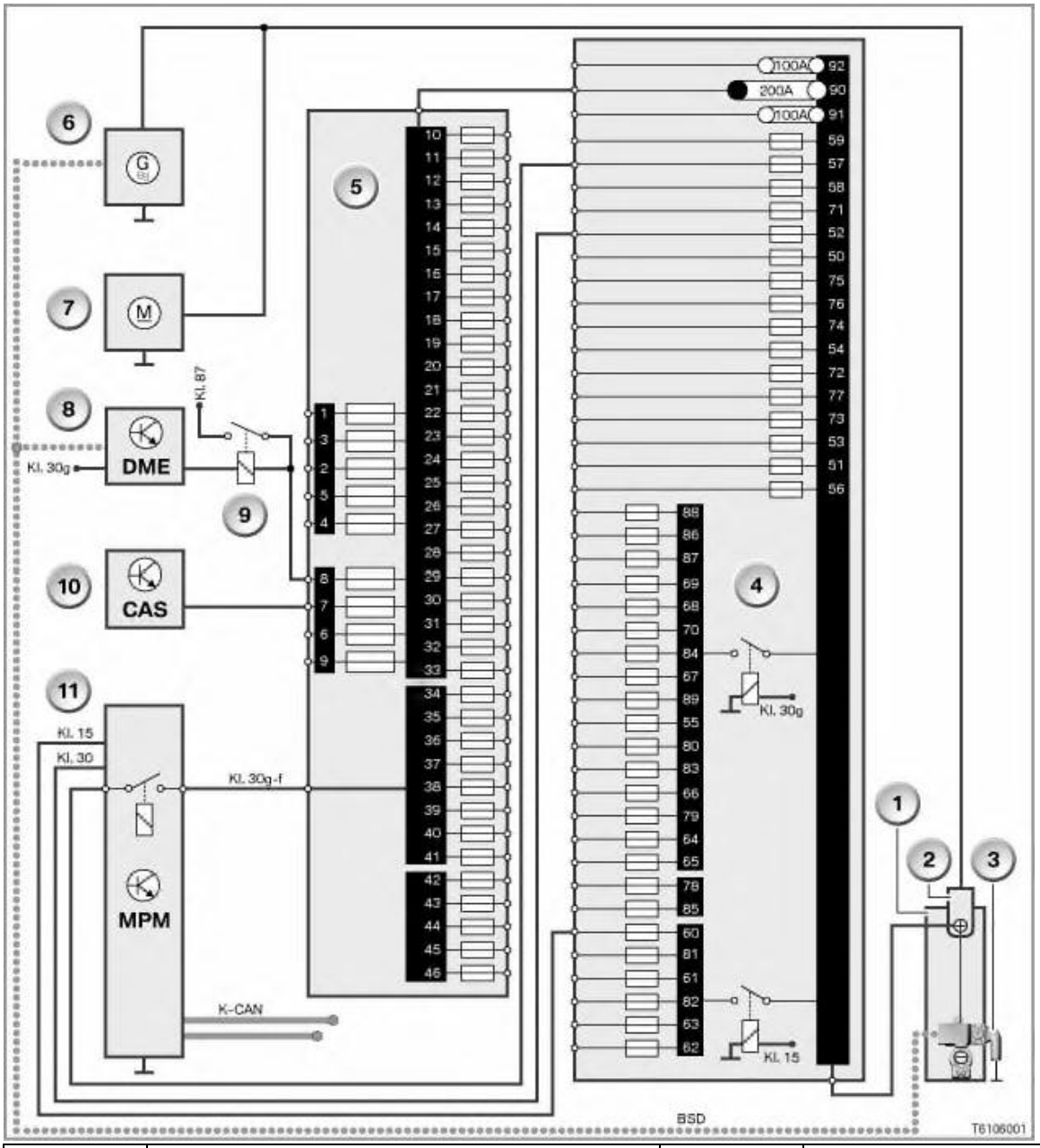


Item	Description	Item	Description
1	Voltage (U)	2	Current (I ±)
3	Temperature (T)	4	Digital engine electronics (DME)
5	Power management	6	Erasable Programmable Read-Only Memory (EPROM) with battery maps for: - Voltage (U) - Current (I ±) - Temperature (T)
7	Idle-speed control	8	Nominal value for charge voltage
9	Auxiliary consumer cutoff	10	Load peak reduction
IN	Input information	OUT	Output information

- System circuit diagram

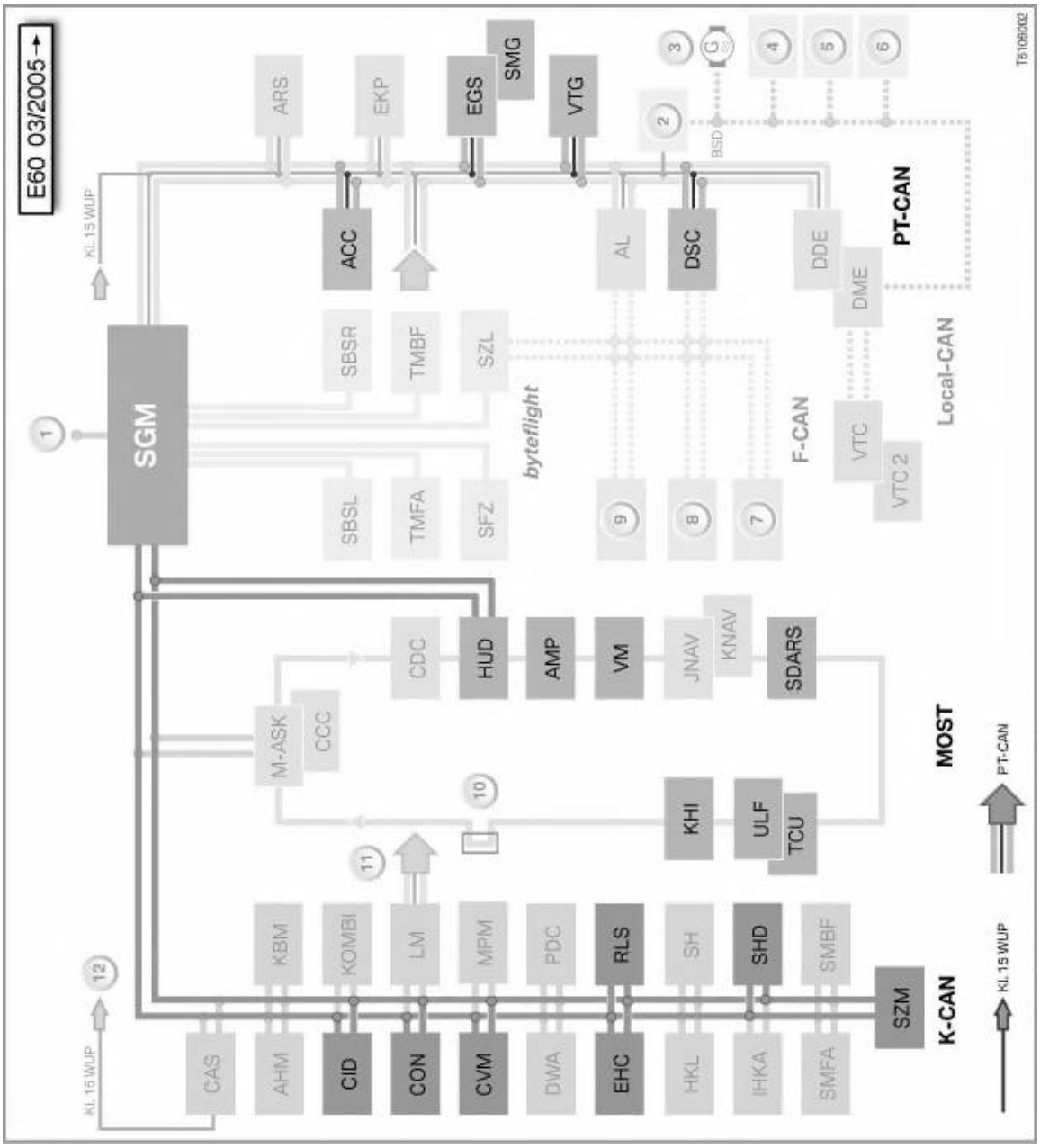
>System circuit diagram power supply for 6-cylinder engine version until 09/2005

Example: E60



Item	Description	Item	Description
1	Battery	2	Safety battery terminal
3	Intelligent battery sensor (IBS)	4	Rear power distributor with terminal 30g relay and terminal 15 relay
5	Power distributor, front	6	Alternator
7	Starter motor	8	Digital engine electronics (DME)
9	DME main relay	10	Car Access System (CAS)
11	Micro-power module (MPM)	K-CAN	Body CAN
Kl. 15	Terminal 15, ignition lock position 2	Kl. 30	Terminal 30, power supply
Kl. 30g	Terminal 30g, active	Kl. 30g-f	Terminal 30 g-f
Kl. 87	Terminal 87	BSD	Bit-serial data interface

- Overview of control unit on terminal 30g-f until 09/2005

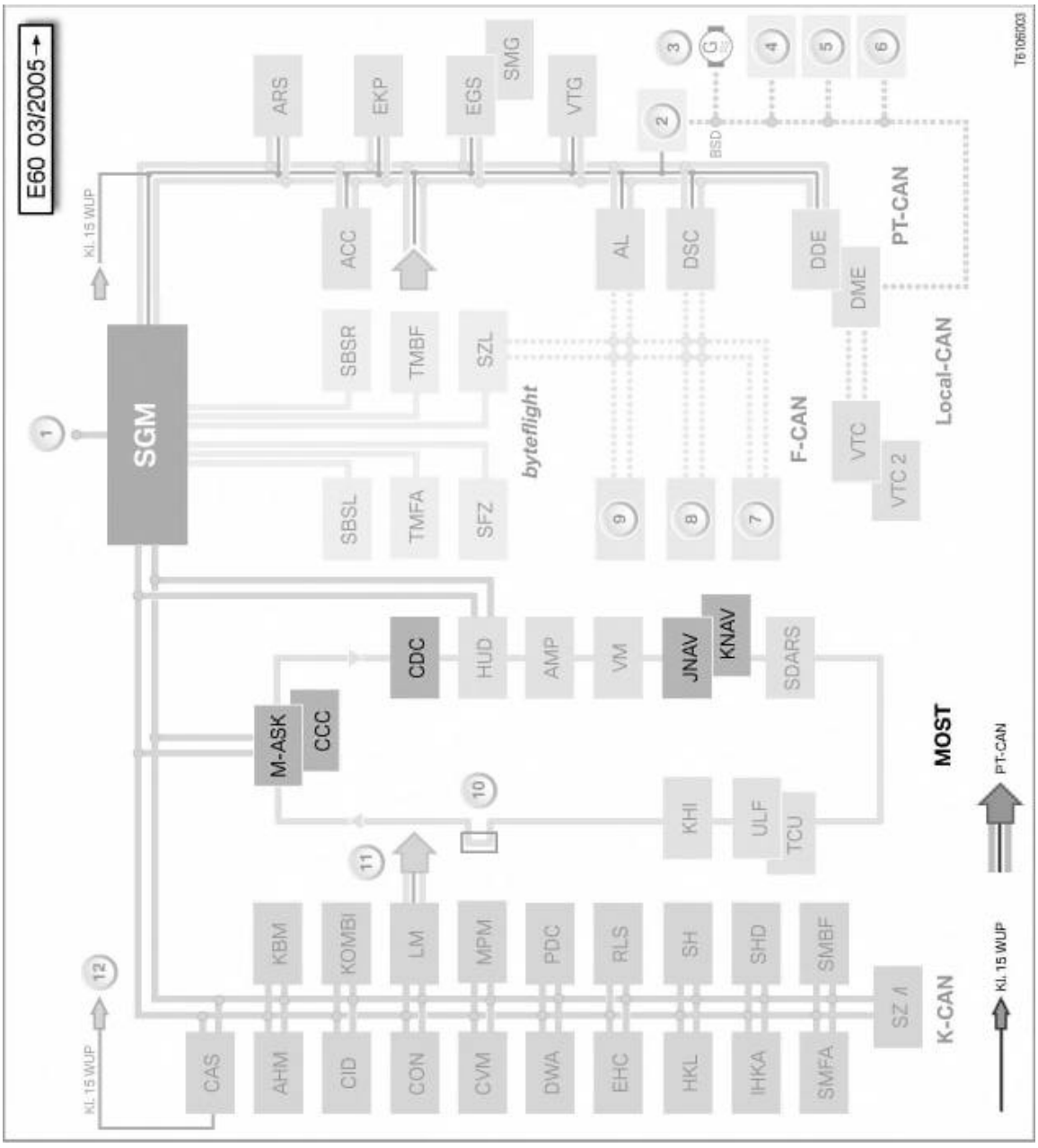


The control units with power supply via terminal 30g are highlighted.

Item	Description	Item	Description
ACC	Active cruise control	AMP	Amplifier
CID	Central Information Display	CON	Controller
CVM	Convertible top module	DSC	Dynamic Stability Control
EGS	Electronic transmission control	EHC	Electronic height control
HUD	Head-up display	KHI	Headphone interface
RLS	Rain-light sensor	SDARS	Satellite tuner
SHD	Sliding/tilting sunroof (on E61: Panorama glass sunroof)	SMG	Sequential manual gearbox

SZM	Centre console switch cluster	TCU	Telematics control unit
ULF	Universal charger and hands-free system	VM	Video module
VTG	Transfer case		

- Overview of control unit on terminal 30g-f until 09/2005



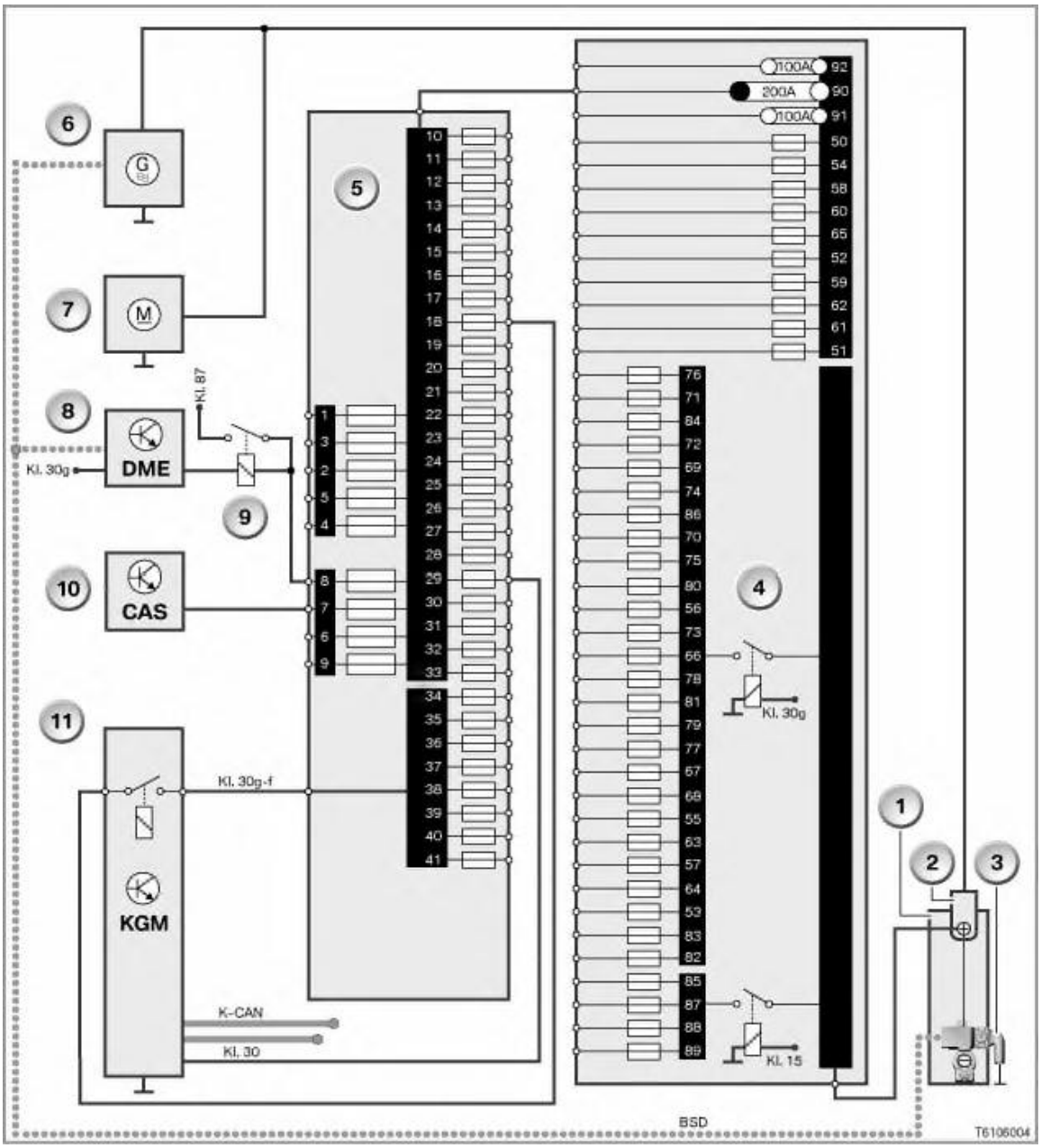
The control units with power supply via terminal 30g-f are highlighted.

Item	Description	Item	Description
CCC	Car Communication Computer	CDC	CD changer
JNAV	Japan navigation system	KNAV	Korea navigation system
M-ASK	Multi-audio system controller		

- System circuit diagram

> System circuit diagram power supply for 6-cylinder engine version from 09/2005

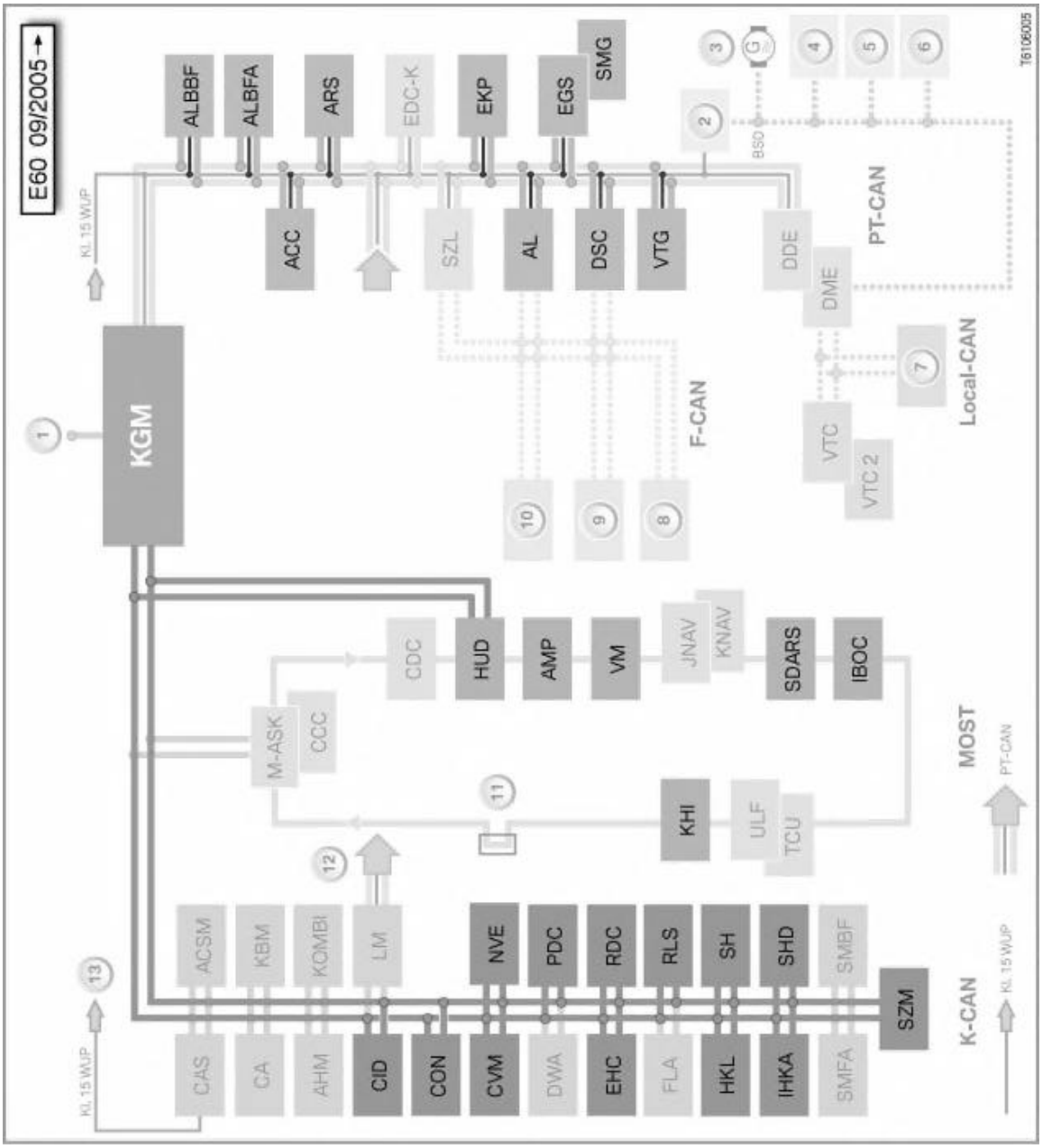
Example: E60



Item	Description	Item	Description
1	Battery	2	Safety battery terminal
3	Intelligent battery sensor (IBS)	4	Rear power distributor with terminal 30g relay and terminal 15 relay
5	Power distributor, front	6	Alternator
7	Starter motor	8	Digital engine electronics (DME)
9	DME main relay	10	Car Access System (CAS)
11	Body gateway module (KGM)	K-CAN	Body CAN
Kl. 15	Terminal 15, ignition lock position 2	Kl. 30	Terminal 30, power supply
Kl. 30g	Terminal 30g, active	Kl. 30g-f	Terminal 30 g-f

Kl. 87	Terminal 87	BSD	Bit-serial data interface

- Overview of control unit on terminal 30g from 09/2005

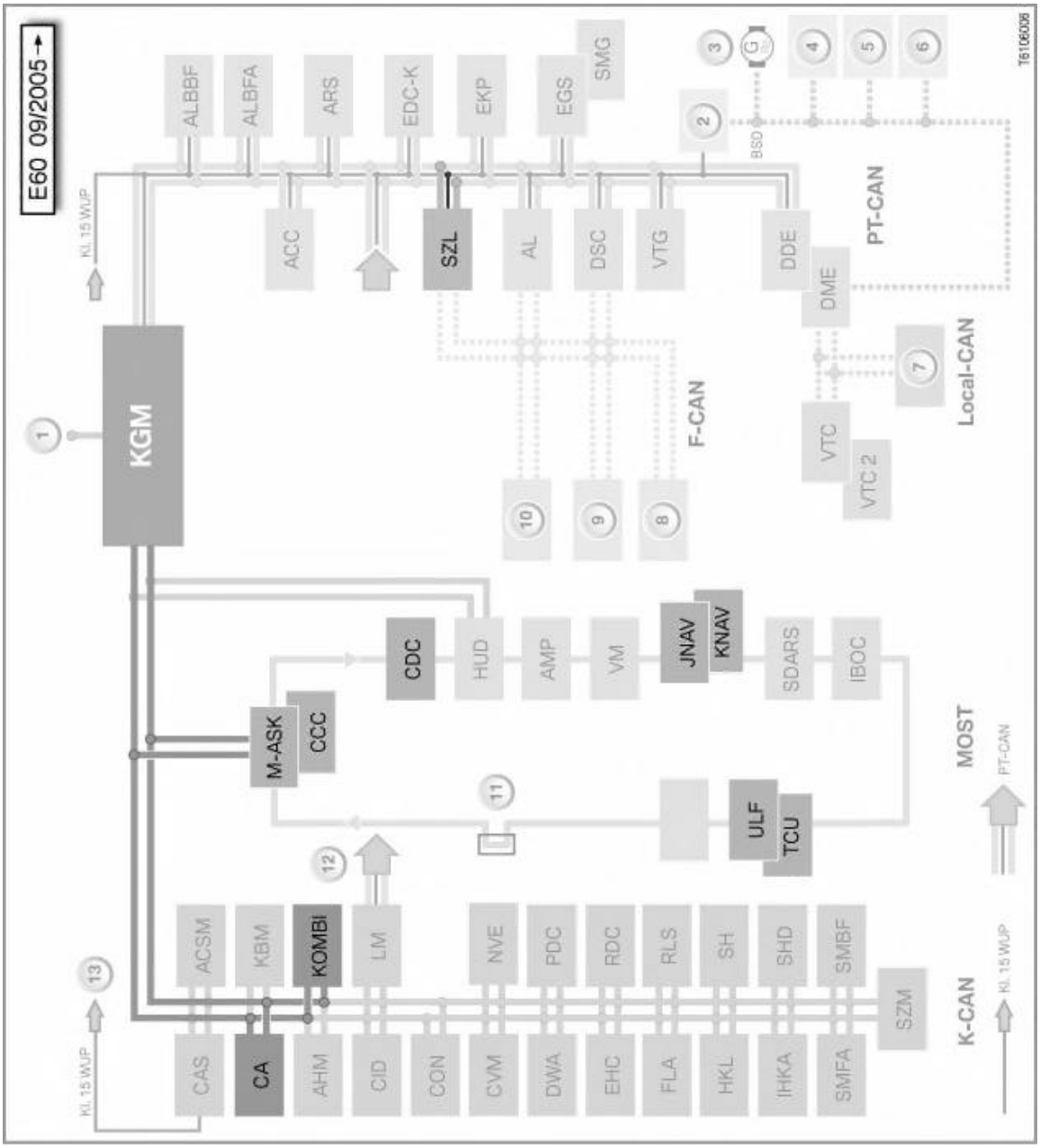


The control units with power supply via terminal 30g are highlighted.

Item	Description	Item	Description
ACC	Active cruise control	AL	Active Steering
ALBBF	Active seat back width, front passenger seat	ALBFA	Active seat back width, driver's seat
AMP	Amplifier	ARS	Active roll stabilisation (sales designation: Dynamic Drive)
CID	Central Information Display	CON	Controller
CVM	Convertible top module	DSC	Dynamic Stability Control
EGS	Electronic transmission control	EHC	Electronic height control

EKP	Regulated fuel pump	HKL	Tailgate lift
HUD	Head-up display	IBOC	Digital tuner US
IHKA	Integrated automatic heating and air-conditioning system	KHI	Headphone interface
NVE	Night-vision electronics (from 03/2006)	PDC	Park Distance Control
RDC	Tyre pressure control (from 03/2006, US version only)	RLS	Rain-light sensor
SDARS	Satellite tuner	SH	Independent heating
SHD	Sliding/tilting sunroof (on E61: Panorama glass sunroof)	SMG	Sequential manual gearbox
SZM	Centre console switch cluster	VM	Video module
VTG	Transfer case		

- Overview of control unit on terminal 30g-f from 09/2005



The control units with power supply via terminal 30g-f are highlighted.

Item	Description	Item	Description
CA	Comfort Access	CCC	Car Communication Computer
CDC	CD changer	JNAV	Japan navigation system
KOMBI	Instrument cluster	KNAV	Korea navigation system
M-ASK	Multi-audio system controller	SZL	Steering column switch cluster
TCU	Telematics control unit	ULF	Universal charger and hands-free system

- Earth points

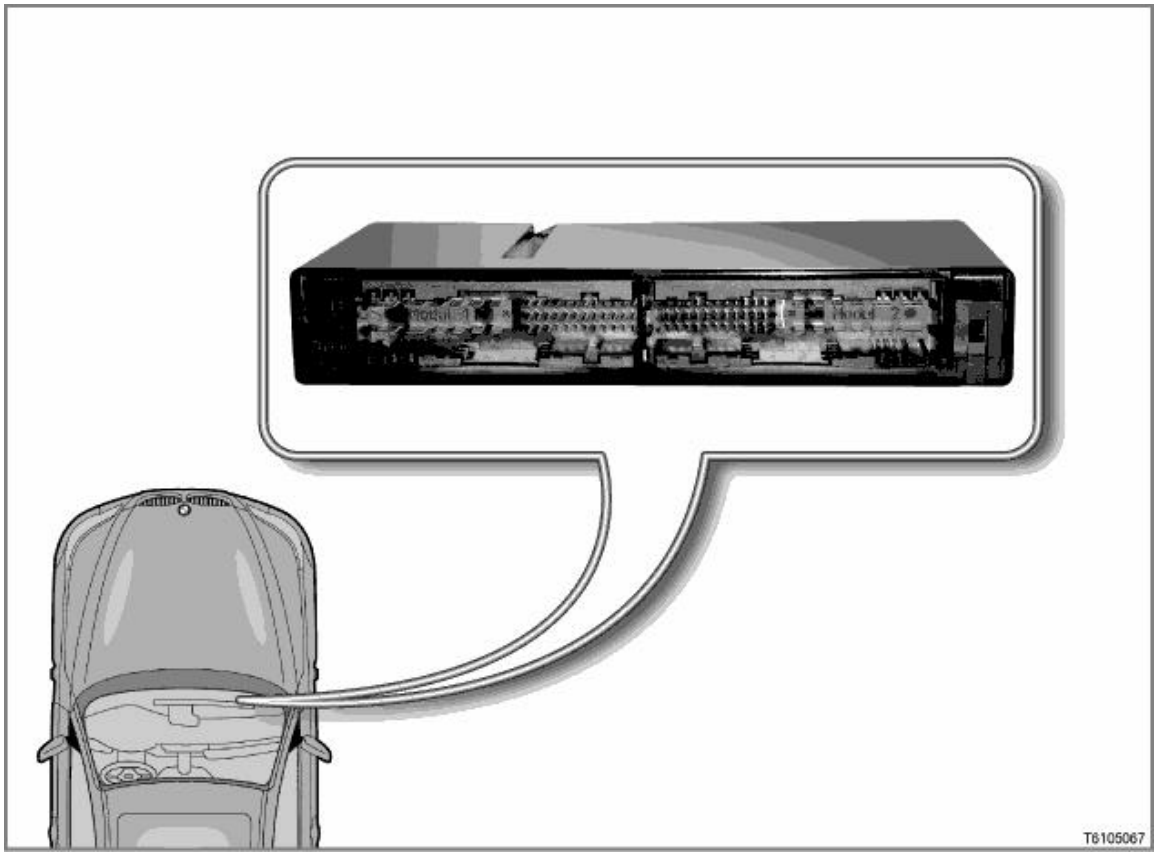
The earth points on the example of the E60 are illustrated for left-hand-drive vehicles. Installation locations may differ on right-hand drive vehicles.

Example: E60

Item	Description	Item	Description
1	X13782 - A-pillar, right	2	X13784 - door entrance, A-pillar
3	X14054 - electric auxiliary heater	4	X13797 - A-pillar, right (blower)
5	X14234 - AFS control unit	6	X13786 - under front-passenger seat
7	X13788 - under front-passenger seat	8	X13790 - wheel arch, rear right
9	X13794 - luggage compartment, rear right	10	X13792 - luggage compartment, rear right
11	X6402 - luggage compartment (battery)	12	X13793 - luggage compartment, rear left
13	X13795 - luggage compartment, rear left	14	X13791 - wheel arch, rear left
15	X13789 - under driver's seat	16	X13787 - under driver's seat
17	X13785 - door entrance, A-pillar, right	18	X13783 - door entrance, A-pillar
19	GRAV earth point, engine compartment, left		

Body-gateway module

E60, E61, E63, E64



Introduction

The system network of the E60, E61, E63, E64 will change as from 09/2005.
As a result of the change, some control units will no longer be installed and some control unit functions will be integrated in new control units.
The new body-gateway module (KGM) replaces the safety and gateway module (SGM), the door modules and the micro-power module installed to date.
[System overview ...]

Brief description of components

The body-gateway module (KGM) combined many functions in one control unit.
Control functions for following systems are integrated in the body-gateway module:

- Exterior mirrors
- Entrance light, front
- Power windows, front
- Micro-power module
- Servotronic
- Central locking, front

[more ...]

System functions

Depending on the equipment configuration, the body-gateway module can control the following functions or register signals (in alphabetical order):

- **Door mirrors**

  The body-gateway module (KGM) controls the functions of the outside mirrors in the basic version and with optional additions.

  - Basic version of outside mirror
    (only mirror heating and mirror adjustment)

    The body-gateway module directly activates the motors for horizontal and vertical mirror adjustment.

    The body-gateway module directly actuates the mirror heating.
  - Outside mirror with optional equipment
    (mirror memory, automatic kerb viewer, electrochromic outside mirror, mirror folding function, courtesy lighting)

    The body-gateway module controls the control electronics in the outside mirror via the LIN-bus if the outside mirror is equipped with one of these items.

  [more ...]

- **Bistable relay**

  The bistable relay and micro-power module have been integrated in the body-gateway module. In the event of closed-circuit current transgressions, the body-gateway module disconnects the electric loads from terminal 30g-f via the bistable relay (closed-circuit current transgression: when the vehicle does not assume the rest status).

  The following electric loads are connected to terminal 30g-f (power supply, front, fuses F34 to F41):

  - CA: Comfort Access
  - CDC: CD changer
  - JNAV or KNAV: Navigation system Japan or navigation system Korea
  - COMBI: Instrument cluster
  - M-ASK / CCC: Multi-audio system controller / Car Communication Computer
  - SZL: Steering column switch cluster
  - TCU or ULF: Telematics Control Unit or universal charging and hands-free device

  Switch-on conditions:

  The bistable relay is activated (contact closed) under one of the following conditions:

  - Connecting the battery
  - Unlocking the vehicle
  - Change in status of door contacts or boot lid
  - Terminal R ON

  Conditions required for switch-off:

  A CAN message requests the loads to switch off if the closed-circuit current is too high and the starting capability limit of the battery is reached (afterrunning time approx. 2 minutes).
  If the closed-circuit current is still too high after the afterrunning time has elapsed, a reset is performed for approx. 10 seconds prior to final shut-down. This reset is performed to eliminate any malfunctions in the control units connected to the bistable relay.

  The closed-circuit current is monitored again after the reset. The bistable relay is no longer activated (contact opened) if there is still a closed-circuit current transgression.

Shut-down or reset is entered in the info memory of the body-gateway module.

- **CAS: Car Access System**

  The CAS controls the access options to the vehicle. The CAS control unit is, amongst other things, the master for the central locking system, the electronic immobiliser and the electrical steering lock.

  The CAS is connected via the K-CAN to the body-gateway module (KGM).

- **Door entry lighting**

  Control of the door entry lighting at the front is distributed over two control units (KGM, KBM). The basic body module (KBM) is the master control unit for the door entry lighting. The KBM sends a CAN message to the body-gateway module (KGM).
  In turn, the KGM activates the door entry lights at the front (driver's and passenger's side).

  The door entry light is located in the bottom area of the front door. The door entry lighting illuminates the ground outside the vehicle in the area of the front door. The door entry lighting switches on or off when the front door is opened or closed.

- **Electrochromic rear-view mirror**

  The electrochromic rear-view mirror has 2 sensors that measure incident light from the front and the rear. A voltage signal is output (the strength of which depends on the difference in intensity between the light from the front and the rear) if the light from the rear is more intense. The greater the voltage signal the more the interior rear-view mirror and the outside mirrors are darkened. The body-gateway module (KGM) receives the voltage signals. The electrochromic outside mirrors are controlled by the KGM via the LIN bus.

  Signal path:

  Electrochromic interior rear-view mirror -> direct cable -> KGM -> LIN-bus -> Electrochromic outside mirror

- **Energy history memory**

  The energy history memory is important for energy diagnosis.

  The energy history memory records vehicle operating cycles, e.g. every time control units are woken or wake up, sleep mode is prevented etc.
  The vehicle operating cycles are stored together with the kilometre reading, time and cause, making it possible to identify the defective control unit in the case of closed-circuit current transgressions.

- **Front power windows**

  All the power windows can be operated via the switch cluster in the driver's door. The body-gateway module (KGM) controls only the front power windows. The rear power windows are controlled by the basic body module (KBM).

  The car access system (CAS) is the master control unit for the power window function. The KGM is connected to the CAS via the K-CAN.

  The KGM evaluates the signals from the front power window switches and the signals from the switch cluster in the driver's door.

  The KGM controls and monitors the front power windows.

  The KGM receives signals from following components:

  - Power window switches in the switch cluster in the driver's door (via LIN-bus)
  - Power window switch in the front passenger door

    The power window switch is connected directly to the KGM.
  - Hall sensors in the power-window motors

    2 Hall sensors are integrated in each of the power window motors at the front. The direction of rotation, speed and position can be determined through these.
  - Remote control (auto-remote opening and auto-remote closing)

    The windows and slide/tilt sunroof can be opened and closed with the remote control. The radio signals from the remote control are received by the remote control receiver and transferred to the CAS control unit. The CAS is

connected to the KGM via the K-CAN.

The KGM controls following actuators:

- Power window motor in the driver's door
- Power window motor in the front passenger's door

- **Gateway (= date interface)**
  The KGM is the data interface for following bus systems:
  - Body CAN
  - Powertrain CAN
  - LIN-bus

  The diagnostic cable is connected to the KGM.
- **Driver's door switch cluster**

  The driver's door switch cluster is connected to the KGM via the LIN-bus (LIN-bus stands for "Local Interconnect Network Bus"; KGM stands for "Body-gateway module"). All the power windows as well as the outside mirrors can be operated via the switch cluster in the driver's door.
  - Child safety lock switch

    The child safety lock is activated/deactivated by the child safety lock switch in the switch cluster. The child safety lock inhibits operation of the rear power windows via the rear power window switches.

    The child safety lock of the power windows is controlled by the CAS. The KGM only reads in the status of the child safety lock switch and activates the LED in the child safety lock switch (LED ON = child safety lock activated).
- **Servotronic valve**

  The body-gateway module (KGM) control the Servotronic valve.

  The Servotronic controls the degree of assistance provided by the hydraulic steering as a function of the vehicle's speed. The flow of hydraulic fluid is restricted to a greater or lesser extent depending on how the Servotronic valve is actuated. Restriction of the flow depends on the current actuating the Servotronic valve.

  The Servotronic valve is activated only when the engine is running.

Note: On vehicles with active steering.
In connection with the option SA 217 "Active steering", the control unit for the active steering activates the Servotronic valve.

- **Door contacts (Hall sensors)**

  The KGM receives signals from the door contact of the driver's door and from the door contact of the passenger's door. The KGM makes available the signals to other bus users in the system network. The antitheft alarm system (DWA), for instance, requires the signals for the purpose of monitoring the doors.
- **Courtesy lighting**

  The courtesy lighting is integrated in the outside mirror.

  The request to switch the courtesy lighting on and off is sent in the form of a CAN message

  from the basic body module (KBM) to the KGM. The body-gateway module (KGM) actuates the courtesy lighting via the LIN-bus.
  The courtesy lighting switches on when the door is unlocked via the remote control. The courtesy lighting also switches on every time the door is opened.

  After closing the door, the courtesy lighting switches off via an automatic timing function. The courtesy lighting is no longer activated as from terminal R ON.

- **Central locking, front**

  Control of the central locking is distributed over three control units (CAS, KGM, KBM). The car access system (CAS) is the master control unit for the central locking. The body-gateway module (KGM) controls the central locking of the front doors. The body basic module (KBM) controls the remaining central locking functions.

  The KGM receives signals from following components:

  - Central locking button

    The central locking button allows the vehicle to be locked/unlocked from the passenger compartment. The fuel filler flap is not locked.

    The central locking button is located in the centre console between the central air vents.

    Signal path:

    Central locking button -> Direct cable -> CAS -> K-CAN -> KGM

  - Remote control

    The remote control can be used to unlock and lock/deadlock the vehicle via an interface. The radio signals from the remote control are received by the remote control receiver and transferred to the CAS control unit. Signal path:

    Remote control -> Remote control receiver -> Direct cable -> CAS -> K-CAN -> KGM

  - Driver's door lock barrel

    The driver's door lock barrel allows manual locking/deadlocking and unlocking of the vehicle. If the vehicle's electrical system fails, the driver's door can be unlocked manually using the key integrated in the remote control.

  The KGM controls activation of all central locking drive units at the front.

  Two motors for the central locking drive units are integrated in each door lock (high-speed motors with connected gear unit).
  The locking mechanism can be brought into the following position by the motors:

  - Lock: The door can still be opened from the inside
  - Deadlock: The door cannot be opened from the inside or from the outside
  - Unlock: The door can be opened from the inside and outside

Notes for service staff

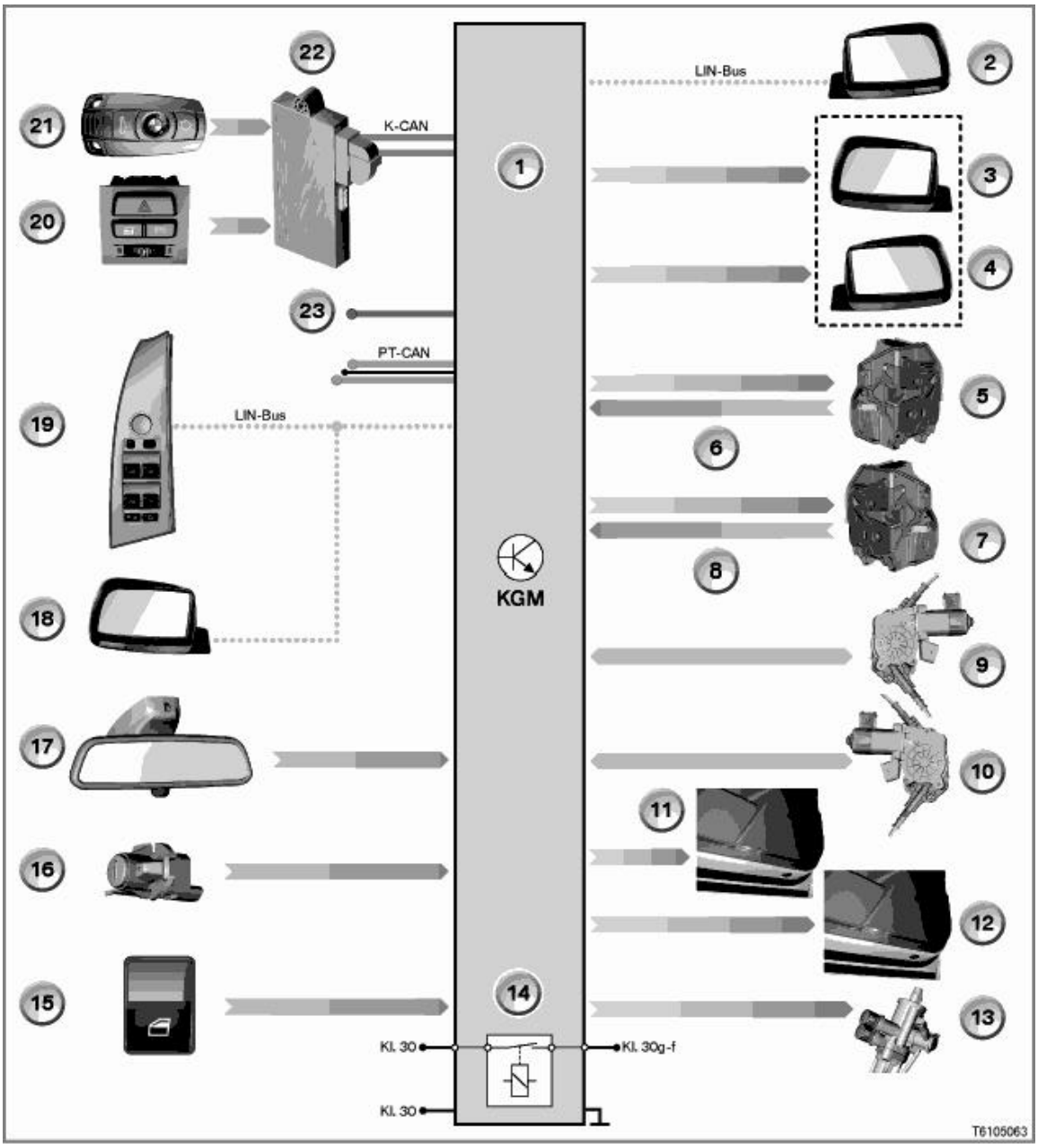
Service staff should note the following points:

- General information: ---
- Diagnosis: ---
- Encoding/programming: ---

Subject to change.

System overview of body-gateway module: E60, E61, E63, E64

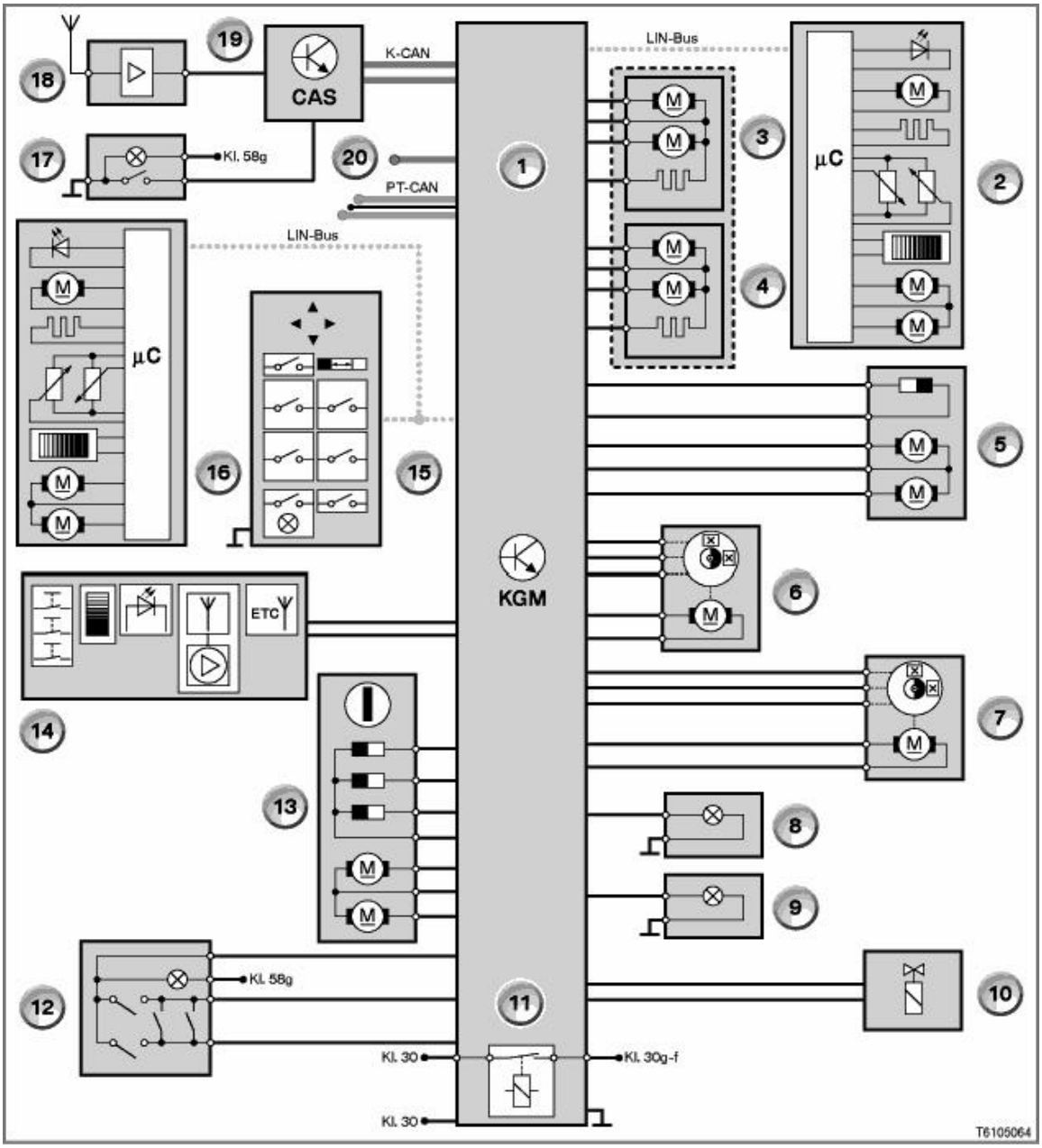
- Inputs/outputs



Item	Description	Item	Description
1	Body-gateway module (KGM)	2	Outside mirror with extended functions (passenger's side)
3	Basic outside mirror (driver's side)	4	Basic outside mirror (passenger's side)
5	Central locking drive in driver's door	6	Door contact in the driver's door
7	Central locking drive in passenger's door	8	Door contact in the front passenger door
9	Power-window motor in the driver's door	10	Power-window motor in the front passenger door
11	Door entry light in driver's door	12	Door entry light in passenger's door
13	Servotronic valve	14	Bistable relay

15	Power-window switch in the front passenger door	16	Driver's door lock cylinder
17	Electrochromic rear-view mirror	18	Outside mirror with extended functions (driver's side)
19	Switch block in the driver's door	20	Central locking button
21	Remote control with integrated key	22	Car Access System (CAS)
23	Diagnostic wire		
Kl. 30	Terminal 30 (power supply)	Kl. 30g-f	Terminal 30 g-f (shut-down for closed-circuit current violation)
K-CAN	Body CAN	LIN-bus	Local data bus (Local Interconnect Network Bus)
PT CAN	Powertrain CAN		

- System circuit diagram

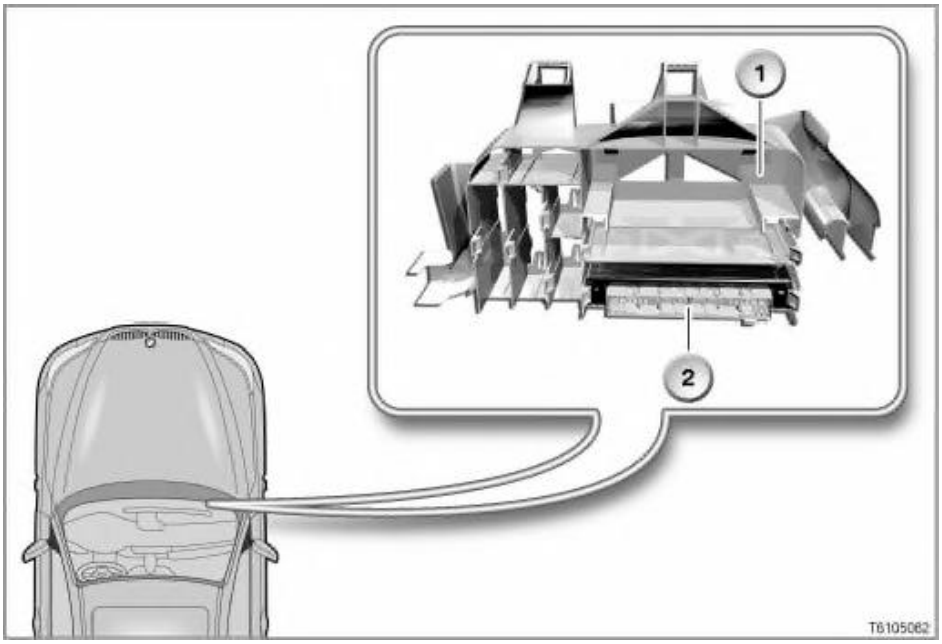


Item	Description	Item	Description
1	Body-gateway module (KGM)	2	Outside mirror with extended functions (passenger's side)
3	Basic outside mirror (driver's side)	4	Basic outside mirror (passenger's side)
5	Central-locking drive and door contact in the front passenger door	6	Power window motor with 2 Hall sensors in driver's door
7	Power window motor with 2 Hall sensors in passenger's door	8	Door entry light in driver's door
9	Door entry light in passenger's door	10	Servotronic valve
11	Bistable relay	12	Power-window switch in the front passenger door
13	Central-locking drive, lock cylinder and door contact in the driver's door	14	Electrochromic rear-view mirror
15	Switch block in the driver's door	16	Outside mirror with extended functions (driver's side)
17	Central locking button	18	Remote control receiver
19	Car Access System (CAS)	20	Diagnostic wire
Kl. 30	Terminal 30 (power supply)	Kl. 30g-f	Terminal 30 g-f (shut-down for closed-circuit current violation)
Kl. 58g	Terminal 58g (locator lighting)		
K-CAN	Body CAN	LIN-bus	Local data bus (Local Interconnect Network Bus)
PT CAN	Powertrain CAN		

Body-gateway module E60, E61, E63, E64

Installation location

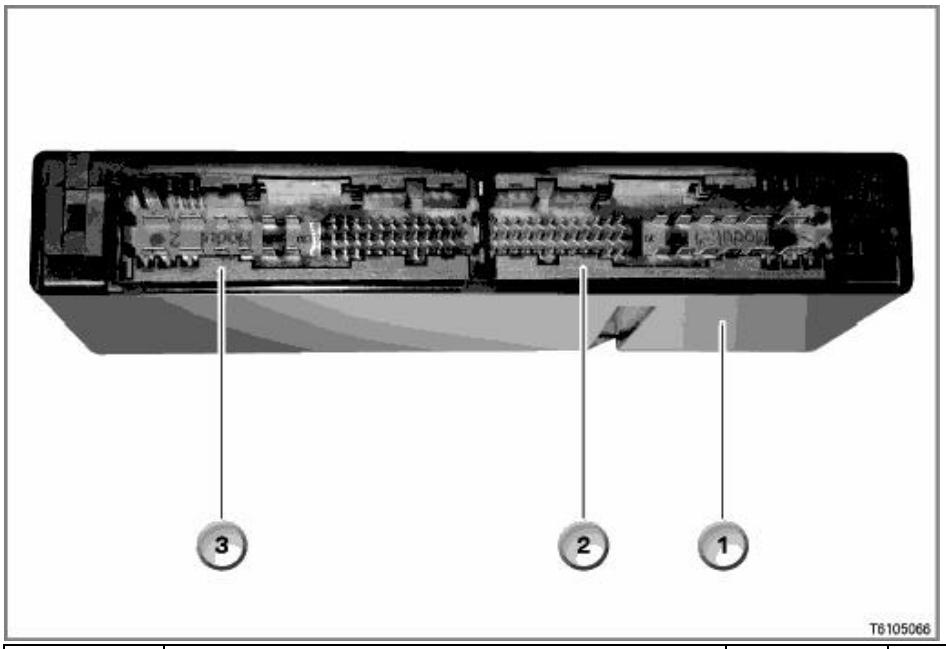
The body-gateway module (KGM) is integrated with the other control units in the rack behind the glove compartment.



Item	Description	Item	Description
1	Device holder	2	Body-gateway module (KGM)

Design

Two plug connections connect the body-gateway module (KGM) to the wiring harness.



Item	Description	Item	Description
1	Body-gateway module (KGM)	2	Connector X16759, 51-pin

3	Connector X16760, 51-pin	4	

- Pin assignments

Pin assignments for connector X16759, 51-pin		
Pin	**Type**	**Description**
1	A	Positive cable to front power distribution box (terminal 30g-f at power distribution box)
2	E	Positive cable from front power distribution box (terminal 30 at power distribution box)
3	---	---
4	---	---
5	---	---
6	---	---
7	---	---
8	---	---
9	---	---
10	A	Positive cable to door entry light (front) in driver's door
11	A	Low-signal for Servotronic
12	A	High-signal for Servotronic
13	---	---
14	A	Power supply for the Hall sensors (power windows) in the driver's door
15	E	Signal for unlocking the lock cylinder (Hall sensor) in the driver's door
16	---	---
17	E	Signal 1 from the Hall sensor (power windows) in the driver's door
18	E/A	Diagnostic wire
19	A	Activation of central locking drive unit for unlocking driver's door
20	---	---
21	A	Power supply for outside mirror adjustment and mirror heating on driver's side (basic outside mirror)
22	---	---
23	E/A	Signals via LIN-bus from driver's door switch cluster to outside mirror on driver's side (outside mirror with extended functions)
24	---	---
25	---	---
26	---	---
27	---	---
28	E	Signal for locking the lock cylinder (Hall sensor) in the driver's door
29	E	Signal from the Hall sensor (door contact) in the driver's door
30	E	Signal 2 from the Hall sensor (power windows) in the driver's door
31	---	---

32	A	Activation of central locking drive unit for locking driver's door
33	E	Power supply (terminal 30) for electric loads on driver's side
34	A	Earth connection for the power window motor in the driver's door
35	A	Positive cable for power window motor in driver's door
36	A	Negative cable for power window motor in driver's door
37	---	---
38	---	---
39	---	---
40	A	Horizontal outside mirror adjustment for driver's side (basic outside mirror)
41	A	Vertical outside mirror adjustment for driver's side (basic outside mirror)
42	A	Power supply to mirror heating for driver's side (basic outside mirror)
43	---	---
44	E	Signal cable from electrochromic interior rear-view mirror
45	E	Negative cable from electrochromic interior rear-view mirror
46	---	---
47	---	---
48	A	Ground connection for Hall sensors (central locking) in driver's door
49	A	Ground connection for Hall sensors (power windows) in driver's door
50	---	---
51	A	Activation of central locking drive unit for central arrest of driver's door
	A = Output E = Input E/A = Input and output For current specifications regarding pin assignments, please refer to BMW diagnosis system	

Pin assignments for connector X16760, 51-pin

Pin	Type	Description
1	---	---
2	---	---
3	A	Positive cable for power window motor in passenger's door
4	A	Negative cable for power window motor in passenger's door
5	---	---
6	---	---
7	---	---
8	E/A	K-CAN Low
9	E/A	K-CAN High
10	---	---
11	A	Ground connection for Hall sensors (power windows) in passenger's door

12	---	---
13	---	---
14	E/A	Signals via LIN-bus from driver's door switch cluster to outside mirror on passenger's side (outside mirror with extended functions)
15	---	---
16	---	---
17	---	---
18	---	---
19	A	Activation of central locking drive unit for central arrest of passenger's door
20	---	---
21	---	---
22	E	CLOSE signal from power window switch on passenger's side
23	A	Ground connection for Hall sensors (central locking) in passenger's door
24	E	Signal 2 from Hall sensor (power windows) in passenger's door
25	A	Power supply to mirror heating for passenger's side (basic outside mirror)
26	---	---
27	E	PT-CAN wake-up line
28	---	---
29	E/A	PT-CAN High
30	E/A	PT-CAN Low
31	---	---
32	A	Activation of central locking drive unit for unlocking passenger's door
33	E	Power supply (terminal 30) for electric loads on passenger's side
34	A	Ground connection for power window motor in passenger's door
35	---	---
36	---	---
37	M	Ground for KGM (terminal 31)
38	V	Supply voltage for KGM control unit (terminal 30)
39	---	---
40	---	---
41	E	OPEN signal from power window switch on passenger's side
42	E	Signal from Hall sensor (door contact) in passenger's door
43	E	Signal 1 from Hall sensor (power windows) in passenger's door
44	---	---
45	A	Power supply for outside mirror adjustment and mirror heating on passenger's side (basic outside mirror)
46	A	Horizontal outside mirror adjustment for passenger's side (basic outside mirror)

47	A	Vertical outside mirror adjustment for passenger's side (basic outside mirror)
48	A	Positive cable to door entry light (front) in passenger's door
49	---	---
50	A	Power supply for the Hall sensors (power windows) in the passenger's door
51	A	Activation of central locking drive unit for locking passenger's door
	A = Output E = Input E/A = Input and output M = Earth V = Power supply For current specifications regarding pin assignments, please refer to BMW diagnosis system	

Outside mirror: E60, E61, E63, E64

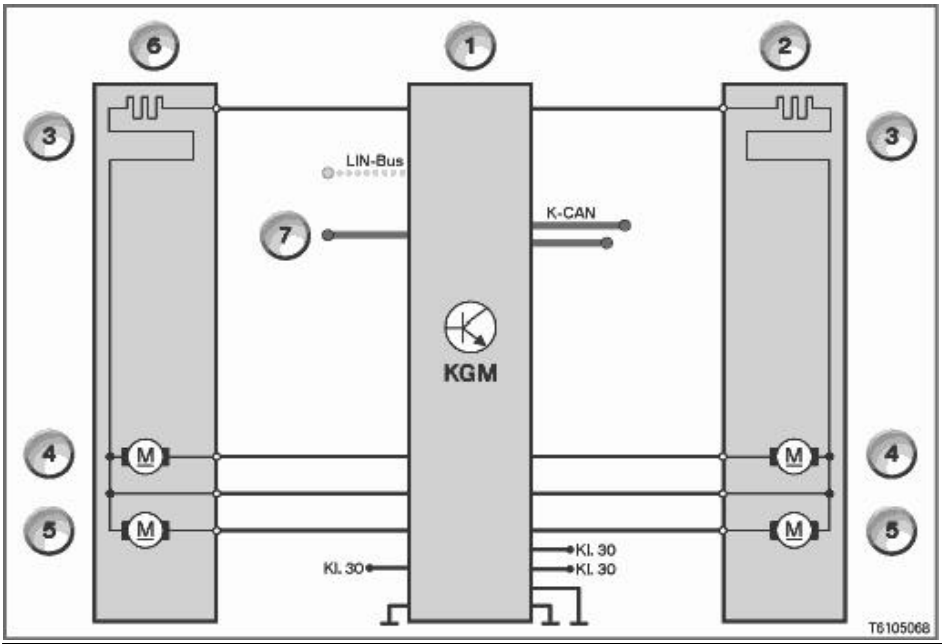
How it works

The body-gateway module controls and monitors the functions of the outside mirrors.

- Basic outside mirror
- Outside mirror with extended functions

Basic outside mirror

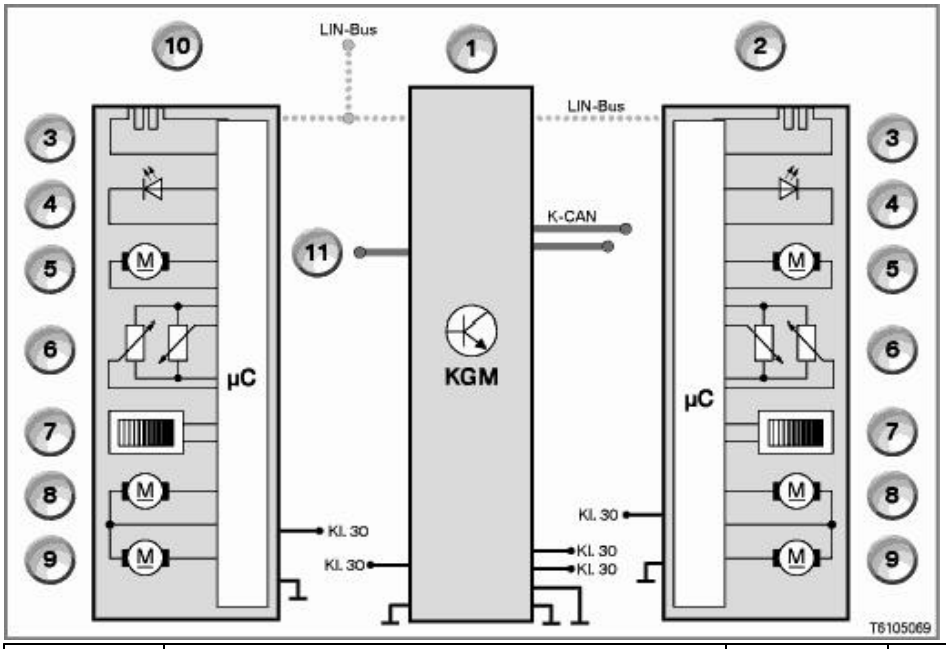
The body-gateway module (KGM) directly controls the components in the outside mirror.
The KGM controls the mirror heating capacity automatically by means of a pulse-width modulated signal (PWM signal). The heat output is dependent on ambient temperature and wiper intensity. If the wipers are operating, the heat output is increased to ensure reliable defrosting of the mirror glass.



Item	Description	Item	Description
1	Body-gateway module (KGM)	2	Front passenger side door mirror
3	Mirror heating	4	Motor for horizontal mirror adjustment
5	Motor for vertical mirror adjustment	6	Driver's side door mirror
7	Diagnostic wire		
Kl. 30	Terminal 30 (power supply)	K-CAN	Body CAN
LIN-bus	Local data bus (Local Interconnect Network Bus)		

Outside mirror with extended functions

The body-gateway module (KGM) controls the mirror electronics via the LIN-bus.
The mirror electronics controls the mirror heating in connection with power semiconductors. The KGM sends information relating to the heating capacity (percentage ON time) via the LIN-bus. The heat output is dependent on ambient temperature and wiper intensity. If the wipers are operating, the heat output is increased to ensure reliable defrosting of the mirror glass.



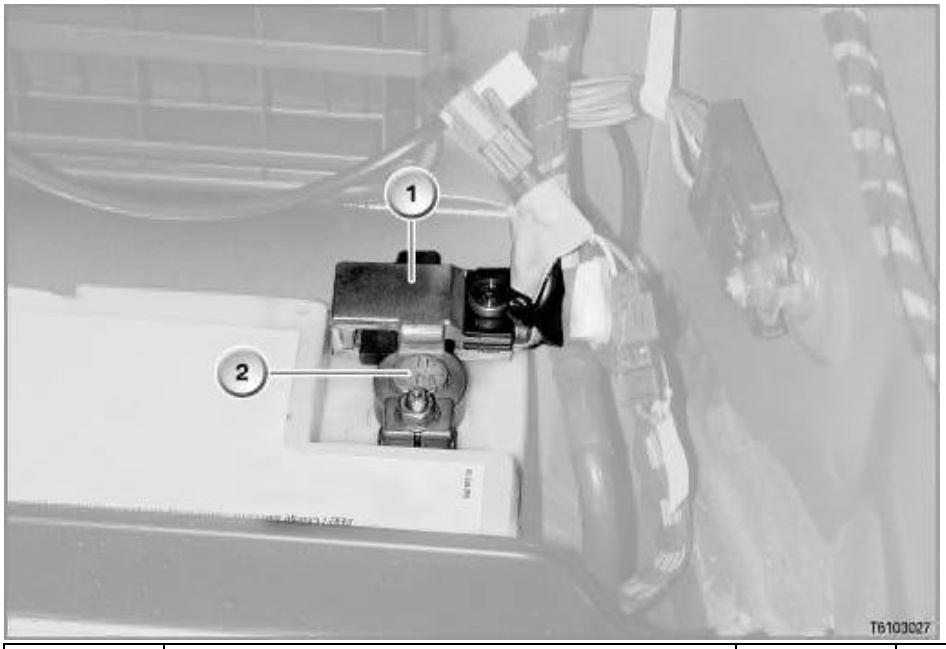
Item	Description	Item	Description
1	Body-gateway module (KGM)	2	Front passenger side door mirror
3	Mirror heating	4	Courtesy lighting
5	Motor for folding in the mirrors	6	Position potentiometer for mirror memory
7	Electrochromic door mirrors	8	Motor for horizontal mirror adjustment
9	Motor for vertical mirror adjustment	10	Driver's side door mirror
11	Diagnostic wire		
Kl. 30	Terminal 30 (power supply)	K-CAN	Body CAN
LIN-bus	Local data bus (Local Interconnect Network Bus)		

Intelligent battery sensor: E60, E61, E63, E64

Installation location

The intelligent battery sensor (IBS) is installed at the negative terminal of the battery.

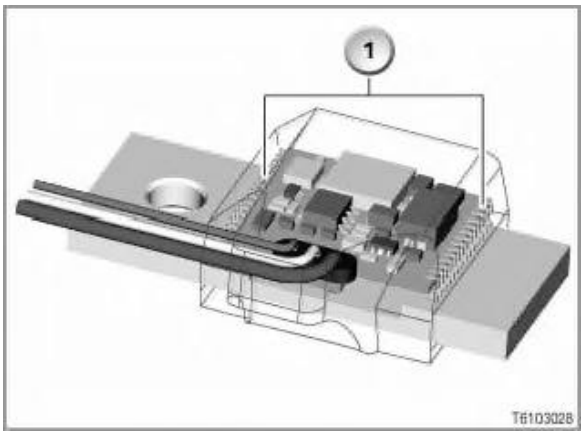
Example: E60



Item	Description	Item	Description
1	Intelligent battery sensor (IBS)	2	Battery negative terminal

Construction

The intelligent battery sensor (IBS) is an intelligent, mechatronic component that monitors the battery condition.
The power supply to the IBS is provided through a separate wire.
For the purpose of data transmission, the IBS is connected to the digital engine electronics (DME) or digital diesel electronics (DDE) via the bitserial data interface (BSD).



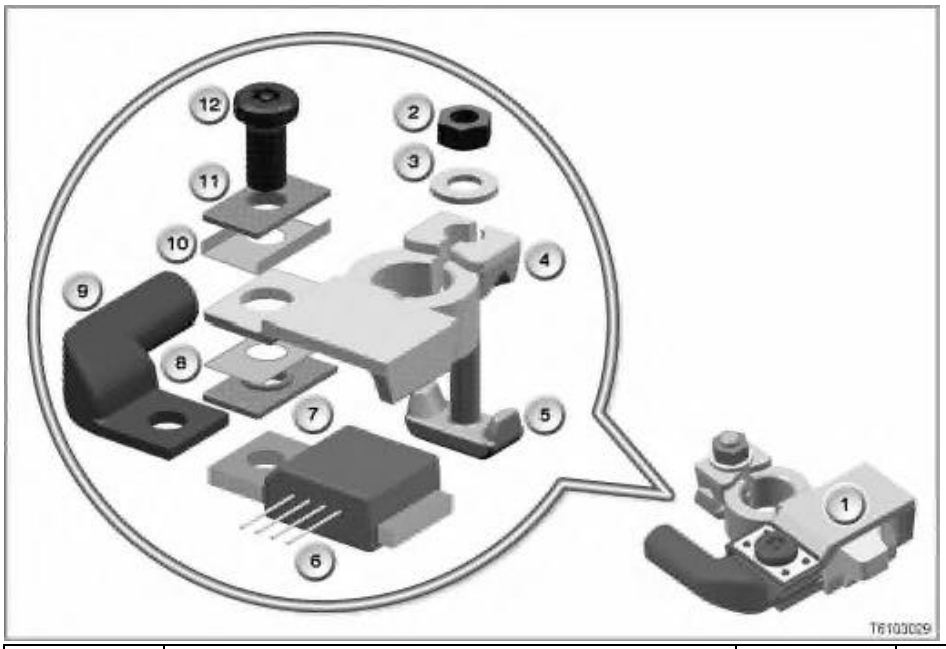
1 Spring element (gull wings) on intelligent battery sensor (IBS)

The intelligent battery sensor (IBS) consists of mechanical components, the electronics module and software.

- Mechanical components
  The battery terminal with earth cable is the connection to the negative terminal of the battery and serves

- to create an electrical contact to the body
- as the support for the sensor element for current measurements
- as the support for the electronic module
- to provide an adequate thermal contact between the temperature sensor and the negative terminal of the battery
- as protection for the sensitive electronic module
- as an earth connection for the IBS

The mechanical parts and the electronic module of the IBS are illustrated below.

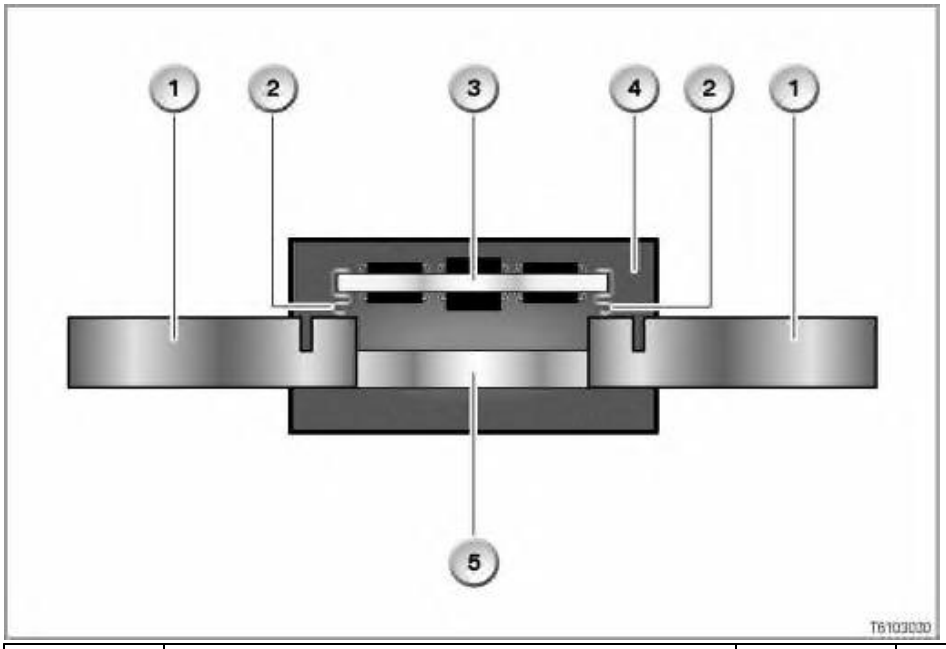


Item	Description	Item	Description
1	Battery negative terminal with intelligent battery sensor (IBS)	2	Nut
3	Shim	4	Part of battery negative terminal
5	Screw	6	Electronics module
7	Pressure plate	8	Insulator
9	Cable shoe for battery negative wire	10	Insulator
11	Pressure plate	12	Torx screw

- Electronic module
  The electronic module has the task of recording the voltage, the current flow and the temperature of the battery. The following components are housed in the electronic module:
  - a shunt (resistance for current measurement)
  - a temperature sensor
  - an electronic evaluation unit on a board
    The board, which is about the size of a fingernail, contains an electronic circuit for evaluating the data measured.

The intelligent battery sensor (IBS) is able to withstand thermal loads of up to 105 °C and the chemical effect of the battery acid. The IBS thus satisfies the necessary conditions for installation in the engine or luggage compartment.

The components of the shunt are illustrated below.



Item	Description	Item	Description
1	Copper	2	Spring element (gull wings)
3	Board with electronic evaluation unit	4	Injection-moulded surround
5	Manganin resistance (resistance alloy)		

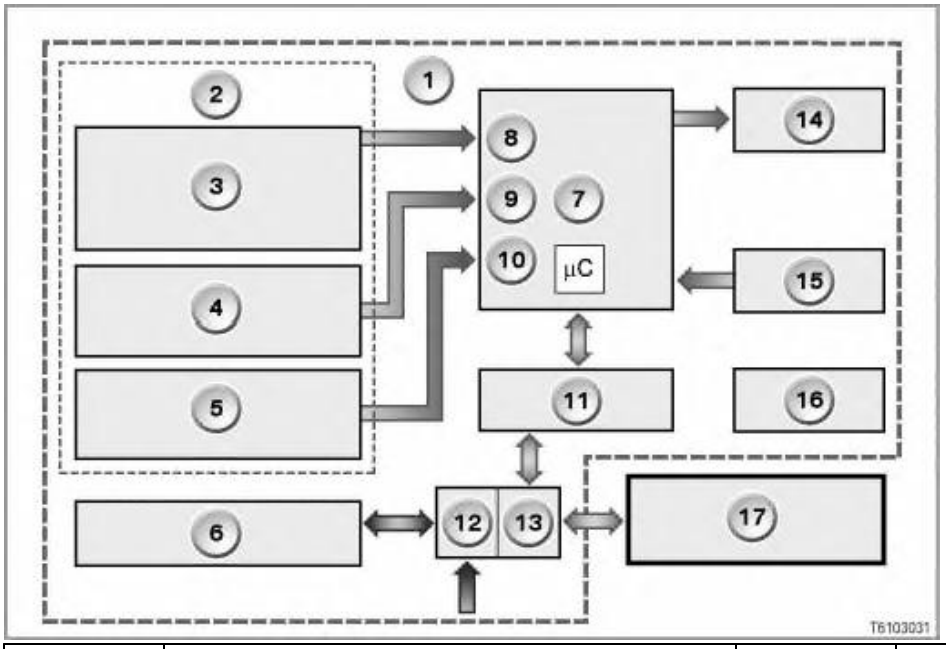
- Software
  The program in the microcontroller of the intelligent battery sensor (IBS)

How it works

The functions of the intelligent battery sensor (IBS) are:

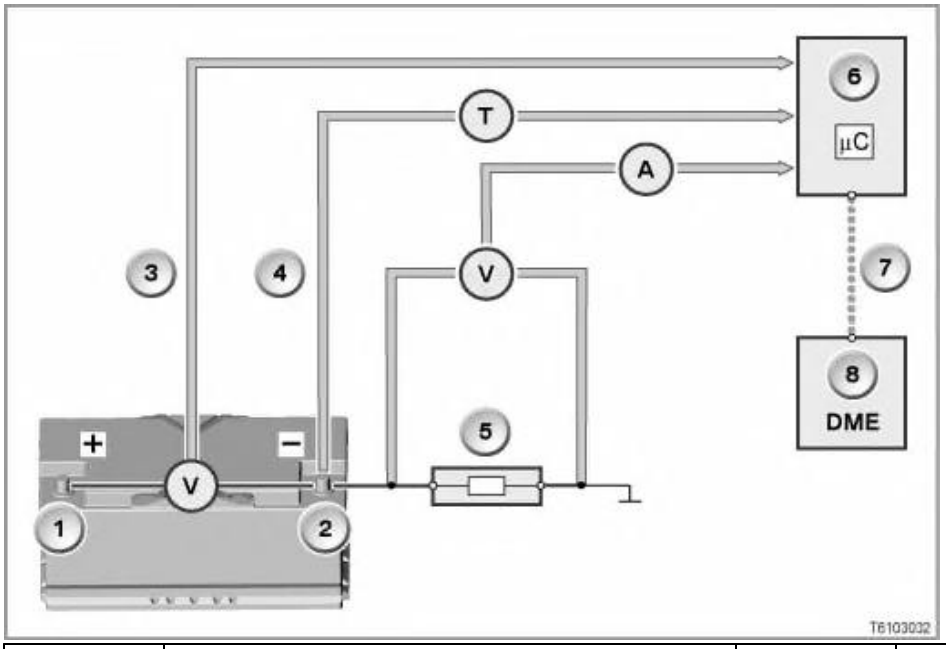
- To continuously measure battery data in all vehicle operating modes
- To compute battery indicators as basis for battery charge state (SoC: "State of Charge") and battery condition (SoH: "State of Health")
- To balance the charge/discharge current of the battery
- To monitor the battery's charge state (SoC) and to activate the electric energy management and power management for countermeasures if the battery charge state becomes critical (battery's limit of starting capability).
- To identify initial data for calibrating the battery charge state (SoC: "State of Charge")
- To calculate the starting current curve to determine the battery condition (SoH: "State of Health")
- To monitor off-load current
- To transmit data to the higher-order control unit (DME or DDE)
- Self-diagnosis
- To perform fully automatic updates of algorithm parameters and parameters for self-diagnosis via DME / DDE
- To be able to independently "wake up" from sleep mode

The individual functions of the IBS are illustrated below as function blocks in the overall function of the IBS. The processes are elucidated by the arrows.



Item	Description	Item	Description
1	Intelligent battery sensor (IBS) complete function	2	Measurement of battery data: - Current - Voltage - Temperature
3	Current measurement, measuring range of IBS: - Operating current: -200 A to +220 A - Off-load current: 0 A to 10 A - Starting current: 0 A to 1000 A	4	Voltage measurement, measuring range of IBS: 6 V to 16.5 V
5	Temperature measurement, measuring range of IBS: -40°C to +105°C	6	Internal voltage regulator for IBS
7	Data processing using microcontroller Communication via bit-serial data interface (BSD)	8	Calculation of battery indicators
9	Partial calculation of battery charge state and battery condition	10	Management of auxiliary consumers
11	Driver for bit-serial data interface (BSD) with "wake-up" function	12	Battery voltage
13	Bit-serial data interface (BSD)	14	Terminal 15 wake-up wire
15	Internal "wake-up" function	16	EEPROM (Electrically Erasable Programmable Read-Only Memory)
17	Digital engine electronics (DME) or digital diesel electronics (DDE)	18	

The principle for measuring and processing the battery values is illustrated below.



Item	Description	Item	Description
1	Battery positive terminal	2	Battery negative terminal
3	Measurement of battery voltage between battery positive terminal and battery negative terminal	4	Measurement of battery temperature (T)
5	Measurement of current (A) [indirect, via the proportional voltage drop (V) at the shunt]	6	Microcontroller (µC) in intelligent battery sensor (IBS)
7	Bitserial data interface (BSD) for transmitting data to DME	8	Digital engine electronics (DME)

Electronic evaluation unit
The electronic evaluation unit in the IBS (intelligent battery sensor) continuously records the measured data. The IBS uses this data to calculate the battery indicators

- Voltage
- Current
- Temperature

The IBS transmits the battery indicator data to the DME or DDE via the bit-serial data interface (BSD). Parallel to the calculation of the battery indicators, a preliminary calculation of the battery's state of charge (SoC) is made.

In the time between engine OFF and DME main relay shutdown, the IBS receives information about the maximum charge available for a reliable engine start from the DME/DDE. The IBS continuously monitors the battery charge state (SoC) when the DME main relay has been switched off.

The message "Auxiliary consumers OFF" from the DME/DDE instructs auxiliary consumers that are switched on to switch themselves off when the critical battery charge state (battery's limit of starting capability) is reached.

Charge balance through IBS
When the vehicle is out of use, the IBS continuously balances the battery charge state (SoC: "State of Charge").

From terminal 15 ON, the DME/DDE receives updated information about the battery indicators (battery condition "SoH"; battery charge state "SoC").

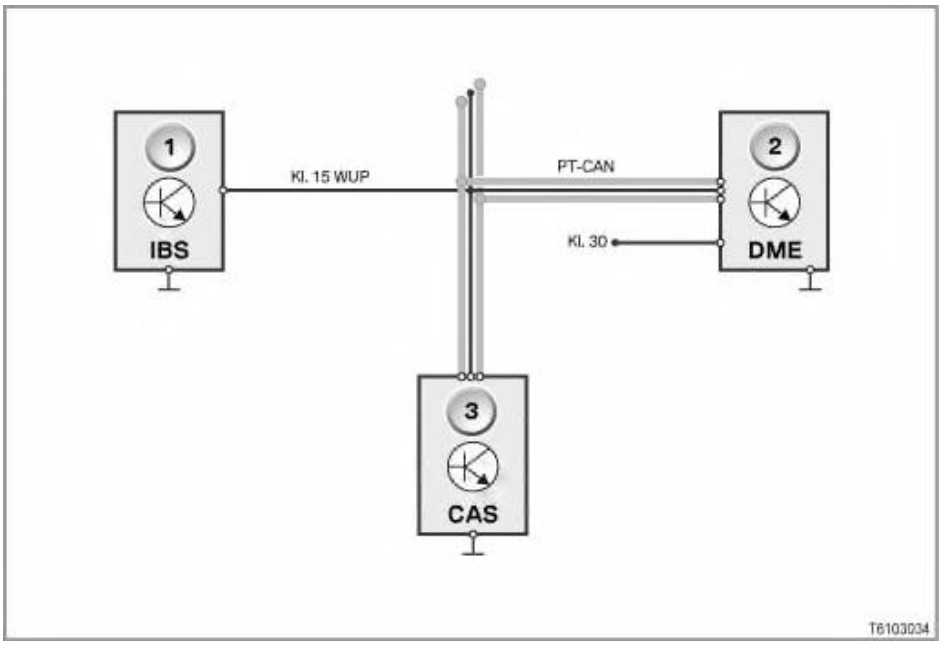
Off-load current measurement
When the vehicle is not in use, the IBS continuously monitors the data relevant to the battery indicators. The IBS is

programmed to "wake up" every 14 seconds so that it can update the measured values with new measurements. The measuring time is approx. 50 milliseconds (ms). The measured data are entered in the IBS memory for monitoring the off-load current.
When the engine is restarted, the DME / DDE reads off the off-load current curve. In the event of a deviation from the defined off-load current curve, an entry will be made in the DME / DDE fault memory.

Terminal 15 wake-up function
The terminal 15 wake-up function is only applicable when the vehicle is not in use. The function sequence is as follows:

- When "terminal 15 OFF" has been received, the DME / DDE informs the IBS of the maximum battery charge quantity available.
  - After issuing the message about the maximum charge quantity available, the DME / DDE will go into sleep mode.
- If the maximum battery charge quantity available has been reached and auxiliary consumers are switched on, the IBS will "wake up" the vehicle (and thus the DME / DDE) via the wake-up wire (terminal 15 wake-up).
- When the battery's critical charge state has been reached (battery's limit of starting capability), the DME / DDE instructs the auxiliary consumers to switch themselves off.
- The DME / DDE no longer allows the IBS to "wake up" the vehicle.
- The vehicle then goes back into sleep mode.

The control units connected to the terminal 15 wake-up function are illustrated below.



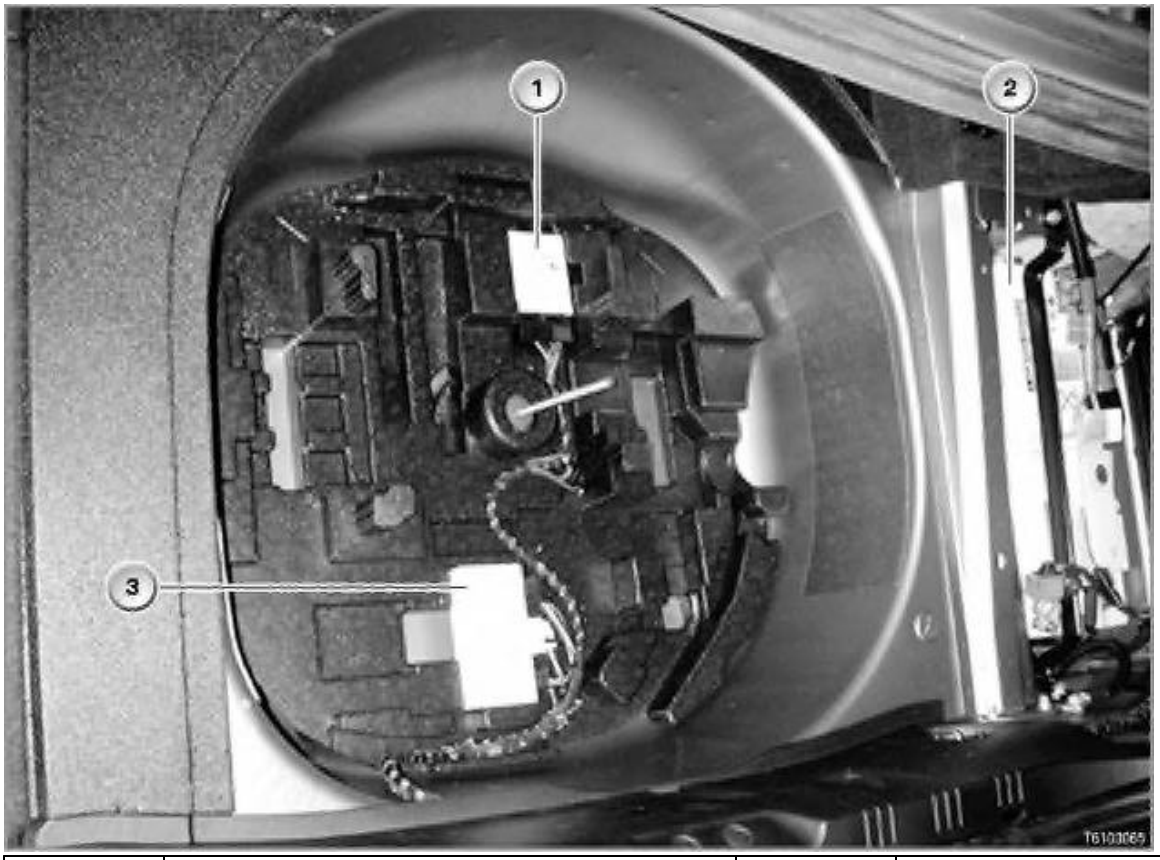
Item	Description	Item	Description
1	Intelligent battery sensor (IBS)	2	Digital engine electronics (DME)
3	Car Access System (CAS)	Kl. 30	Terminal 30
PT-CAN	Powertrain CAN	Kl. 15 WUP	Terminal 15 wake-up wire

Micro-power module: E60, E61, E63, E64

Installation location

>up to 09/2005: The micro-power module (MPM) is located in the spare-wheel well.
> From 09/2005: The MPM function is integrated into the body-gateway module (KGM).

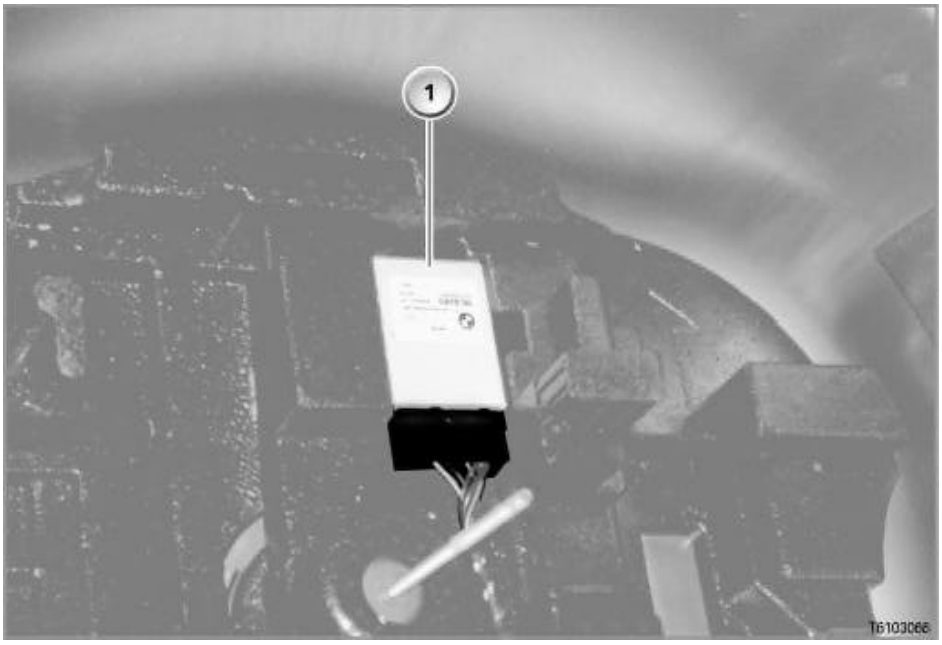
Example: E60 until 09/2005



Item	Description	Item	Description
1	Micro-power module (MPM)	2	Battery
3	PDC control unit (Park Distance Control)		

Construction

Example: E60 until 09/2005



A 15-pin connector links the MPM to the vehicle electrical system and the K-CAN. The K-CAN connection allows the exchange of CAN messages between the control units of the body electronics.

Pin assignment X16021, 15-pin multi-pin connector

Pin	Type	Description
1	---	---
2	---	---
3	E/A	K-CAN Low
4	M	Earth
5	---	---
6	---	---
7	E	Continuous positive
8	E	Input power supply from rear fuse carrier
9	---	---
10	---	---
11	E/A	K-CAN High
12	---	---
13	---	---
14	E	Terminal 15
15	A	Output power supply for terminal 30g-f
	A = Output E = Input E/A = Input and output M = Earth V = Supply For current specifications regarding pin assignments, please refer to BMW diagnosis system	

How it works

The micro-power module (MPM) enables consumers to be switched off in a defined manner if a fault develops while the vehicle is out of use. The MPM is linked with other control units in the vehicle to allow it to transmit and receive CAN messages via the K-CAN. The MPM has a bistable relay which controls terminal 30g-f. If the MPM detects a fault, the relay will switch terminal 30g-f off. The reason for the deactivation will be stored in the MPM.

The following consumers are connected to terminal 30g-f:

- Multi-audio system controller (M-ASK)
- Car Communication Computer (CCC)
- CD changer (CDC)
- Japan navigation system (JNAV), Korea navigation system (KNAV)

Conditions required for switch-on

The switch-on conditions for the bistable relay are:

- Battery connected
- Vehicle unlocked
- Change in condition of door contacts or boot-lid switch

The MPM is woken up by activity in the K-CAN. After being "woken up", the bistable relay returns to the switch state it was in before it was "woken up".

Conditions required for switch-off:

The switch-off conditions for the bistable relay are:

- Off-load current too high (more than 80 milliampères) and battery's starting limit reached
- Undervoltage
- Permissible number of "wake-up" actions in K-CAN exceeded
- Bus active after 60 minutes with terminal R OFF without any switch-on conditions being satisfied.

  The time is reset by switch-on conditions, e.g. by a door being opened. This means: The vehicle is unable to go into sleep mode after terminal R is switched OFF.
  There is no limit to the number of times this process can be repeated. It could thus cause the battery to become discharged!

The MPM goes into sleep mode approx. 1 second after the K-CAN goes into sleep mode. Before the MPM goes into sleep mode, the current switch state of the bistable relay is stored.

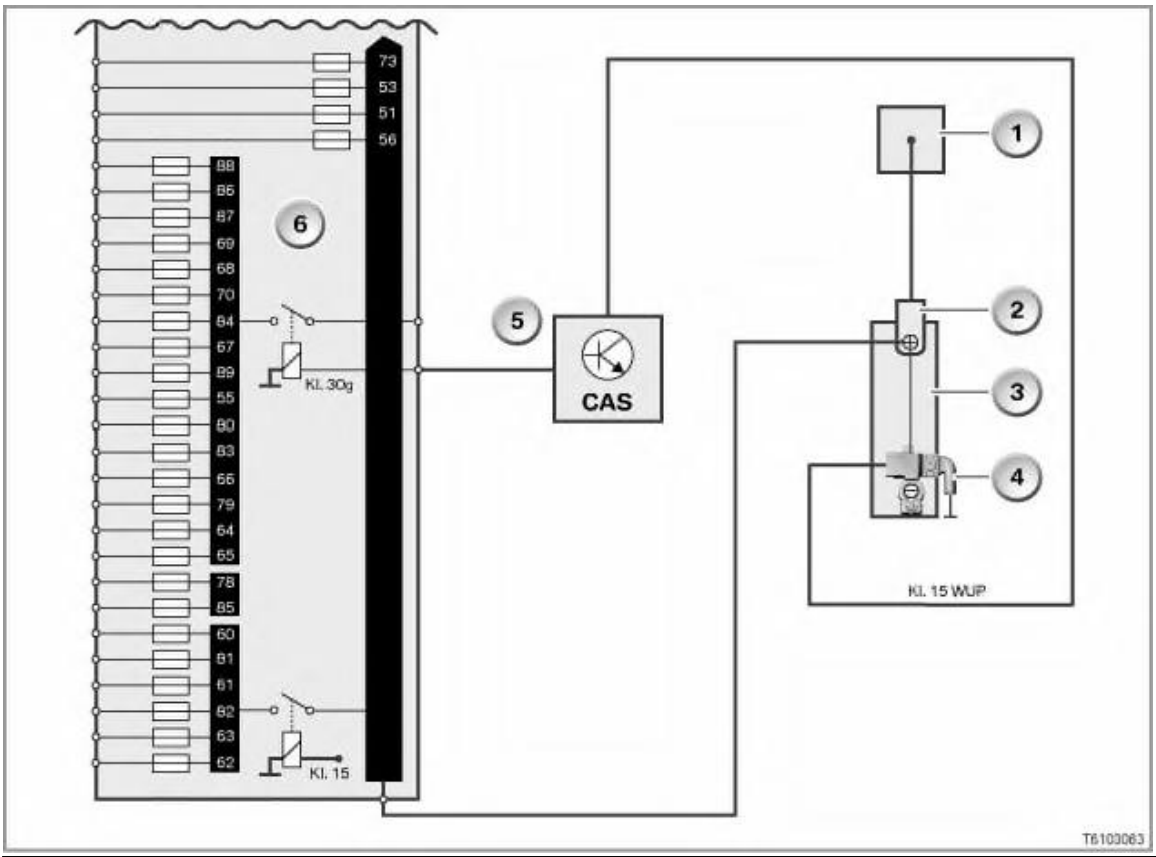
Rear power distributor with terminal 30g relay E60, E61, E63, E64

Installation location

The rear power distributor with terminal 30g relay is located in the right-hand side of the luggage compartment.

Construction

Along with other components, the terminal 30g relay is installed on the rear power distributor.



Item	Description	Item	Description
1	Starting-aid terminal	2	Safety battery terminal
3	Battery	4	Intelligent battery sensor (IBS)
5	Car Access System (CAS)	6	Rear power distributor with terminal 30g relay
Kl. 30g	Terminal 30g, active	Kl. 15	Terminal 15, ignition lock position 1
Kl. 15 WUP	Terminal 15 wake-up wire		

How it works

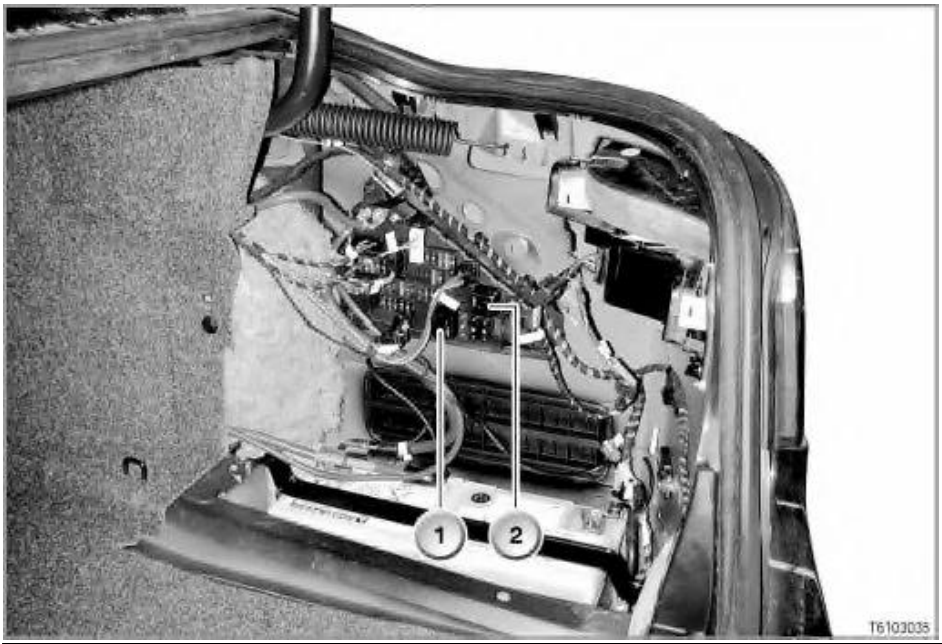
The rear power distributor is connected to the positive terminal of the battery. The terminal 30g relay on the rear power distributor is actuated by the Car Access System (CAS) according to predefined priorities. The consumers connected to the terminal 30g relay are switched on and off according to these priorities.

Terminal 30g relay: E60, E61, E63, E64

Installation location

Example: E60

The terminal 30g relay is located in the rear power distributor on the right-hand side of the luggage compartment.



Item	Description	Item	Description
1	Terminal 30g relay	2	Relay for heated rear window

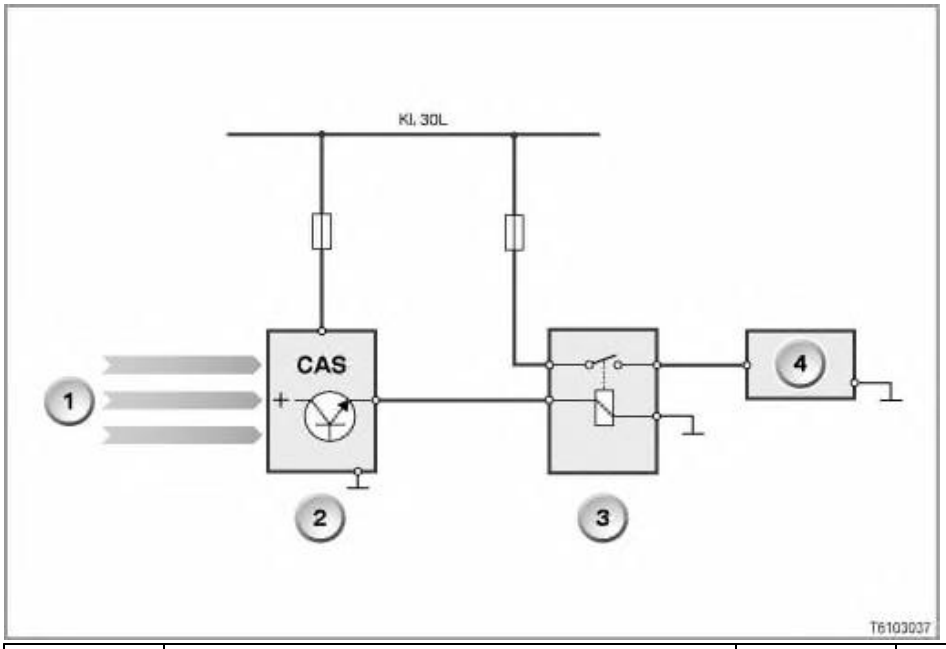
Construction

The terminal 30g relay is a relay for switching high direct currents.

How it works

The terminal 30g relay, which is actuated by the Car Access System (CAS). This allows the standard consumers to be switched on and off in a defined manner. Terminal 30g is actuated depending on the input information from the CAS.

The actuation of the terminal 30g relay by the CAS is illustrated below.



Item	Description	Item	Description
1	Input signals	2	Car Access System (CAS)
3	Terminal 30g relay	4	Consumer
Kl. 30L	Terminal 30, load		

- **Switch-on conditions for terminal 30g relay**

  The conditions required for switch-on are as follows:

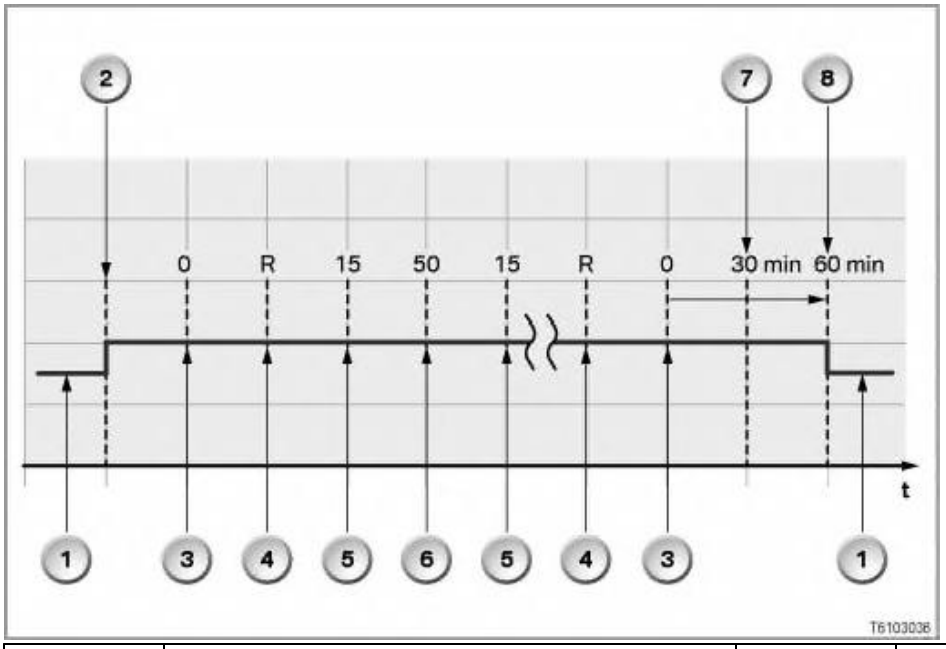
  - Terminal R ON
    or
  - An occurrence-controlled change is made (vehicle is unlocked)
    or
  - Convenience closing is activated with remote control
    or
  - Change in condition of door contacts or boot-lid-contact switch
    or
  - Telephone wake-up wire for telematic services is activated
    or
  - BMW diagnosis system applications trigger reaction

- **Switch-off conditions for terminal 30g relay**

  The conditions required for switch-off are: :

  - 30 minutes have passed since "terminal R OFF" (60 minutes with permanently installed telephones)
    or
  - Application in service

The chronological sequence of switching on and switching off is illustrated below.



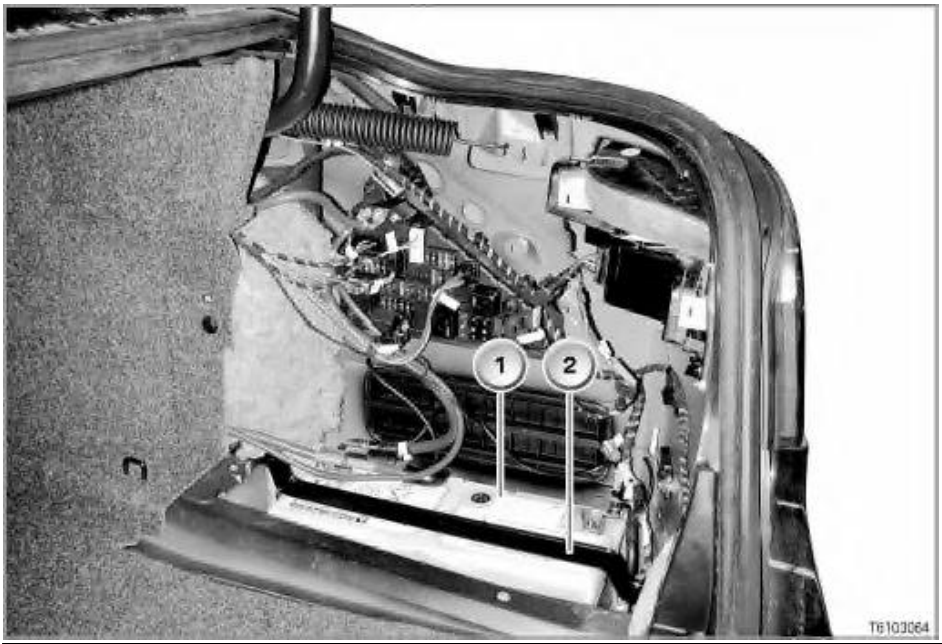
Item	Description	Item	Description
1	Terminal 30g relay OFF	2	Terminal 30g relay ON
3	Ignition lock position 0	4	Terminal R, ignition lock position 1
5	Terminal 15, ignition lock position 2	6	Terminal 50, ignition lock position 3, starting procedure
7	Delayed switch-off, 30 minutes	8	Delayed switch-off, 60 minutes, only with permanently installed telephone

Battery: E60, E61, E63, E64

Installation location

The battery is installed in the right-hand side of the luggage compartment.

Example: E60



Item	Description	Item	Description
1	Battery	2	Battery holder

Construction

The capacity of the battery installed depends on the engine used and the equipment installed in the vehicle. Selection criteria for the required capacity are:

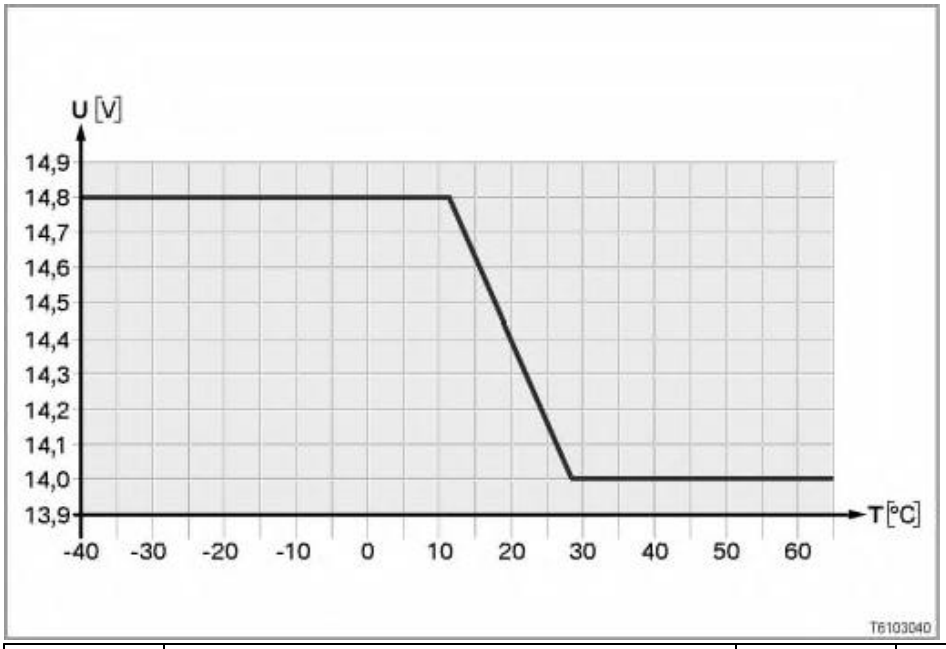
- the cold-start characteristics of the engine
- the off-load current consumption of the vehicle
- the energy requirements of the auxiliary consumers, such as the independent heater, telephone, etc.

How it works

To guarantee that the battery works as well as is possible, the power management continuously measures the exact battery charge state and battery condition.

To determine the current battery condition, the IBS feeds the necessary information to the power management.
The battery is continuously monitored by the intelligent battery sensor (IBS), regardless of the vehicle's operating state.

When charging and discharging the battery, the operating temperature is a key factor, besides the charging voltage. The following illustration shows how charge voltage U develops as a function of the battery temperature T.



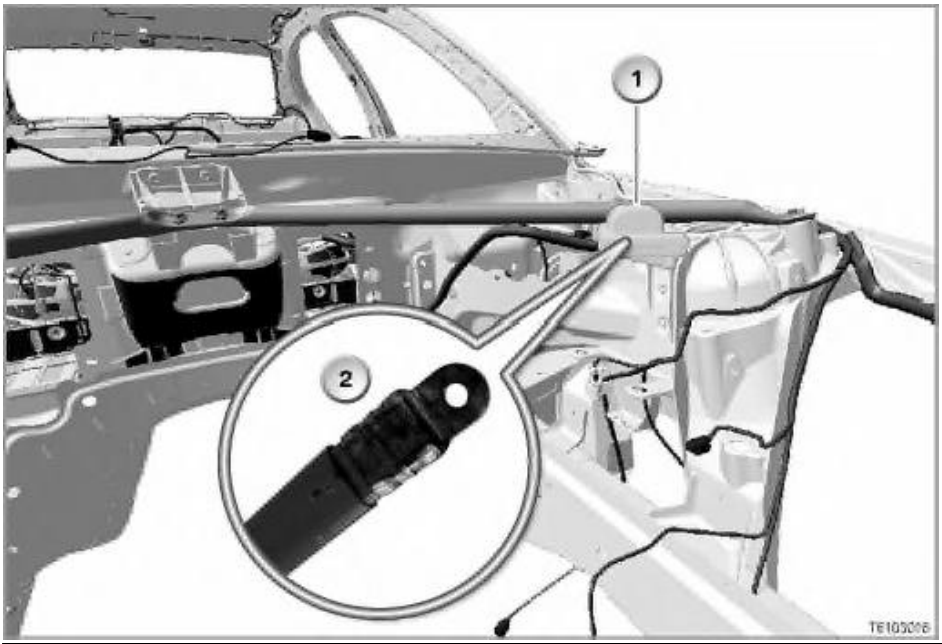
Item	Description	Item	Description
U [V]	Charging voltage (U) in volts	T [°C]	Battery temperature (T) in degrees Celsius

Starting-aid terminal: E60, E61, E63, E64

Installation location

The starting-aid terminal is located on the left-hand side of the engine compartment, behind the suspension strut dome.

Example: E60



Item	Description	Item	Description
1	Starting-aid terminal	2	Battery cable

Construction

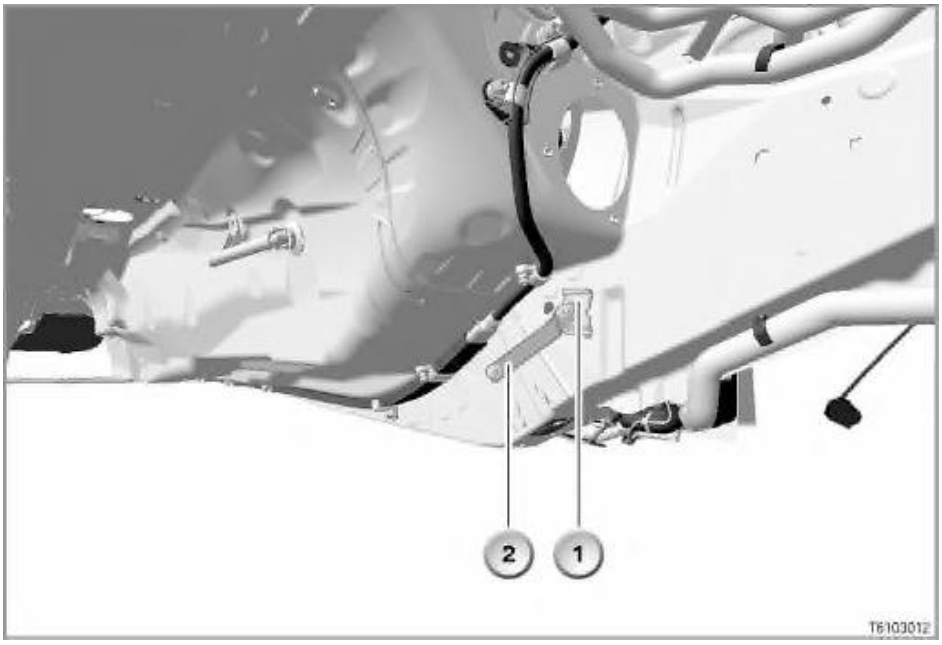
The starting-aid terminal is installed in a two-part plastic housing. The front part of the plastic housing is marked with a red plus sign and can be folded open. The battery cable is connected to the starting-aid terminal under the folding part of the plastic housing. The wire to the starter motor is connected under the rear part of the plastic housing.

Earth point on lightweight aluminium front end (GRAV): E60, E61, E63, E64

Installation location

The earth point on the lightweight aluminium front end (GRAV) is located on the left-hand side of the vehicle. The GRAV earth point is on the left-hand side member at the connection point between the lightweight aluminium front end and the steel body.

Example: E60



Item	Description	Item	Description
1	Earth point (GRAV)	2	Earth lead

Construction

The GRAV earth point consists of a profile connected to the aluminium front end with a threaded stud. An earth lead is connected to this threaded stud. The earth lead goes to the steel body.

How it works

The connection of the lightweight aluminium front end (GRAV) and the steel body with an earth lead improves the vehicle's electromagnetic compatibility (EMC). Contact resistances between the front end and the rest of the body are bridged.

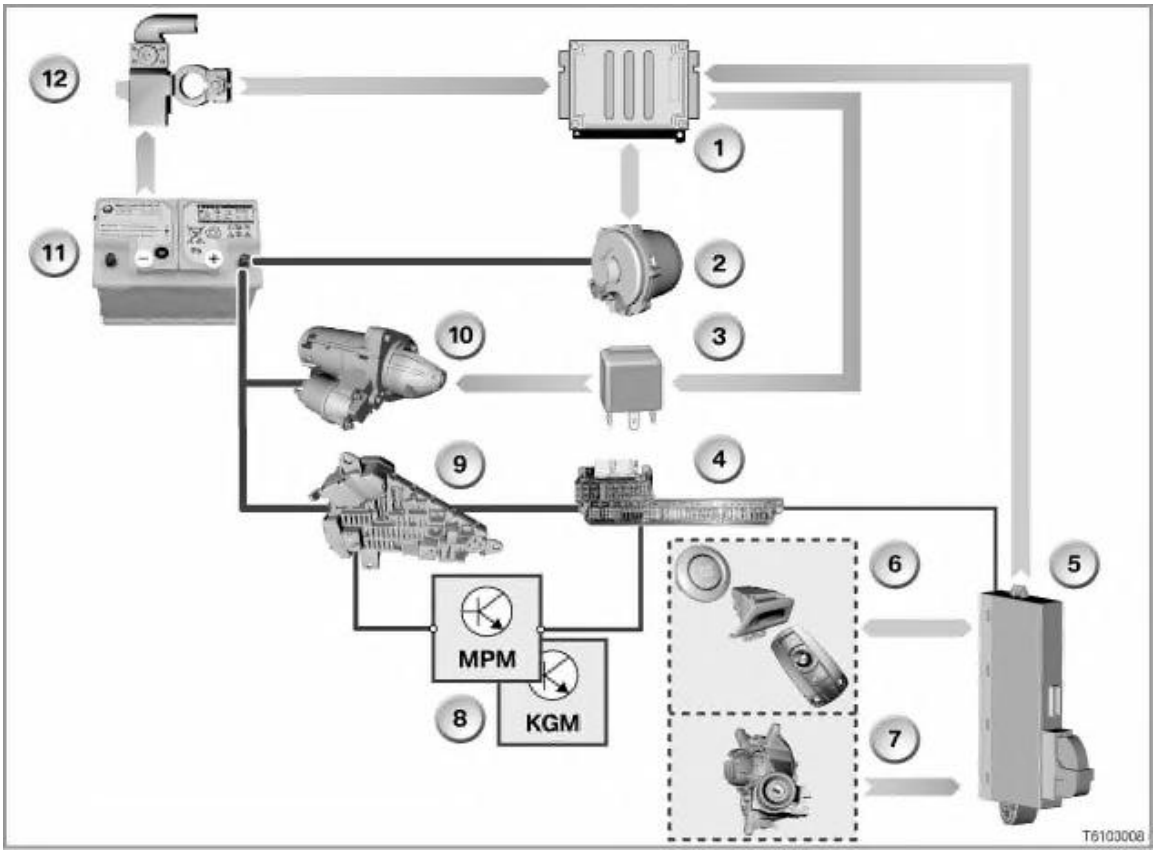
Power supply, system overview: E60, E61, E63, E64

This system overview comprises the following overviews:

- Inputs/outputs (power supply for 6-cylinder engine version)
- Principle of electrical energy management
- Principle of power management
- System circuit diagram (power supply for 6-cylinder engine version) until 09/2005
- Overview of control unit on terminal 30g until 09/2005
- Overview of control unit on terminal 30g-f until 09/2005
- System circuit diagram (power supply for 6-cylinder engine version) from 09/2005
- Overview of control unit on terminal 30g from 09/2005
- Overview of control unit on terminal 30g-f from 09/2005
- Earth points (left-hand drive vehicles)

- Inputs/outputs

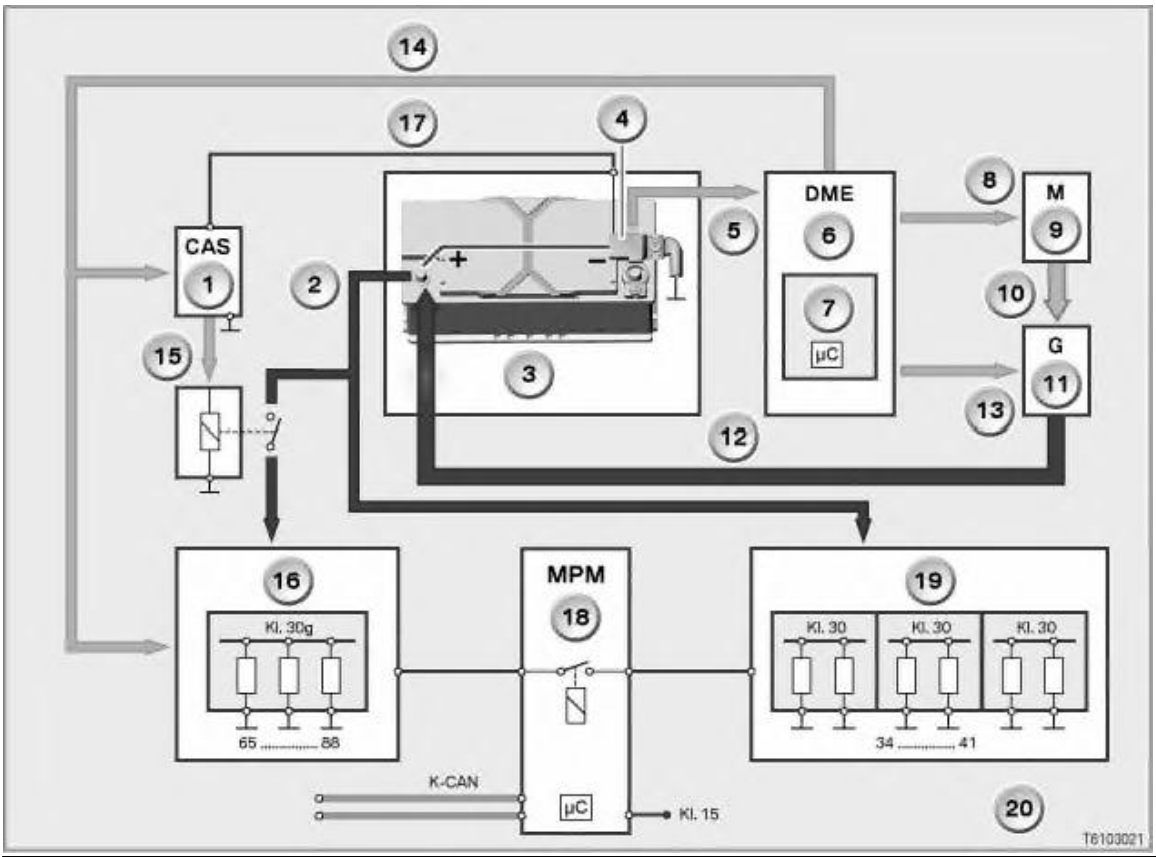
Power supply for 6-cylinder engine version



Item	Description	Item	Description
1	Digital engine electronics (DME)	2	Alternator
3	Starter relay	4	Power distributor, front
5	Car Access System (CAS)	6	>from 09/2005: START/STOP button with insert compartment and remote control
7	>Until 09/2005: Ignition starter switch	8	

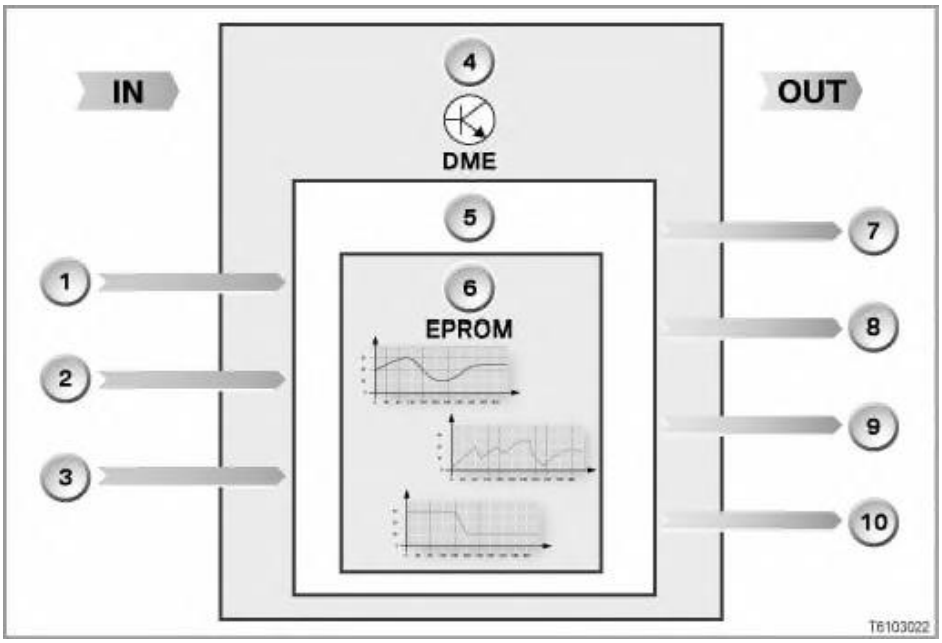
			>Until 09/2005: Micro-power module (MPM) > From 09/2005: Body-gateway module The MPM function is integrated into the KGM.
9	Rear power distributor with terminal 30g relay	10	Starter motor
11	Battery	12	Intelligent battery sensor (IBS)

- Principle of electrical energy management



Item	Description	Item	Description
1	Car Access System (CAS)	2	Current flow to consumers
3	Battery	4	Intelligent battery sensor (IBS)
5	Bit-serial data interface (BSD)	6	Digital engine electronics (DME)
7	Power management	8	Increased idling speed
9	Engine	10	Mechanical energy (alternator drive)
11	Alternator	12	Battery charge current
13	Nominal value for charge voltage	14	Consumer shutdown
15	Terminal 30g relay	16	Rear power distributor, consumers on terminal 30g
17	Terminal 15 wake-up wire	18	>up to 09/2005: Micro-power module (MPM) >from 09/2005: Body gateway module (KGM) The MPM function is integrated into the KGM.
19	Power distributor, front	20	Electric energy management
K-CAN	Body controller area network	Kl. 15	Terminal 15, ignition lock position 2

- Principle of power management

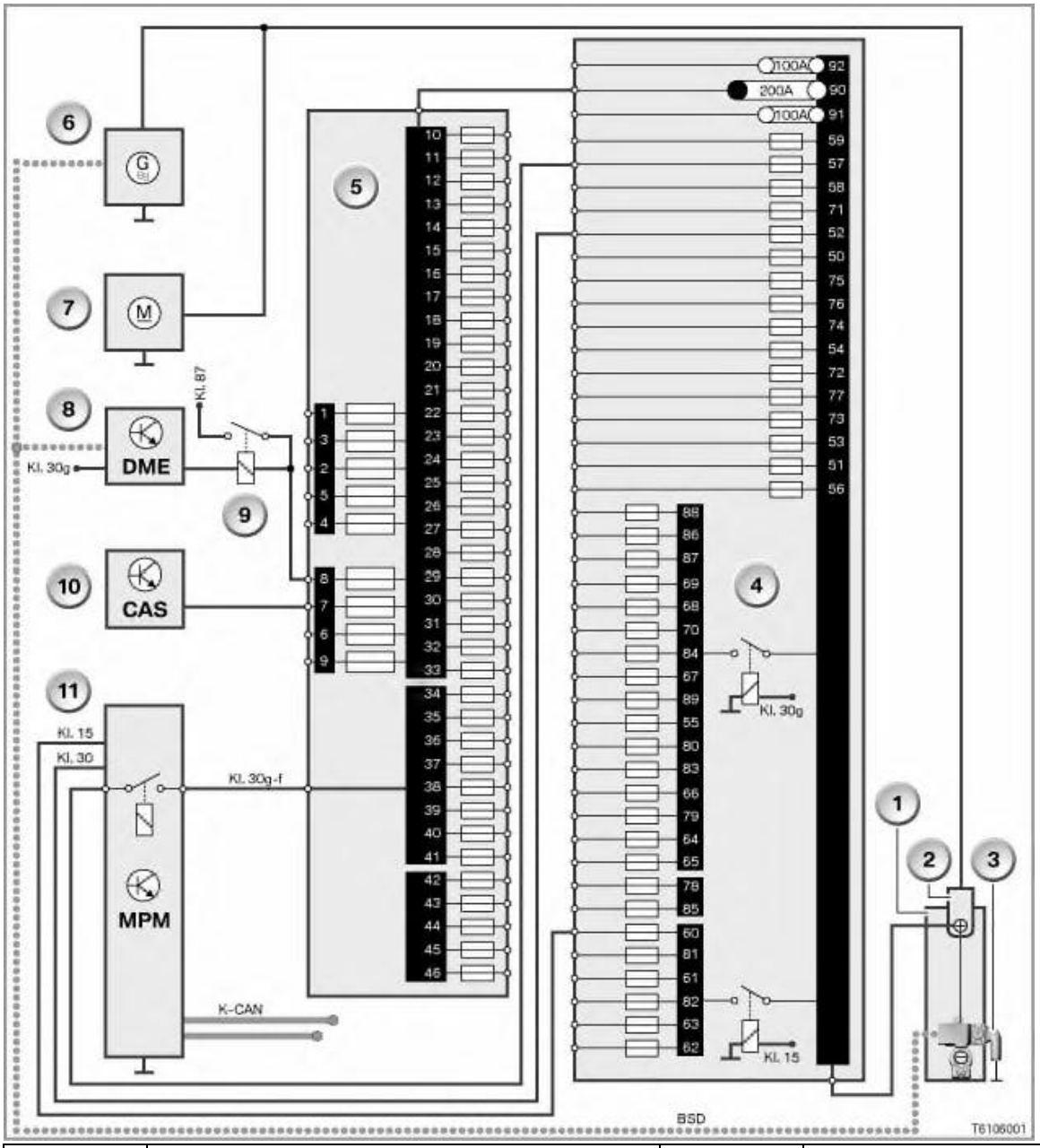


Item	Description	Item	Description
1	Voltage (U)	2	Current (I ±)
3	Temperature (T)	4	Digital engine electronics (DME)
5	Power management	6	Erasable Programmable Read-Only Memory (EPROM) with battery maps for: - Voltage (U) - Current (I ±) - Temperature (T)
7	Idle-speed control	8	Nominal value for charge voltage
9	Auxiliary consumer cutoff	10	Load peak reduction
IN	Input information	OUT	Output information

- System circuit diagram

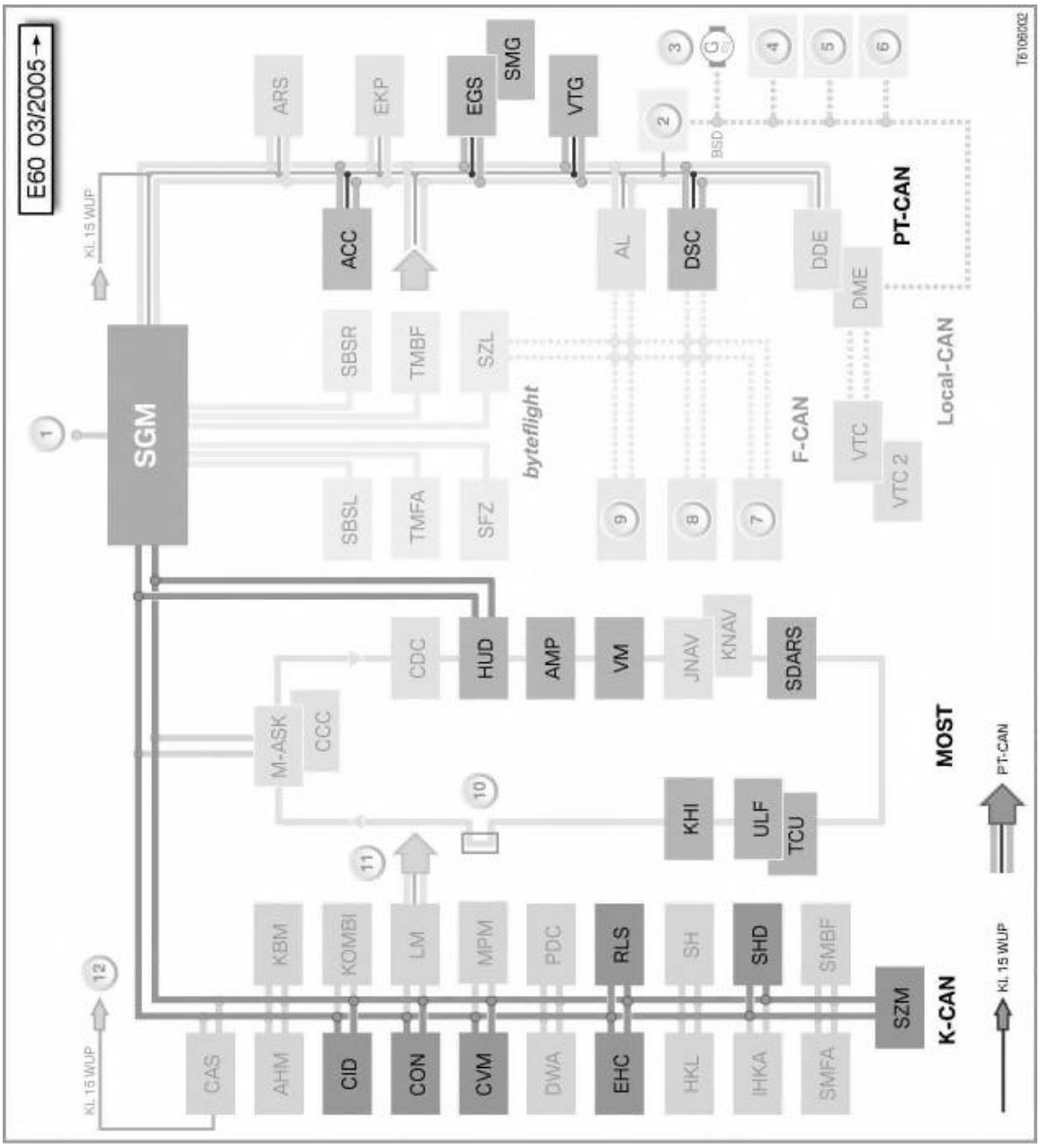
>System circuit diagram power supply for 6-cylinder engine version until 09/2005

Example: E60



Item	Description	Item	Description
1	Battery	2	Safety battery terminal
3	Intelligent battery sensor (IBS)	4	Rear power distributor with terminal 30g relay and terminal 15 relay
5	Power distributor, front	6	Alternator
7	Starter motor	8	Digital engine electronics (DME)
9	DME main relay	10	Car Access System (CAS)
11	Micro-power module (MPM)	K-CAN	Body CAN
Kl. 15	Terminal 15, ignition lock position 2	Kl. 30	Terminal 30, power supply
Kl. 30g	Terminal 30g, active	Kl. 30g-f	Terminal 30 g-f
Kl. 87	Terminal 87	BSD	Bit-serial data interface

- Overview of control unit on terminal 30g-f until 09/2005

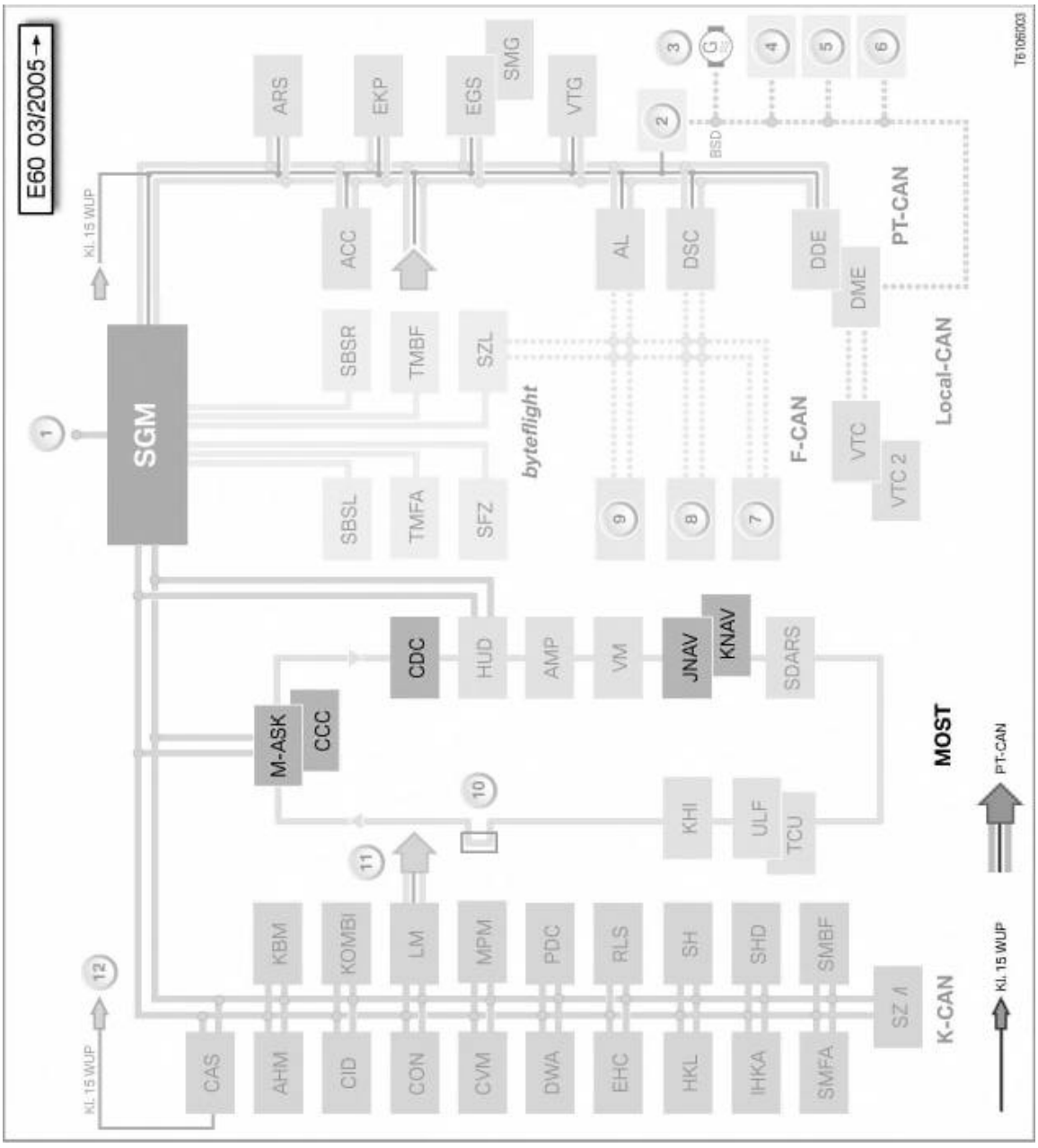


The control units with power supply via terminal 30g are highlighted.

Item	Description	Item	Description
ACC	Active cruise control	AMP	Amplifier
CID	Central Information Display	CON	Controller
CVM	Convertible top module	DSC	Dynamic Stability Control
EGS	Electronic transmission control	EHC	Electronic height control
HUD	Head-up display	KHI	Headphone interface
RLS	Rain-light sensor	SDARS	Satellite tuner
SHD	Sliding/tilting sunroof (on E61: Panorama glass sunroof)	SMG	Sequential manual gearbox

SZM	Centre console switch cluster	TCU	Telematics control unit
ULF	Universal charger and hands-free system	VM	Video module
VTG	Transfer case		

- Overview of control unit on terminal 30g-f until 09/2005



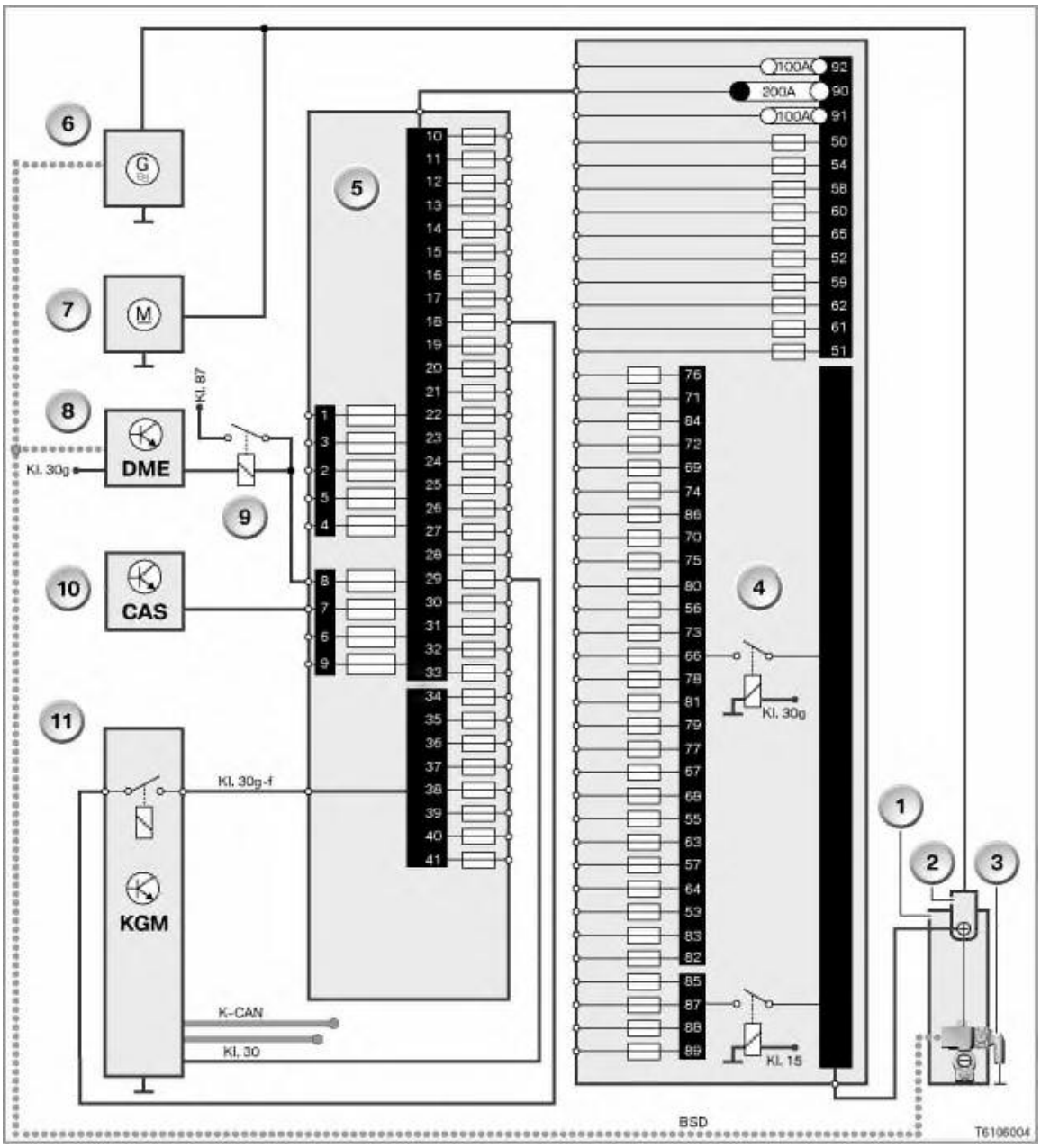
The control units with power supply via terminal 30g-f are highlighted.

Item	Description	Item	Description
CCC	Car Communication Computer	CDC	CD changer
JNAV	Japan navigation system	KNAV	Korea navigation system
M-ASK	Multi-audio system controller		

- System circuit diagram

> System circuit diagram power supply for 6-cylinder engine version from 09/2005

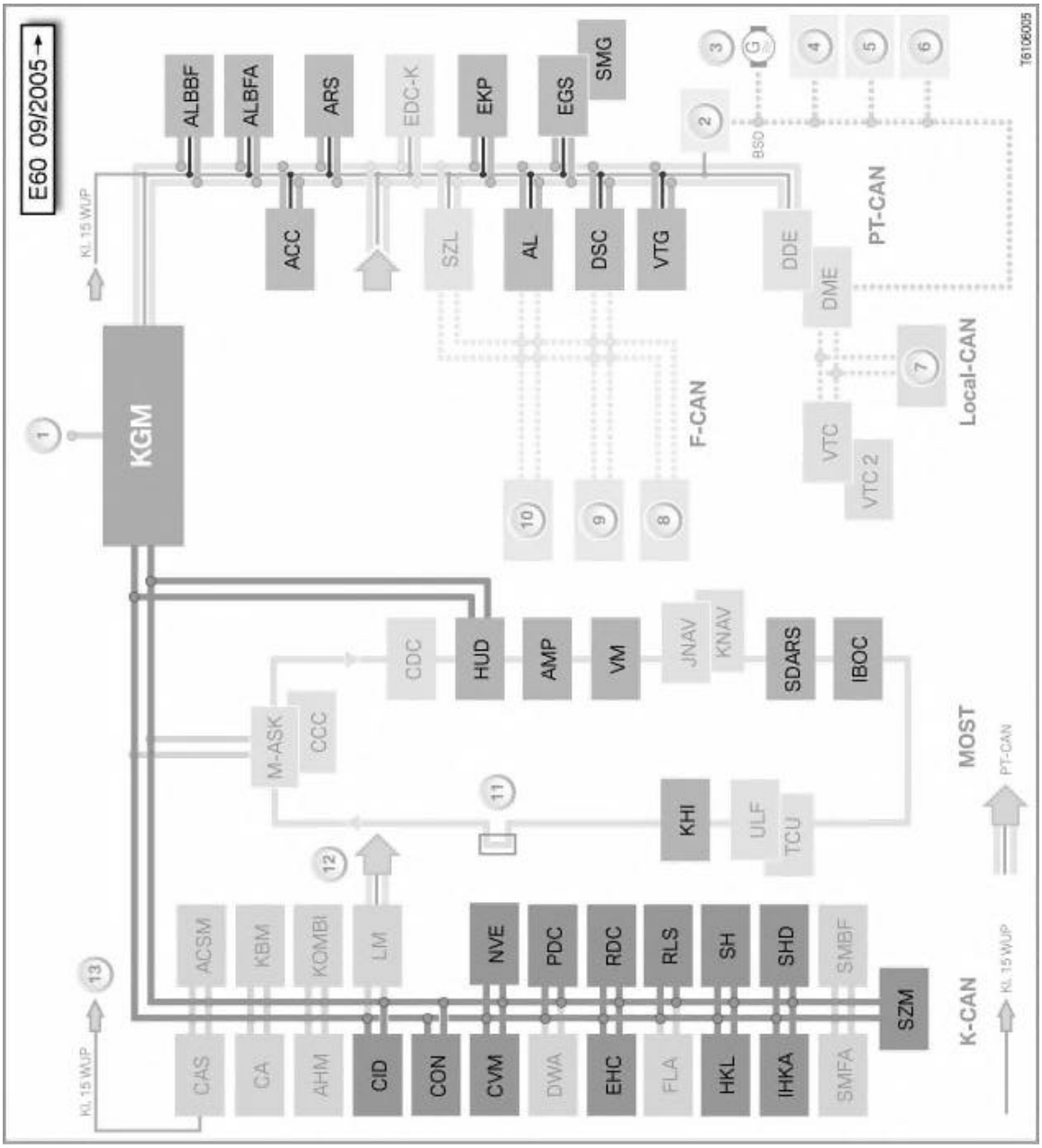
Example: E60



Item	Description	Item	Description
1	Battery	2	Safety battery terminal
3	Intelligent battery sensor (IBS)	4	Rear power distributor with terminal 30g relay and terminal 15 relay
5	Power distributor, front	6	Alternator
7	Starter motor	8	Digital engine electronics (DME)
9	DME main relay	10	Car Access System (CAS)
11	Body gateway module (KGM)	K-CAN	Body CAN
Kl. 15	Terminal 15, ignition lock position 2	Kl. 30	Terminal 30, power supply
Kl. 30g	Terminal 30g, active	Kl. 30g-f	Terminal 30 g-f

Kl. 87	Terminal 87	BSD	Bit-serial data interface

- Overview of control unit on terminal 30g from 09/2005

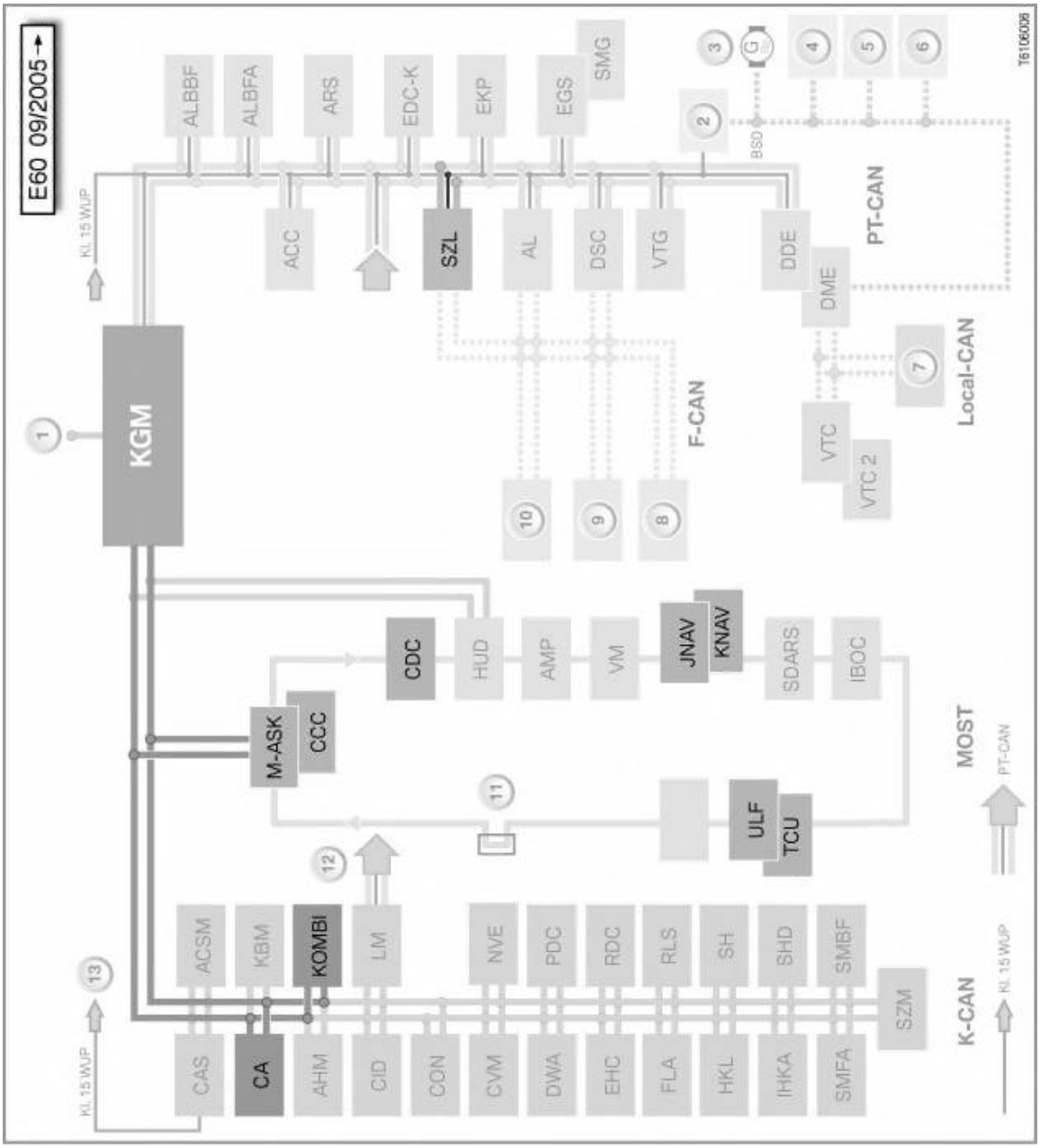


The control units with power supply via terminal 30g are highlighted.

Item	Description	Item	Description
ACC	Active cruise control	AL	Active Steering
ALBBF	Active seat back width, front passenger seat	ALBFA	Active seat back width, driver's seat
AMP	Amplifier	ARS	Active roll stabilisation (sales designation: Dynamic Drive)
CID	Central Information Display	CON	Controller
CVM	Convertible top module	DSC	Dynamic Stability Control
EGS	Electronic transmission control	EHC	Electronic height control

EKP	Regulated fuel pump	HKL	Tailgate lift
HUD	Head-up display	IBOC	Digital tuner US
IHKA	Integrated automatic heating and air-conditioning system	KHI	Headphone interface
NVE	Night-vision electronics (from 03/2006)	PDC	Park Distance Control
RDC	Tyre pressure control (from 03/2006, US version only)	RLS	Rain-light sensor
SDARS	Satellite tuner	SH	Independent heating
SHD	Sliding/tilting sunroof (on E61: Panorama glass sunroof)	SMG	Sequential manual gearbox
SZM	Centre console switch cluster	VM	Video module
VTG	Transfer case		

- Overview of control unit on terminal 30g-f from 09/2005



The control units with power supply via terminal 30g-f are highlighted.

Item	Description	Item	Description
CA	Comfort Access	CCC	Car Communication Computer
CDC	CD changer	JNAV	Japan navigation system
KOMBI	Instrument cluster	KNAV	Korea navigation system
M-ASK	Multi-audio system controller	SZL	Steering column switch cluster
TCU	Telematics control unit	ULF	Universal charger and hands-free system

- Earth points

The earth points on the example of the E60 are illustrated for left-hand-drive vehicles. Installation locations may differ on right-hand drive vehicles.

Example: E60

Item	Description	Item	Description
1	X13782 - A-pillar, right	2	X13784 - door entrance, A-pillar
3	X14054 - electric auxiliary heater	4	X13797 - A-pillar, right (blower)
5	X14234 - AFS control unit	6	X13786 - under front-passenger seat
7	X13788 - under front-passenger seat	8	X13790 - wheel arch, rear right
9	X13794 - luggage compartment, rear right	10	X13792 - luggage compartment, rear right
11	X6402 - luggage compartment (battery)	12	X13793 - luggage compartment, rear left
13	X13795 - luggage compartment, rear left	14	X13791 - wheel arch, rear left
15	X13789 - under driver's seat	16	X13787 - under driver's seat
17	X13785 - door entrance, A-pillar, right	18	X13783 - door entrance, A-pillar
19	GRAV earth point, engine compartment, left		

General information for service staff on power supply: E60, E61, E63, E64

Note: Do not connect a trickle-charger to the cigarette lighter.

Power is fed to the cigarette lighter from the rear power distributor via a relay. This relay is deactivated when terminal 15 is switched off. That means that a trickle-charger connected to the cigarette lighter is separated from the battery. Only recharge the battery using the external-start support point. Only then can the energy fed into the vehicle be registered.

Intelligent battery sensor

Important: Risk of irreparable damage if mechanically stressed

- Do not attach any additional connections to the negative terminal of the battery.
- Do not modify the earth cable in any way.
  The earth cable also serves to carry off heat.
- Do not create a connection between the IBS (intelligent battery sensor) and the sensor screw.
- Do not use force when disconnecting the terminal clamp from the battery terminal:
  - Do not pull on the earth cable.
  - Do not apply any tools under the IBS to lever off the terminal clamp.
- Do not use the IBS connections as a lever.
- Use a calibrated torque wrench with tightening torque set according to the Repair Instructions.
- Do not loosen or tighten the sensor screw (Torx screw).
- Prevent direct contact between the IBS and earth.

Change battery

Important: Risk of irreparable damage to the IBS and the wires when changing the battery

When the battery is replaced, the IBS (intelligent battery sensor) and the wires could be damaged beyond repair by mechanical stressing.

Please note the following when replacing the battery:

- Always proceed in accordance with the Repair Instructions.
- Avoid subjecting the integrated battery sensor to mechanical stress.

Note: When changing the battery, perform service function "Register battery renewal".

When changing the battery, use the battery size (capacity) installed in production. The battery size needed for the vehicle is encoded in the Car Access System (CAS) and in the engine electronics (DME/DDE).

- If a battery with a different capacity is fitted, the CAS must be recoded. Run "Battery" retrofit with Progman.
- Erase any fault memory entry in the engine control unit relating to the battery replacement.

Micro-power module until 09/2005

> From 09/05, MPM function is integrated into the body-gateway module (KGM)

If consumers are cut off from the vehicle electrical system by the MPM, a fault will be registered in the fault memory.
The following faults can be read off in the BMW diagnosis system:

- Fault at terminal 15
- Cutoff with information about switch-off conditions.
  The information about the switch-off conditions is stored in the info memory used for storing additional information.
- Undervoltage
- Contact fault in relay contacts

Fault at terminal 15

- If there is a different level at terminal 15, pin 14 and in the CAN message, the MPM will register a fault in the fault memory.
- The MPM cyclically monitors the relay contacts every 100 milliseconds (ms) from terminal 15 ON. If the relay contacts do not remain closed, despite the switch-on conditions being satisfied, an entry will be made in the fault memory.

Alternator

Alternators manufactured by Bosch and by Valeo are installed on 5- and 6-Series vehicles.

- Air-cooled alternator models are used.
- The alternator model used depends on the engine installed and the vehicle's equipment specification.

Diagnosis for power supply: E60, E61, E63, E64

The following information is given concerning diagnosis:

- Intelligent battery sensor self-diagnosis
- Power diagnosis
- Diagnosis with BMW diagnosis system.

Intelligent battery sensor (IBS) self-diagnosis

The IBS has a fault memory. Fault-memory entries are read off by the DME / DDE. (DME = "digital engine electronics"; DDE = "digital diesel electronics")
IBS self-diagnosis detects the following faults:

Internal voltage error
Short circuit in voltage-measuring path

- to battery positive, or
- to earth.

Current error
A current of 1000 ampères (A) is measured for longer than 20 seconds.

Temperature error
A temperature T lower than -48 °C is measured.

System error
System errors are:

- Faulty data memory
- Faulty read memory
- Failure of voltage reference (source of reference voltage)
- Loss of calibration information

Break in terminal 15 wake-up wire
A break in the terminal 15 wake-up wire (Kl. 15 WUP) is recognised by a plausibility check. Here, it is checked whether the information about terminal 15 from the DME / DDE and the information on the terminal 15 wake-up wire are plausible.

Fault in output stage of terminal 15 wake-up wire
The IBS will detect a fault in the output stage of the terminal 15 wake-up wire (Kl. 15 WUP) with diagnosis of the output stage.

Communication error
A communication error is recognised if the connection between the bit-serial data interface (BSD) and the IBS fails.

Extended communication error
An extended communication error means that continuous transmission of data blocks is not assured. This check recognises irregular or undefined gaps the data blocks.

Sensor implausible
This fault means that the software in the DME / DDE and the software in the IBS are not compatible, i.e. are implausible. The fault can be caused by

- installing an incorrect IBS
  or
- loading the incorrect software in the DME / DDE.

Power diagnosis

A breakdown caused by a flat battery or problems in the vehicle electrical system can have various causes. In most cases,

the cause is not the battery itself. For this reason, replacing the battery will not usually lead to a lasting solution to the problem.
Instead, systematic diagnosis of the source of the fault is needed.
Complaints reported are often no longer present when the vehicle is taken to the workshop. For this reason, the data stored in the vehicle form the basis for troubleshooting. Information about the battery condition and function processes in the different bus systems are stored in the corresponding control units.

This information can be called up and evaluated with the BMW diagnosis system. A test module is provided in the BMW diagnosis system for this purpose. The energy diagnosis test module reads off all relevant data from the control units concerned.
The following information is displayed:

- Conspicuous information

  An entry is only made if a fault is assumed to be present.

- Standard information

  This information can always be displayed.

Energy diagnosis detects the following faults:

- Operating error
- Faults on vehicle

Operating error

- Side lights, parking lights or hazard warning lights switched on too long while vehicle was parked.
- Terminal R or terminal 15 switched on too long with engine switched off.
- Vehicle left parked up too long.
- Frequent short-distance driving with several power consumers switched on

Faults on vehicle

- Battery defective
- Alternator defective
- Excessive off-load current, sometimes exceeding 80 milliampères (mA) with inactive bus systems
- Vehicle does not go into sleep mode: The vehicle does not achieve sleep mode, the bus systems remain active.
- Vehicle repeatedly "woken up"

Note: Do not connect a trickle-charger to the cigarette lighter.

Power is fed to the cigarette lighter from the rear power distributor via a relay. This relay is deactivated when terminal 15 is switched off. That means that a trickle-charger connected to the cigarette lighter is separated from the battery. Only recharge the battery using the external-start support point. Only in this way can the energy supply from the vehicle be recorded.

Energy diagnosis evaluates the following data:

- History memory

  > up to 09/2005 in the safety and gateway module (SGM)

  > from 09/2005 in the body gateway module (KGM)

  The KGM supersedes the SGM.

- Fault memory and info memory for storing additional information from the micro-power module (MPM)
  > From 09/2005, the MPM function is integrated in the KGM.
- Energy history memory

> From 09/2005 in KGM

The energy history memory in the body-gateway module (KGM) is an extension to the current history memory used in the safety and gateway module (SGM).

- IBS data from DME / DDE

Encoding/programming power supply: E60, E61, E63, E64

The battery data is encoded in the Car Access System (CAS). These data can be read off with the BMW diagnosis system.