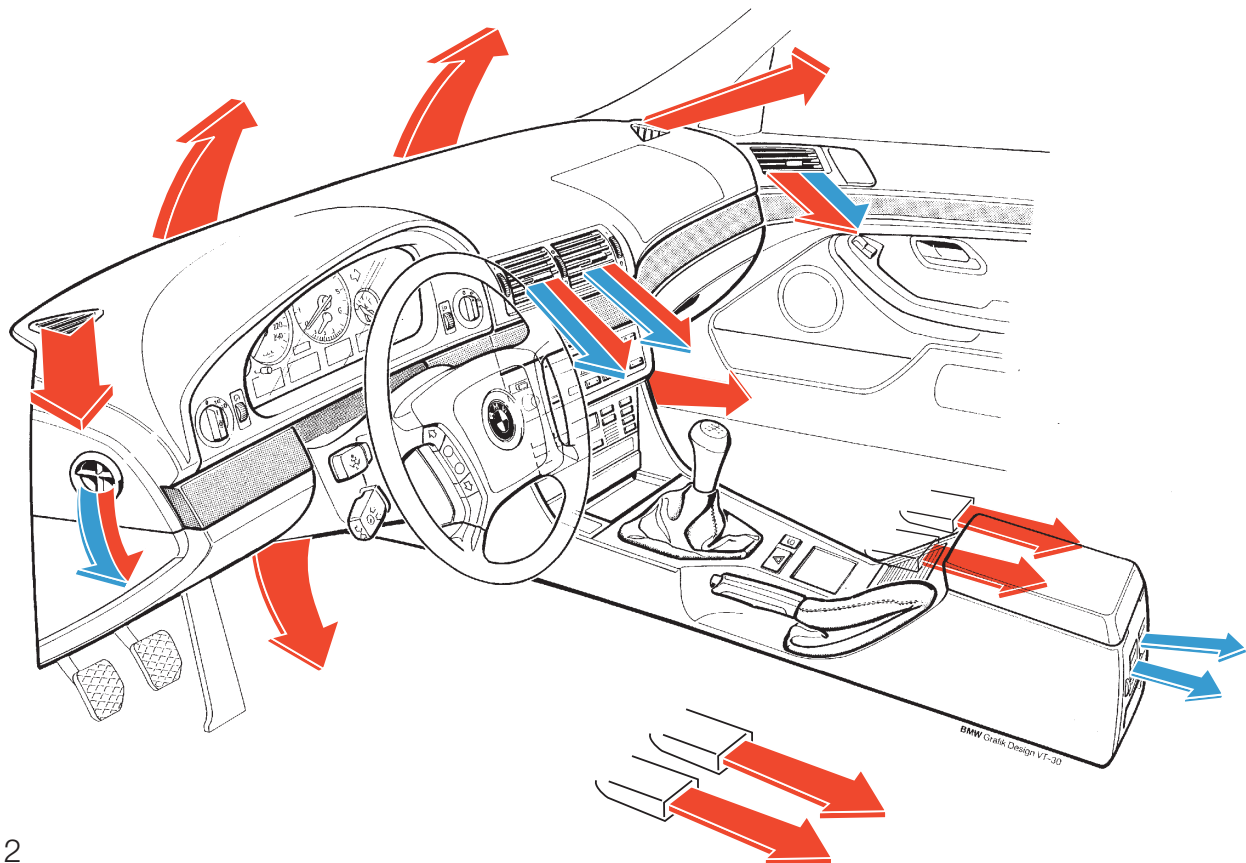

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INTRODUCTION

The E39 IHKA follows the IHKA E38 system and provides features and functions similar to that unit. It incorporates the following features:

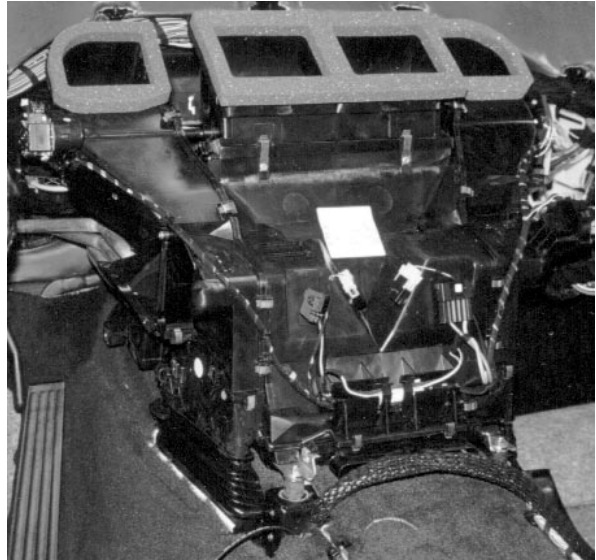
- Integrated control panel/module.
- Separate temperature control for the driver and front passenger.
- Air flap control through the use of bussed stepper motors.
- Automatic Recirculation Control (AUC).
- Recirculation air flap control from the MFL.
- “REST” function for residual heat when vehicle is stopped.
- Service station feature that closes the water valves when stopped to prevent hot water circulating into the heater cores.
- A/C compressor clutch activation through a final stage control.
- Center face vent stratification control through a bowden cable.



COMPONENTS

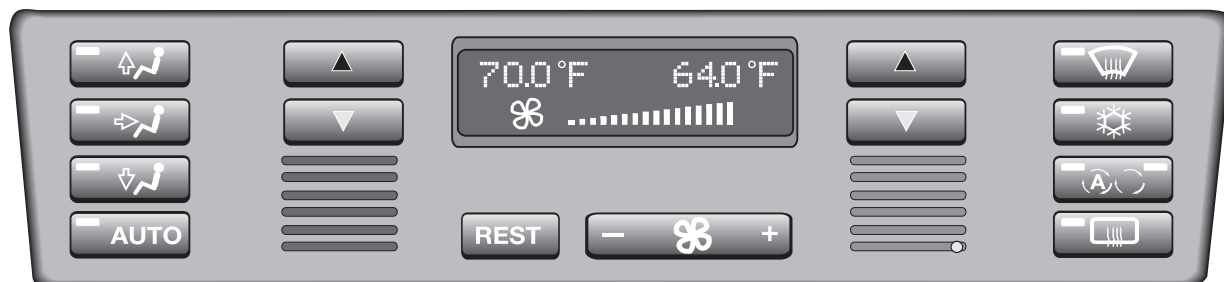
The major components of the IHKA E39 heater case include:

- Two heater cores with separate inlets and one common outlet.
- Two heater core temperature sensors and one evaporator temperature sensor.
- One evaporator with expansion valve.
- Five stepper motors (six as of 9/97) - four on the M-Bus link and one conventionally controlled.
- One auxiliary water pump.
- One blower motor and relay with final stage output control (final stage located in air flow on passenger side of IHKA housing).



CONTROL PANEL/MODULE

All heater/ air conditioner operation is controlled from the button and rocker switches located on the control panel. The control module is integrated into the control panel and contains all of the control electronics except the final stage for the blower motor control.



The control module contains a fault memory in a non volatile RAM and incorporates a sleep mode when the ignition is switched off. The control module will switch to the sleep mode 16 minutes after the ignition is switched off. The control panel consists of the following:

AIR DISTRIBUTION BUTTONS: Manual distribution buttons with selection for:



- Defrost - air to the windshield without maximum defrost.



- Air distribution to the face vents.



- Air distribution to the footwell outlets.

The defrost, face vent and footwell buttons can be selected in any order for distribution to the desired vents.



AUTO: Overrides the manual buttons and provides distribution based on the control module settings as with other systems.



TEMPERATURE SELECTION BUTTONS: For the driver and passenger's side with digital temperature readout in the LCD.



There is one LCD panel for the display of both the left/right side temperature selections and the blower speed.



REST BUTTON: For activation of the residual heat feature.



AIR VOLUME CONTROL ROCKER SWITCH: The air volume can be adjusted through 16 steps using the rocker switch. The selected volume is displayed as a wedge on the LCD panel.



FRONT WINDSHIELD DEFROST: - Maximum defrost to the front windshield is provided by pressing this button. This overrides the other distribution button settings and switches on the rear defroster simultaneously.



AIR CONDITIONING BUTTON: - Pressing the snowflake is the A/C on request input to the control module.



RECIRCULATION/AUTOMATIC RECIRCULATION (AUC) BUTTON: The button allows switching between:

- Fresh/Recirculated air flap activation
- Automatic control of Fresh/Recirculated air flaps.

The AUC system incorporates a sensor that reacts to the levels of oxidizable gasses in the ambient air. When the levels exceed a set value stored in the IHKA control module, the system switches automatically to the recirculation air mode.

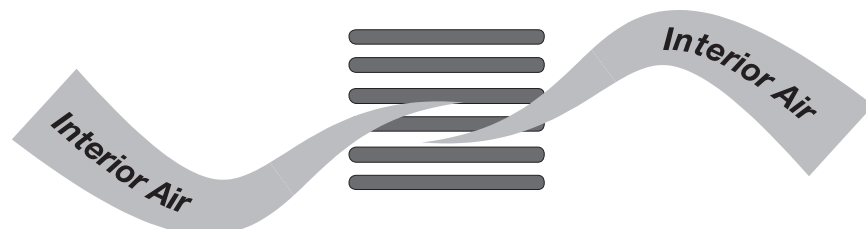


REAR DEFROSTER BUTTON: - When pressed, the rear defroster is switched on for:

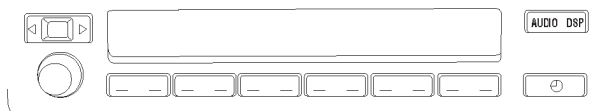
- 10 minutes with the outside temperature $> 14^{\circ}\text{F}$.
- 17 minutes with the outside temperature $< 14^{\circ}\text{F}$.

After the initial timed duration, each subsequent pressing of the button will switch the defroster on for 5 minutes.

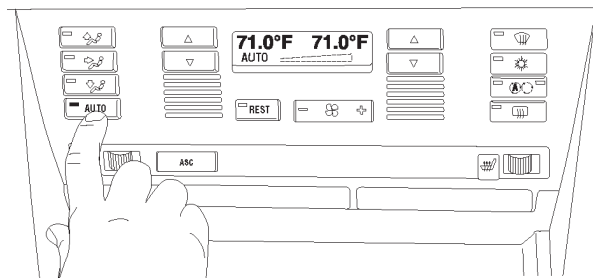
INTERIOR AIR TEMPERATURE SENSOR: The sensor includes the integral blower fan which continuously draws interior air over the sensor. This helps the system to stabilize the output of the system to match the desired settings on the control panel.



CHANGES TO 5 SERIES (E39) IHKA CONTROL PANEL

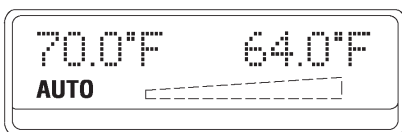


The operation and appearance of the IHKA on the E39 as of 9/96 production has changed only slightly:



On the LCD display the new “AUTO-symbol” replaced the fan symbol, indicating activation of the automatic blower speed program.

The lit LED on the “AUTO-button” indicates activation of the automatic air distribution.



Note:

From 9/96 to 3/97 Production:

When in the automatic blower speed mode, the “AUTO-symbol” and the blower wedge silhouette will be displayed



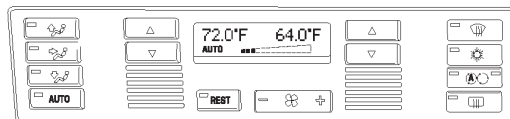
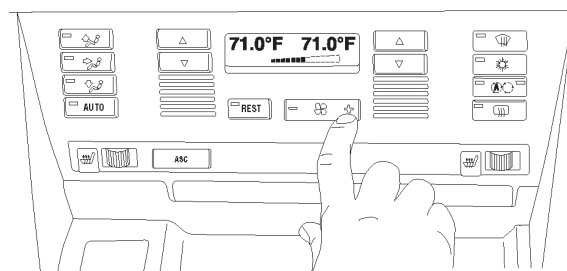
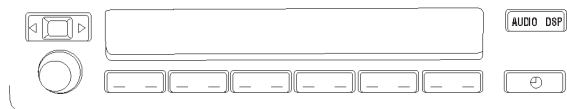
After 3/97 Production:

When in the automatic blower speed mode, the “AUTO-symbol” and the actual blower speed indicated by the bars, will be displayed. The number of bars will automatically change as the auto control of the blower takes place.

If the plus or minus fan speed button is pressed when in the auto mode, the “AUTO-symbol” in the display will be turned off and the manual blower speed control takes place. Blower speed is indicated by the bars.

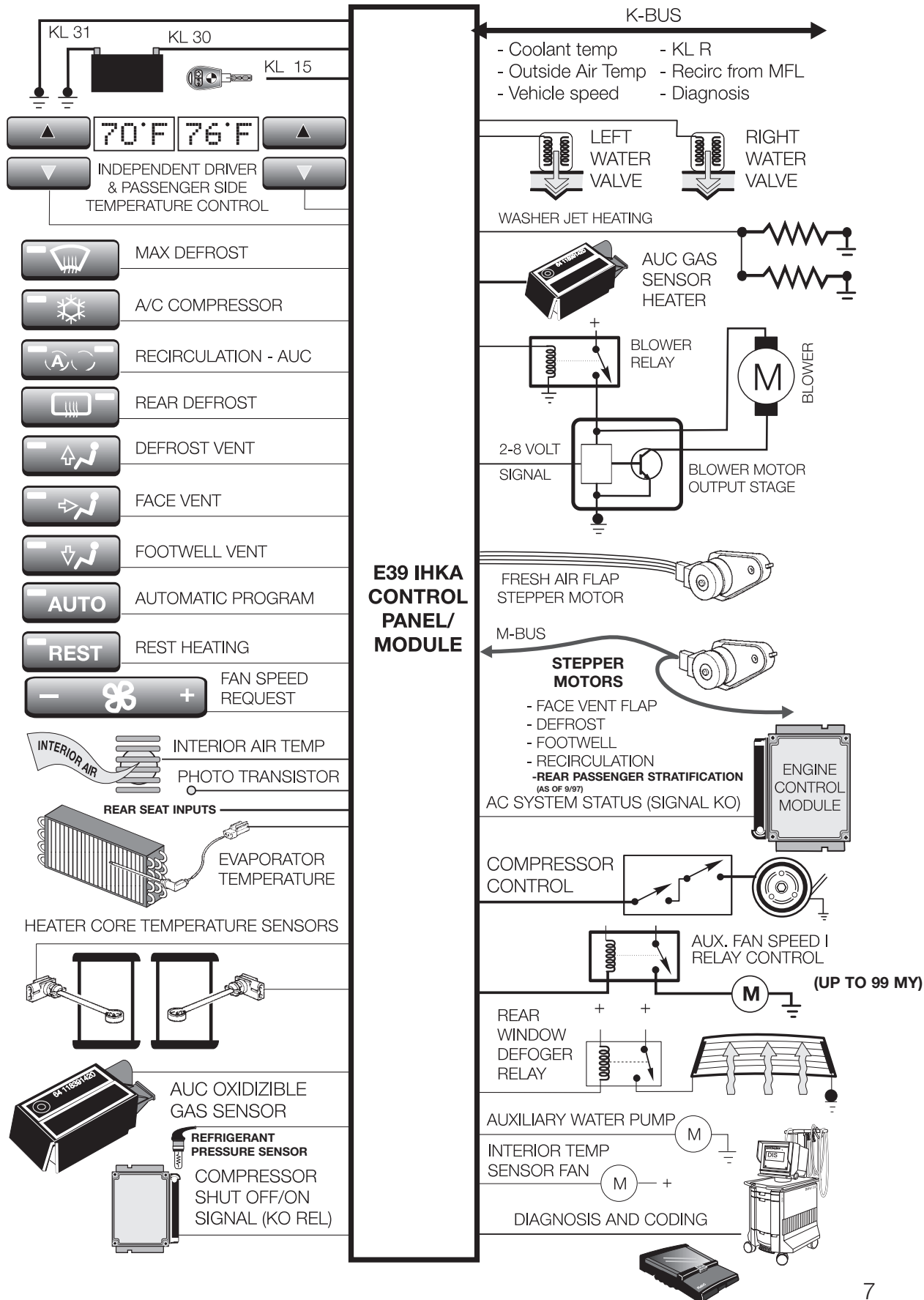
At the same time the automatic air distribution program is still active and the LED in the “AUTO-button” will be:

1. **turned off** - from 9/96 to 3/97 production
2. **turned on** - after 3/97 production



If one of the air distribution buttons is pressed when in the auto mode (1), the air distribution will come out of the automatic program, however, the automatic blower speed program will remain active and the “AUTO-symbol” will continue to be displayed in the LCD panel.

NOTE: If the control module is replaced it must be coded.



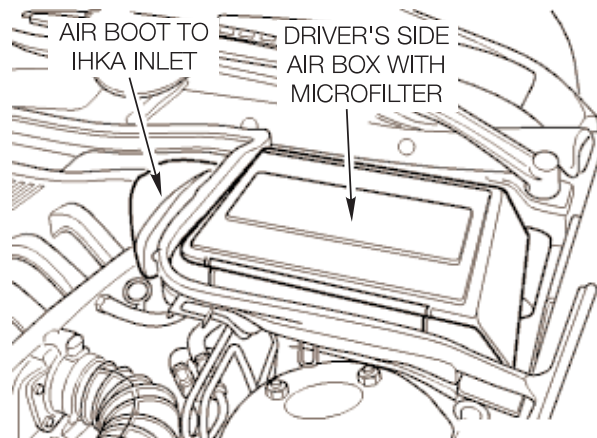
OPERATION

AIR VOLUME CONTROL

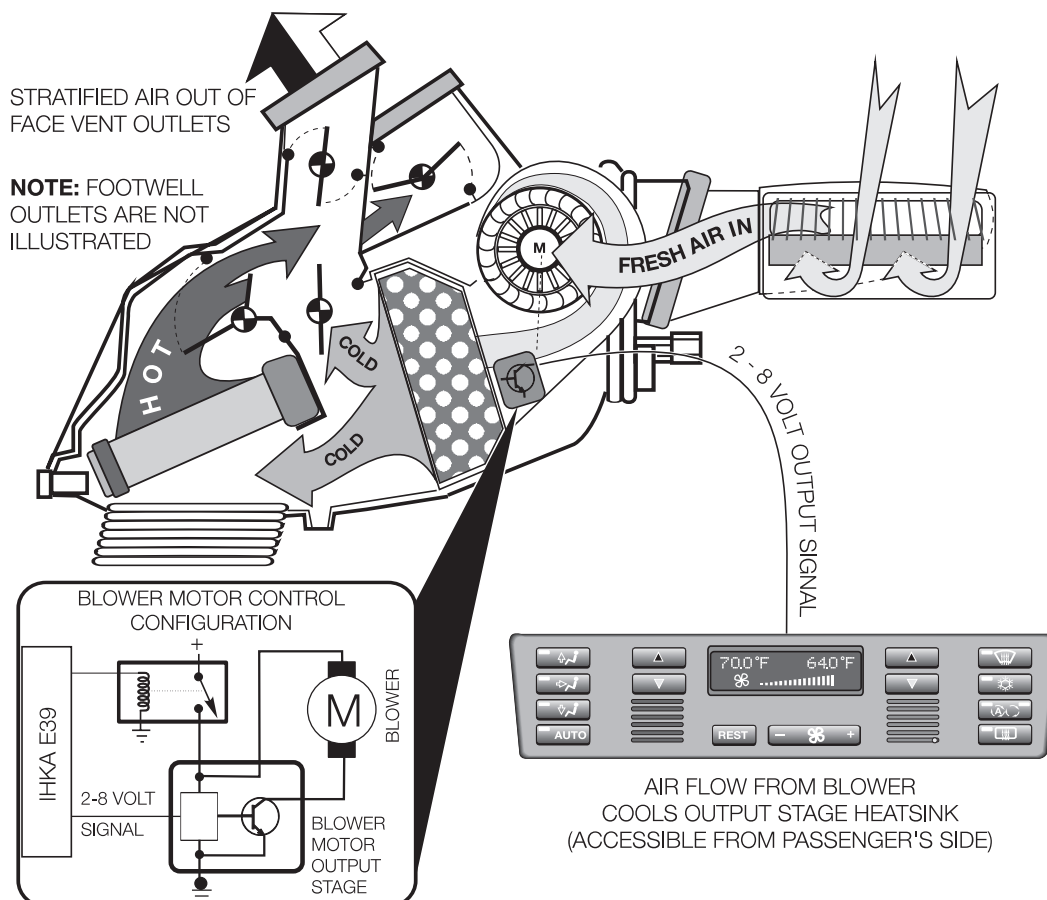
Fresh air enters the IHKA system through the fresh air inlets mounted in the bulkhead area behind the engine. The air passes through the micro/activated carbon filters positioned on each side of the engine compartment.

The left side is positioned above the brake power booster and the right side above the power distribution/E box.

The micro filters serve two functions, one is to filter out small dust and dirt particles. The second is to neutralize unpleasant odors. This function is carried out by the active carbon filter.



Care must be taken when servicing the micro filters or moving them for access to other components. When reinstalling the filters, ensure that the seals are properly installed to prevent odors from entering the interior.



The blower motor is controlled through an output stage that is mounted in a heat sink on the heater case.

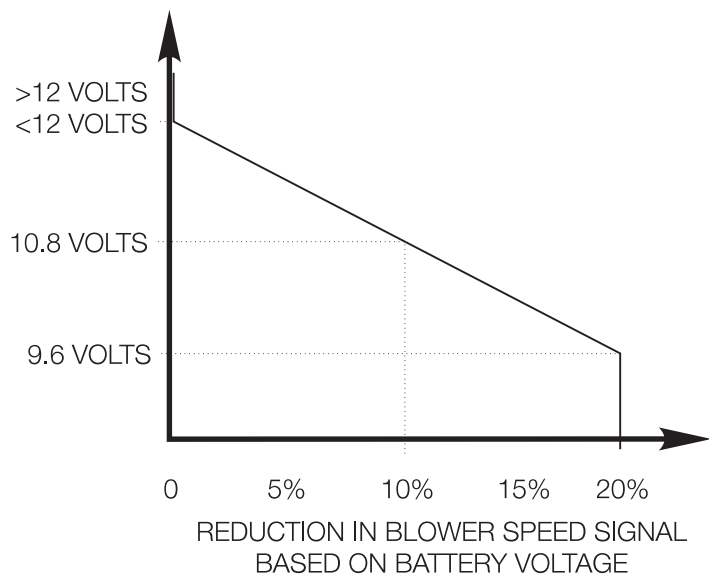
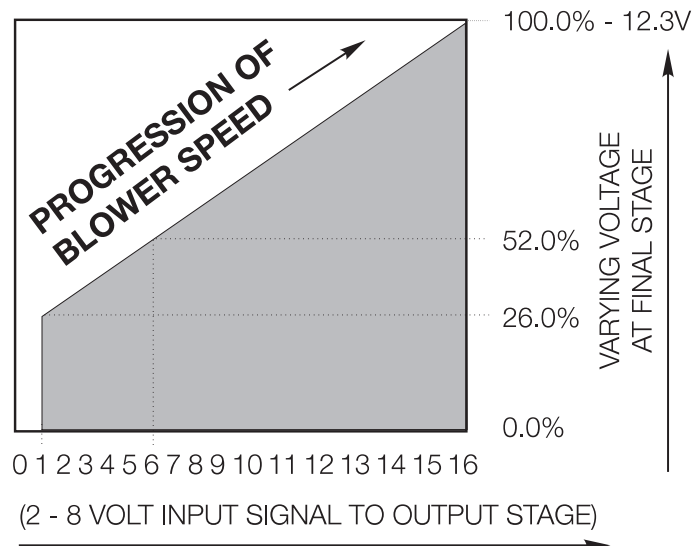
The control lead from the IHKA module supplies a varying voltage (2.0 to 8.0 VDC) based on the position of the blower control rocker switch. The blower speed increases through the 15 steps until 8 volts is supplied to the control lead. At this point (the 16th step), the blower is running at maximum speed.

The speed of the blower fan is also influenced by the “Y” factor and degree of heating or cooling power requested.

When the IHKA system is switched ON, the blower fan will come ON at a speed that is dependent on the “Y” factor and system settings.

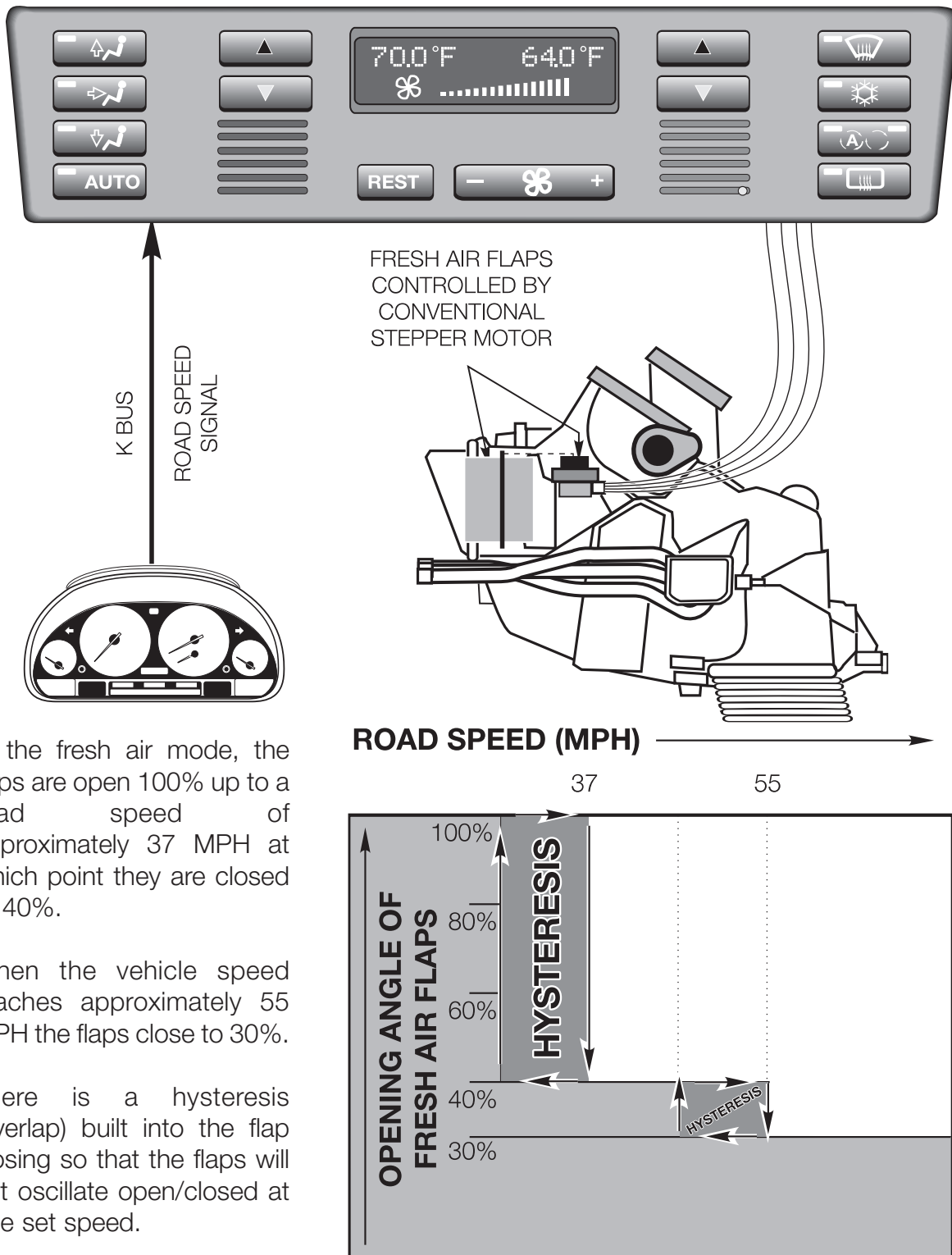
The battery charge condition also contributes to blower speed. When the battery drops below 12 volts, the blower speed signal to the blower output stage is reduced proportionately. Therefore a reduction in blower speed may be noticed.

To switch the system OFF, the rocker switch must be stepped down to the lowest setting and then toggled OFF.



RAM AIR PRESSURE COMPENSATION

The air volume entering the IHKA system is compensated for at higher vehicle speeds. This is carried out through the road speed dependent fresh air flap operation.



In the fresh air mode, the flaps are open 100% up to a road speed of approximately 37 MPH at which point they are closed to 40%.

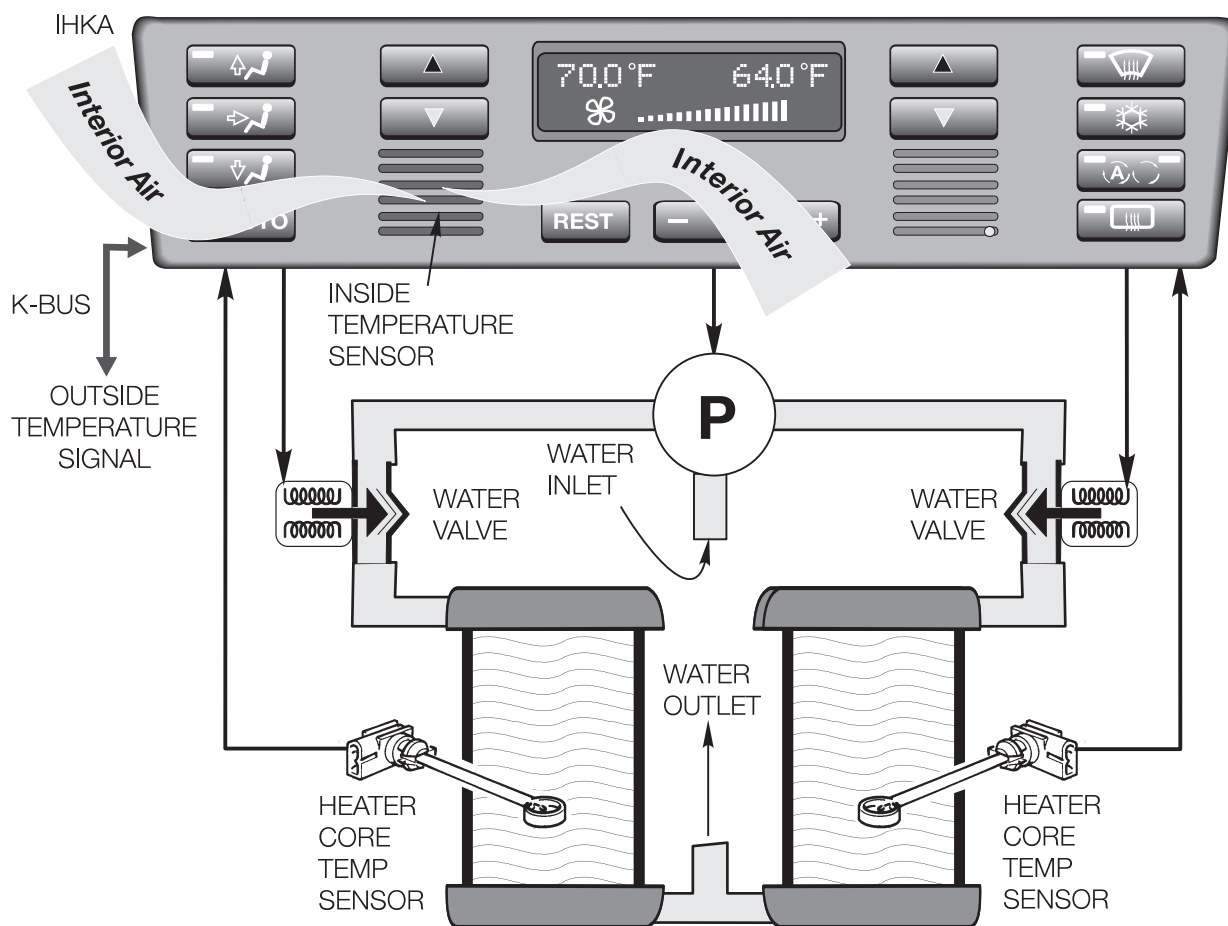
When the vehicle speed reaches approximately 55 MPH the flaps close to 30%.

There is a hysteresis (overlap) built into the flap closing so that the flaps will not oscillate open/closed at one set speed.

TEMPERATURE REGULATION (HEATING)

The IHKA E39 uses two separate heater cores for the driver and passenger sides. Each heater core is controlled by a pulsed water valve to regulate the flow of coolant, as on other IHKA systems. The valves are powered closed and wide open when deactivated. The water valves are pulsed to regulate the temperature based on the following inputs:

- Left/right temperature settings
- Left/right heater core temperatures
- Outside temperature
- Interior temperature
- “Y” factor



The auxiliary water pump is used to ensure that a sufficient volume of coolant is available to the heater cores for all heating conditions. The auxiliary pump is also used to supply coolant for the “REST” feature of the IHKA. The auxiliary water pump is powered directly from the IHKA control module through a final stage output.

There are individual maximum heat functions for the left/right side temperature control settings. At the maximum settings, temperature regulation is canceled and the water valves are 100% open to provide maximum heat.

Correspondingly, the water valves are powered closed in the maximum cold position of the temperature control settings.

COLD START INTERLOCK

Cold start interlock is active in the AUTO program with a driver's side heater core temperature below 20°C. In this program, the defrost flaps are 100% open, the footwell and face vents are closed. The blower fan will run at the set speed.

SERVICE STATION FEATURE

This feature prevents hot coolant from entering the heater cores after the engine is switched OFF. It is designed to prevent a blast of hot air, on a restart, that would arise from coolant bleeding into the heater cores (heat surge) when the engine is switched OFF.

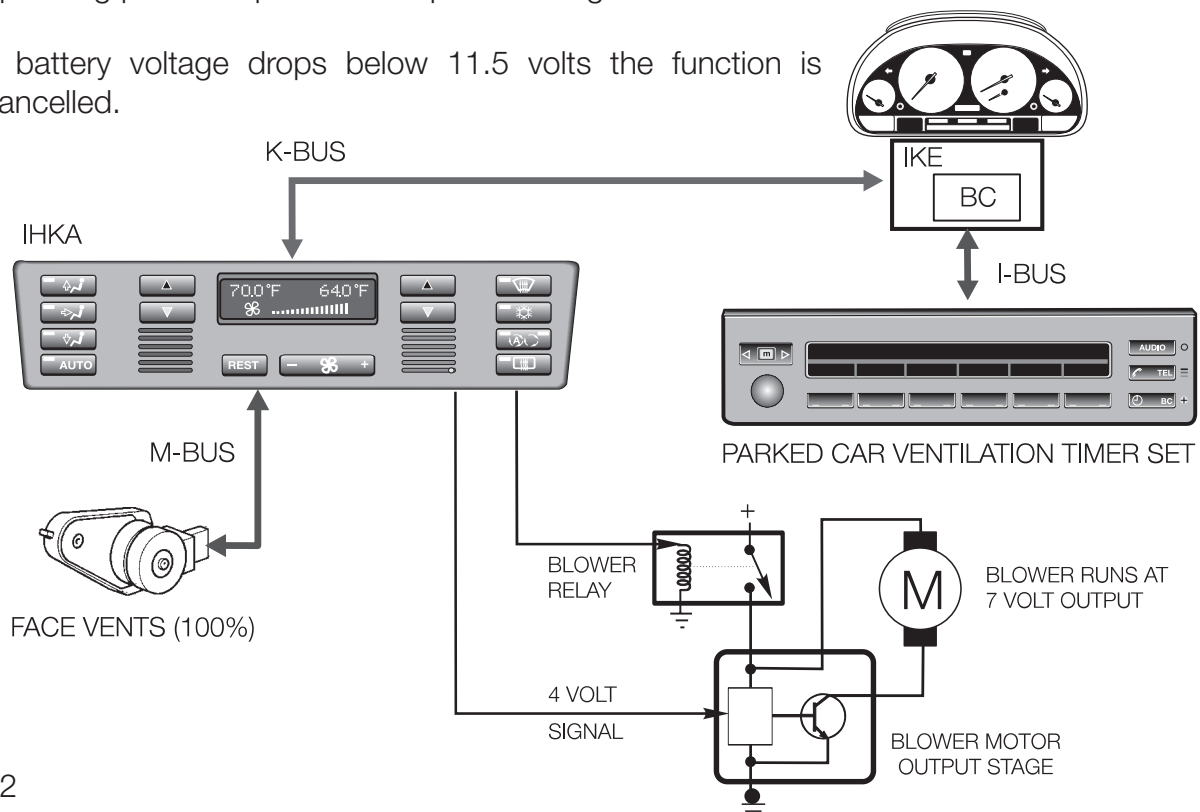
If the coolant temperature is above 15°C, the water valves are powered closed for 3 minutes when the vehicle is switched OFF.

PARKED CAR VENTILATION

The parked car ventilation feature of the E38 IHKA system is retained on the E39 IHKA system. The feature is only available with the High BC. The signal to activate the venting function is generated by the BC function of the IKE. The signal is passed over the K-Bus to the IHKA for fan and flap activation.

The signal prompts the IHKA to open the face vent flaps to 100%. The blower relay is energized and the blower output stage is sent a 4 volt signal. The blower is run at 7 volts operating power to provide adequate venting.

If battery voltage drops below 11.5 volts the function is cancelled.



REST FEATURE

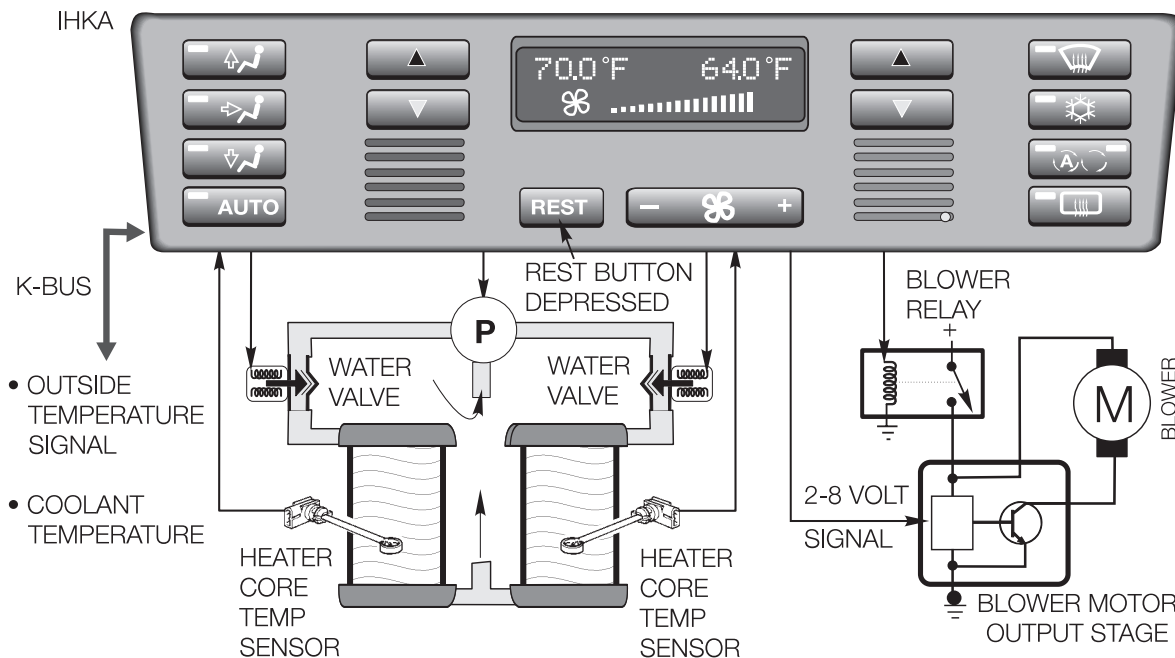
The interior of the vehicle can continue to be heated with the engine switched OFF using the REST feature of the IHKA. The feature is activated by pressing the REST button on the IHKA control panel. When activated, the auxiliary water pump and blower motor are switched on. This feature will remain active for up to 15 minutes or until the coolant temperature drops below 30°C.

Switching **ON** requirements for the REST feature include:

- Ignition switched OFF or in KL R
- Rest button pressed
- Outside temperature < 15°C
- Coolant temperature > 70°C
- Battery voltage > 11.4 volts
- Less than 15 minutes after ignition is switched OFF

Switching **OFF** conditions for the REST feature include:

- Ignition switched ON - KL15
- Battery voltage < 11.4 volts
- Rest button pressed while system is ON
- Coolant temperature < 30°C
- After 15 minutes time period.



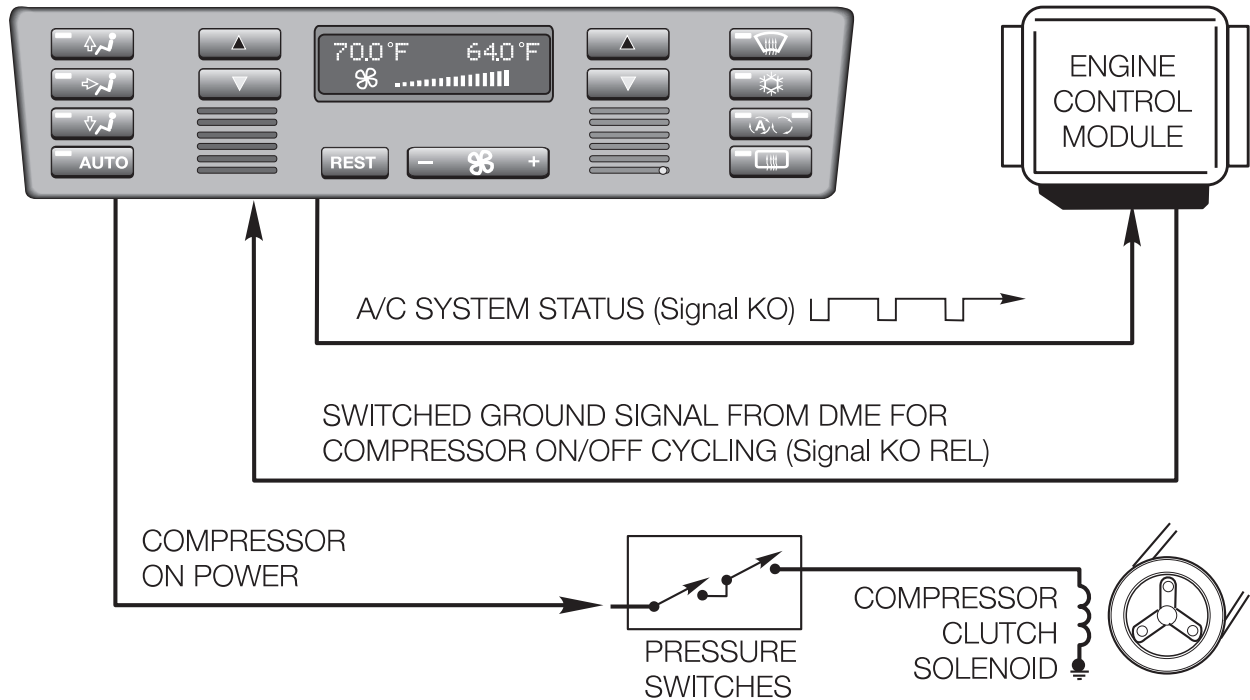
When the REST feature is activated in KL R, all of the IHKA functions are operable. This includes the blower speed, air distribution control and temperature settings.

With the ignition switched OFF, the REST feature is in a preset operating mode. The blower fan runs at medium speed and the temperature is set to allow maximum heat.

A/C COMPRESSOR CONTROL

Activation of the compressor clutch is an output control function of the IHKA module. As with the E38 IHKA, activation is carried out directly through a final stage in the module (no relay required).

The signals KO and AC have been combined into one signal providing multiple data through a stepped increase in signal duty cycle.



- SIGNAL KO:**
- 15% Duty Cycle: IHKA is OFF.
 - 30% Duty Cycle: IHKA is switched ON (Standby).
 - 45% Duty Cycle: Snowflake button is pressed, the IHKA signals the engine control module to raise the idle speed in preparation of the compressor being switched on. This takes place before the IHKA energizes the compressor.

SIGNAL KOREL:

The engine control module signals the IHKA (Signal KOREL) when the idle increase has taken place and the IHKA will then activate the compressor clutch, as long as all other compressor requirements are satisfied. Compressor cut off conditions include:

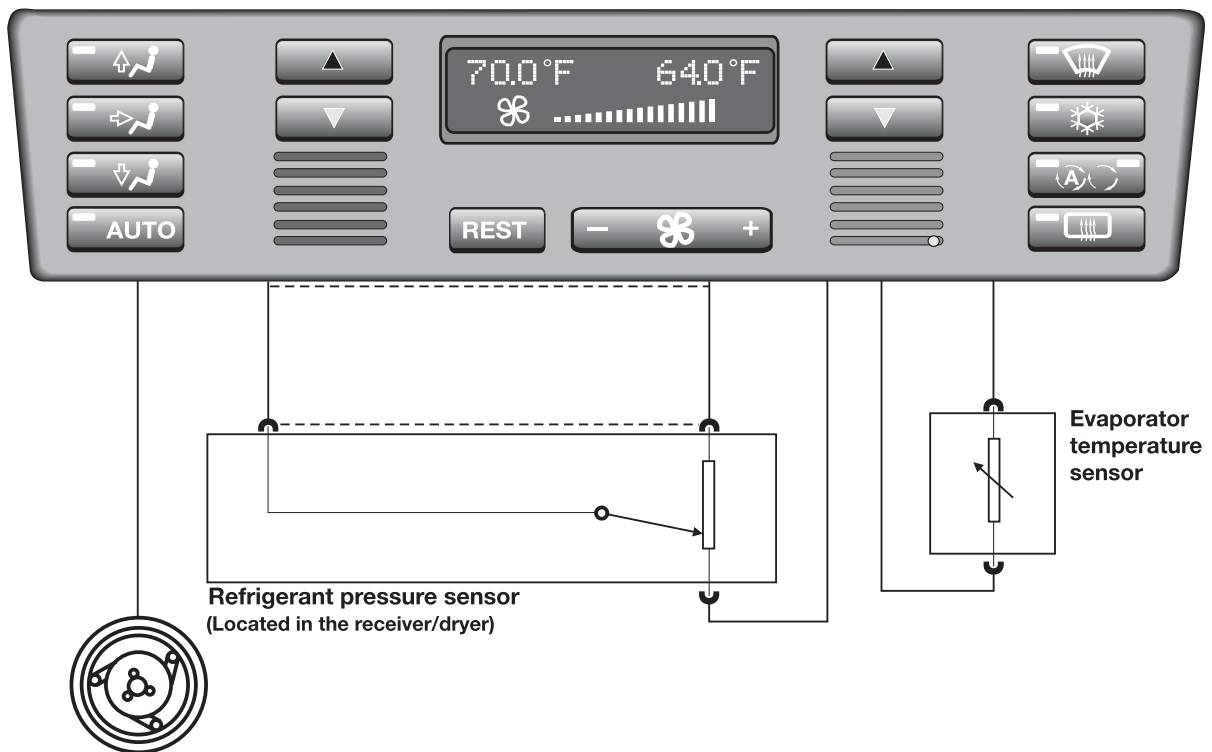
- Evaporator temperature below 2°C
- Coolant temperature > 117°C - causes the compressor to run in a pulsed operation.
- Coolant temperature > 120°C - the compressor clutch is deactivated until the temperature drops below 117°C.
- Full acceleration at low speeds - below 10 MPH with a full throttle input will cause the compressor to shut off for 10 seconds.

COMPRESSOR SIGNALING '99 MODEL YEAR

For '99 Model Year, E39 IHKA now receives a variable input from the refrigerant pressure "sensor". The sensor is mounted in the receiver/dryer.

Based on the refrigerant pressure, the pressure sensor input allows the IHKA module to determine the "start up" torque of the A/C compressor. If the pressure is too low or high the compressor will be deactivated. The IHKA also anticipates the necessary auxiliary fan speed and passes this information on to the ECM via the K-bus.

This change now removes the pressure sensor from the compressor activation circuit.



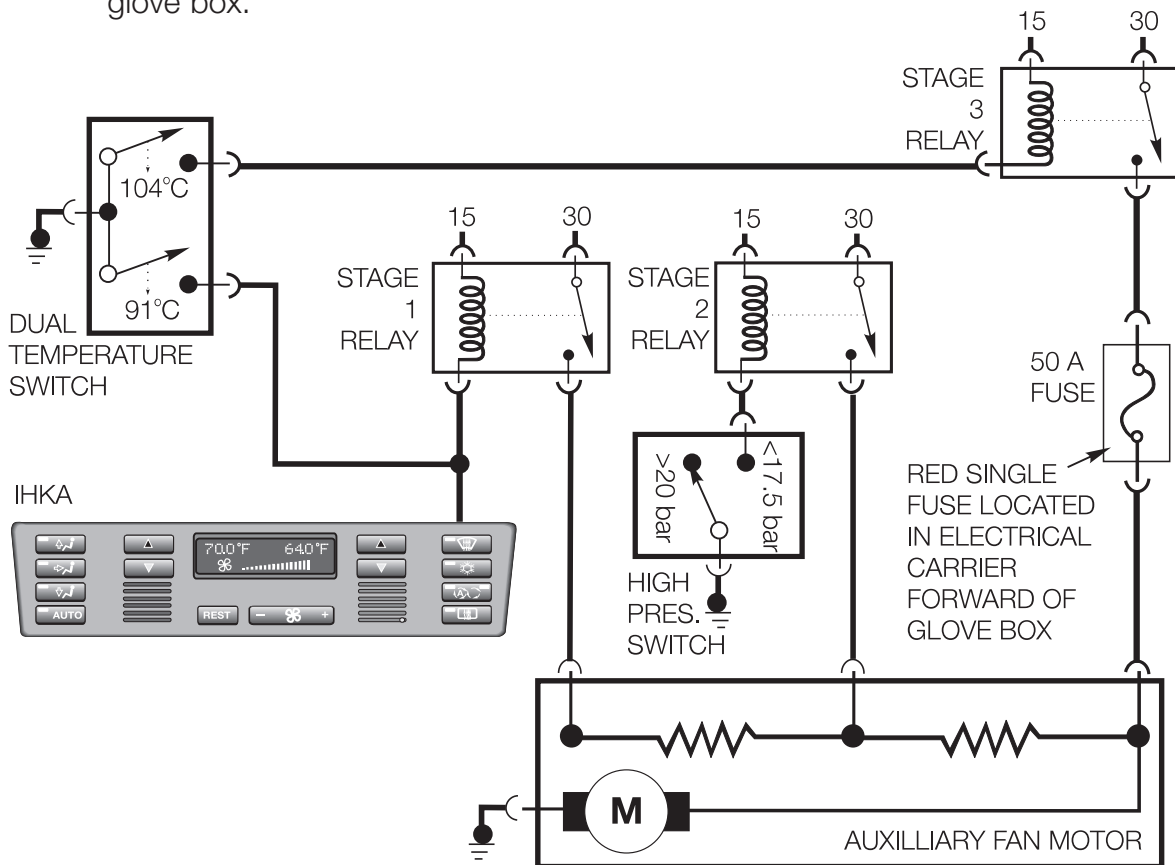
AUXILIARY FAN

The auxiliary fan is a three stage operation as introduced on the 1996 E38.

Stage 1: Activated simultaneously with the compressor with an ambient air temperature $>10^{\circ}\text{C}$ (50°F). If the coolant temperature rises to $>91^{\circ}\text{C}$ the fan will also be switched on. Fan Speed = 1250 RPM.

Stage 2: Activated when the medium pressure switch on the receiver/dryer closes at 17.5 bar. Fan Speed = 2000 RPM.

Stage 3: Activated when the coolant temperature reaches 104°C at the double temperature switch. The stage 3 switched voltage circuit is protected by a 50 amp remote fuse (red). The fuse is located in the electrical carrier forward of the glove box.



AUXILIARY FAN CONTROL ('99 MODEL YEAR - E39)

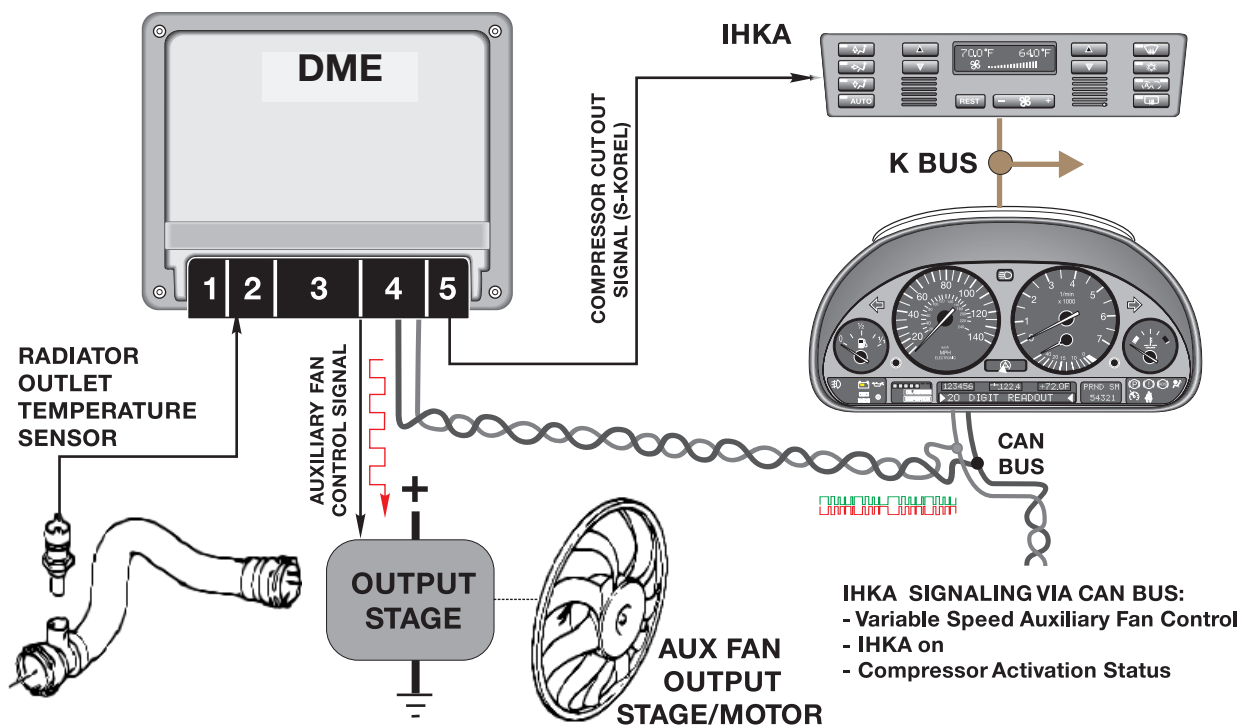
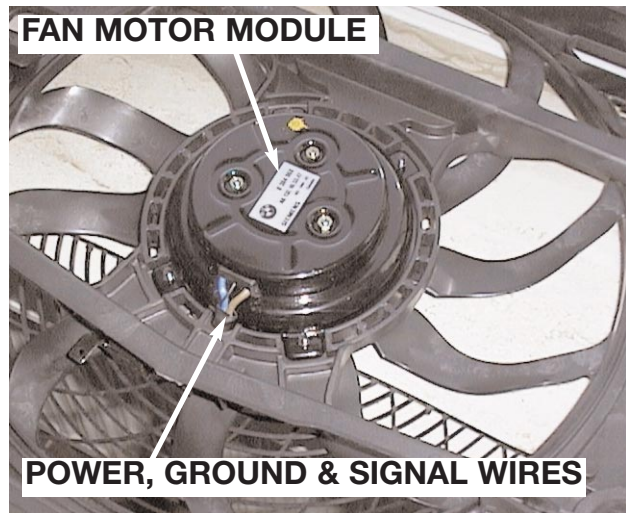
The Auxiliary Fan motor incorporates and output final stage that activates the fan motor at variable speeds.

The auxiliary fan is controlled by ECM. The motor output stage receives power and ground and activates the motor based on a PWM signal (10-100 Hz) received from the ME 7.2.

The fan is activated based on the following factors:

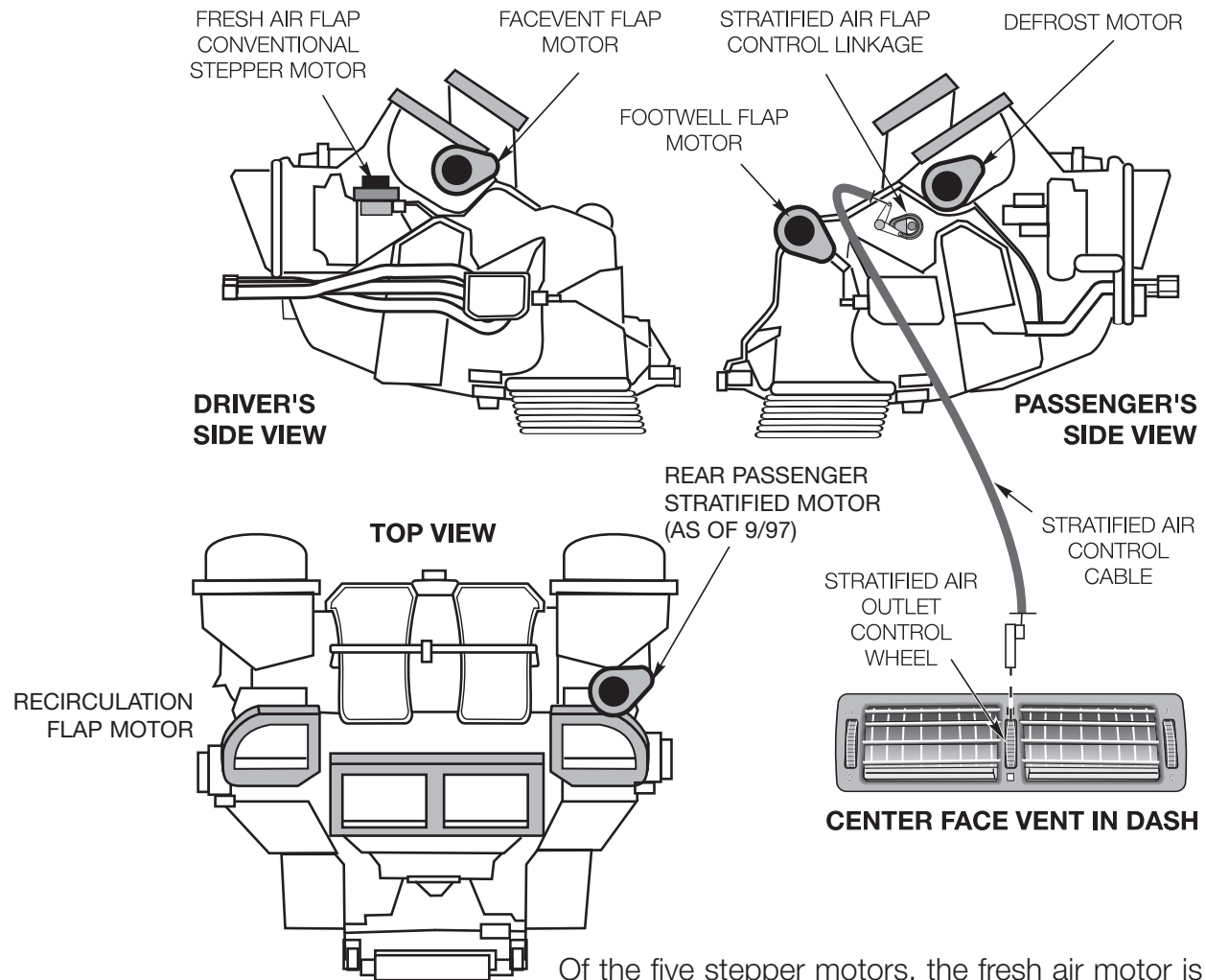
- Radiator outlet temperature sensor input exceeds a preset temperature.
- IHKA signalling via the K and CAN bus based on calculated refrigerant pressures.
- Vehicle speed
- Battery voltage level

When the over temperature light in the instrument clust is on (120°C) the fan is run in the overrun function. This signal is provided to the ECM via the CAN bus. When this occurs the fan is run at a frequency of 10 Hz.



AIR DISTRIBUTION CONTROL

Air distribution on the IHKA E39 is controlled through five stepper motors and a bowden cable. The five stepper motors include:



Of the five stepper motors, the fresh air motor is operated as on the E38 system in a conventional manner. The other four are controlled through the M Bus with a micro processor on each motor.

STRATIFIED AIR

The stratified face vent function is adjusted with a bowden cable as on the E36 IHKA system. The stratified air output is only possible at the center face vents. The system operates the same as the stratification flap on the E36 - IHKA system.

The cable manipulates the stratification flap in the IHKA housing allowing cold air to flow into the face vent air ducts mixing with heated air.

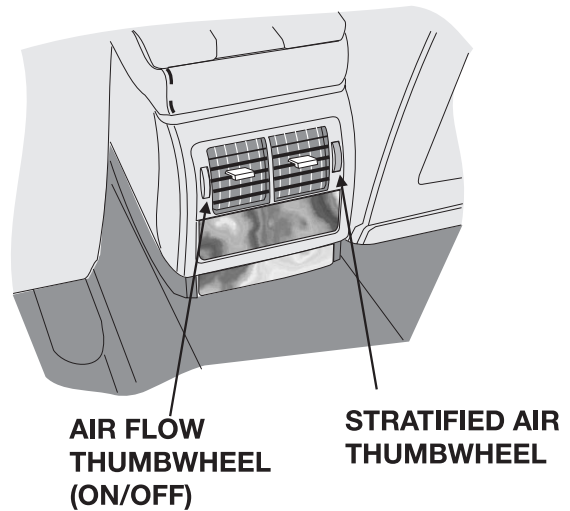
- As of production 9/97 stratified air is available from the console rear outlet.
- This caused a housing change (similar to E38) and an additional stepper motor.
- The thumbwheel to the left of the outlet operates an on/off switch for airflow control.

Note: From production date 9/97 to 3/98 the rear compartment flap motor assumes the COLD position when the switch is closed. As from production date 03/98, the flap moves in the WARM direction in order to avoid draughts in the event of flap leaking.

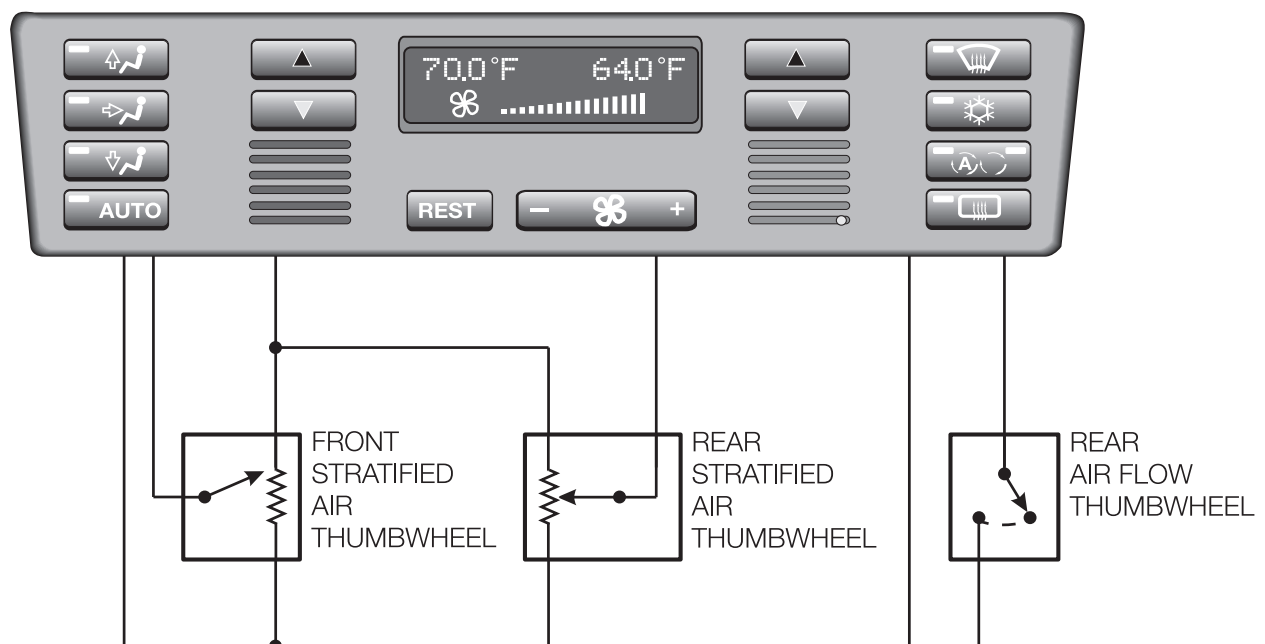
- An additional thumbwheel to the right of the outlet allows rear seat passengers to vary air discharge temperature as well.

The console outlet is almost always open when the IHKA system is “on” and the rear seat passengers request air flow. An exception is during windshield defrosting (and maximum defrost mode) when the console outlet flap is fully closed.

The same flap and stepper motor, located on the IHKA E39 housing assembly, performs both the open/close and temperature control functions for the console outlet.



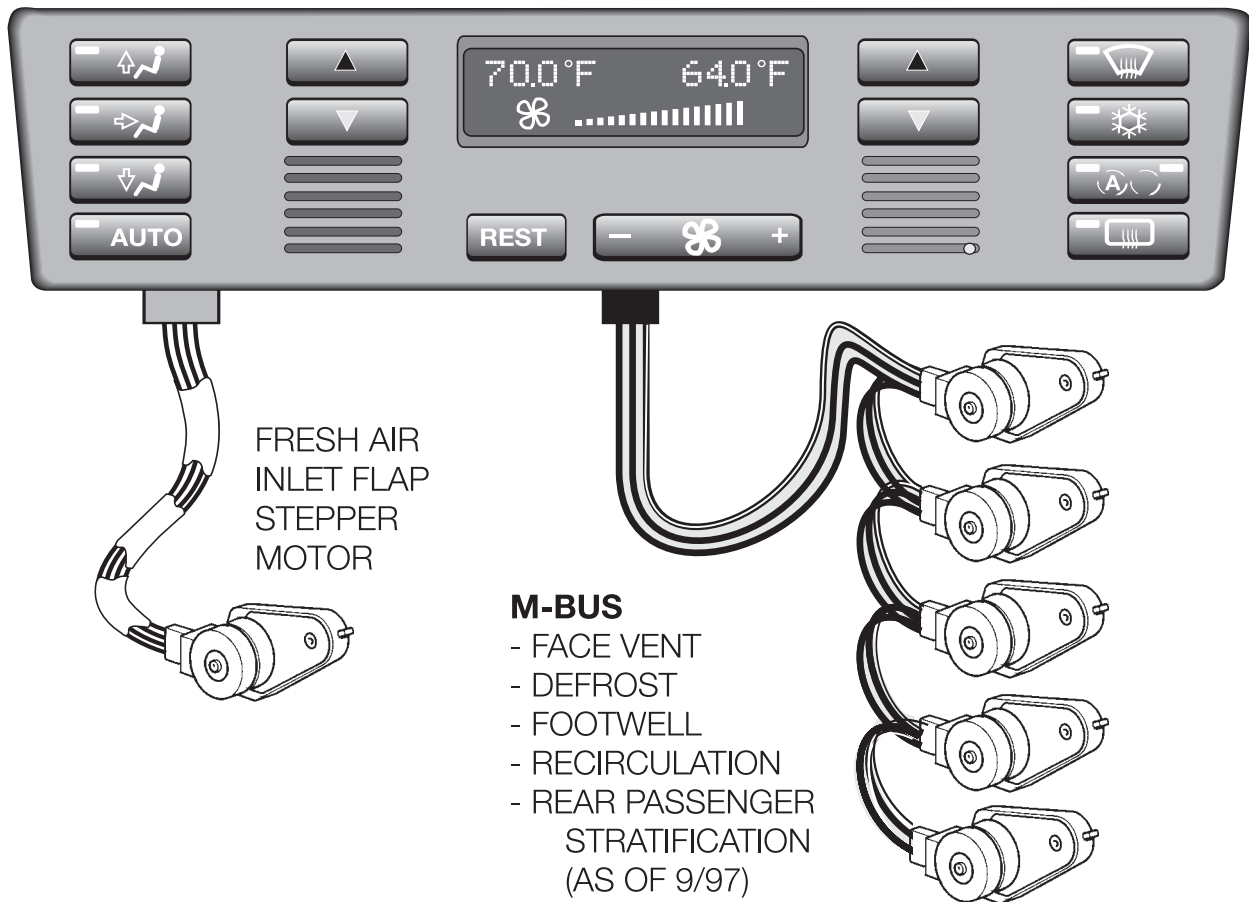
The stepper motor is operated by the control panel/module using information from the console rear outlet thumbwheels and the control panel/module buttons (left air distribution only).



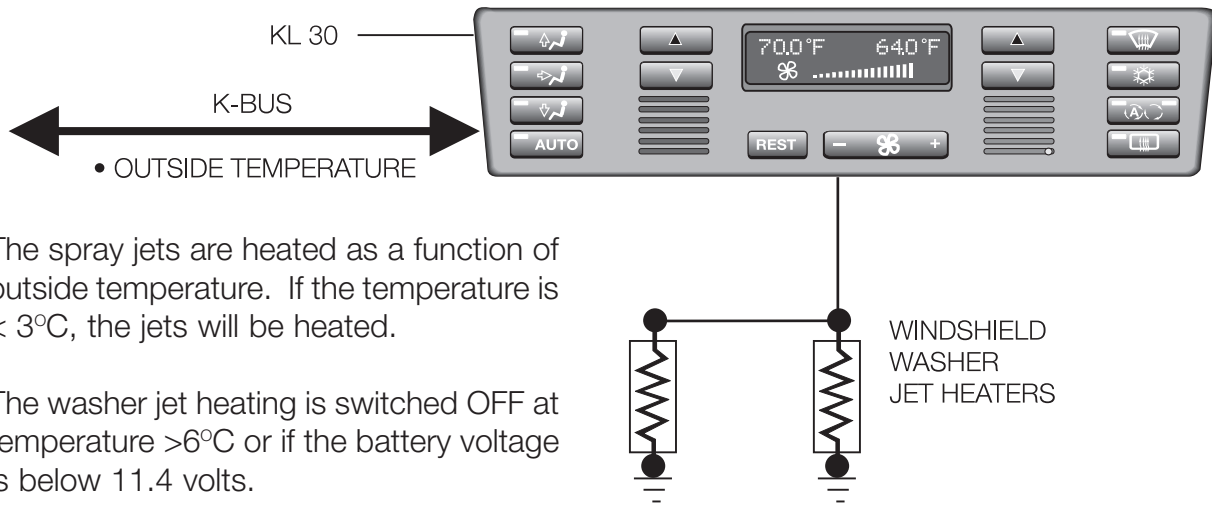
M BUS

Each M-Bussed motor is connected through a ribbon cable that contains three wires (power, ground and signal). A command for motor movement is sent over the signal wire and addressed to a specific motor. All of the motor processors receive the signal, but only the addressed motor will respond and move to the desired position.

Because of the unique address stored in the processor, all bussed motors have a unique part number and cannot be interchanged.



WINDSHIELD WASHER SPRAY-JET HEATING



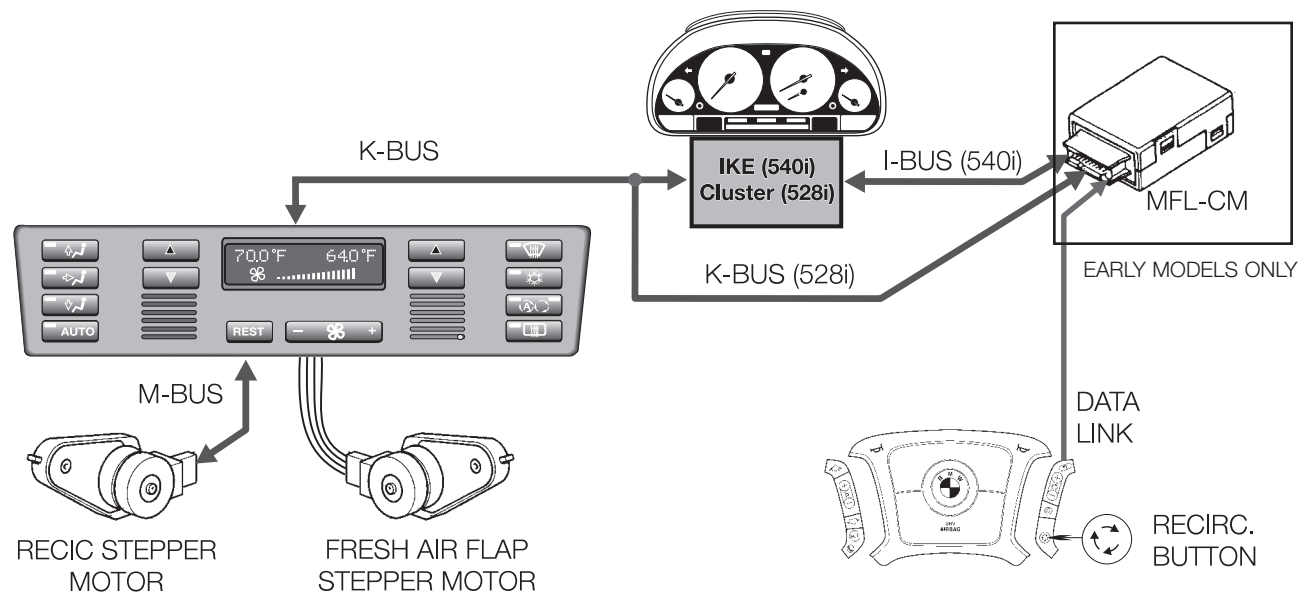
The spray jets are heated as a function of outside temperature. If the temperature is $< 3^{\circ}\text{C}$, the jets will be heated.

The washer jet heating is switched OFF at temperature $> 6^{\circ}\text{C}$ or if the battery voltage is below 11.4 volts.

MULTI-FUNCTION STEERING WHEEL - RECIRC BUTTON

The recirc button in the multi-function steering wheel communicates with IHKA over the I/K bus links. Pressing the button signals the IHKA to close the fresh air flap and open the recirc flaps or visa-versa.

If the heated steering wheel option is installed, the recirc button is deleted from the MFL.



AUTOMATIC RECIRCULATED AIR CONTROL (AUC)

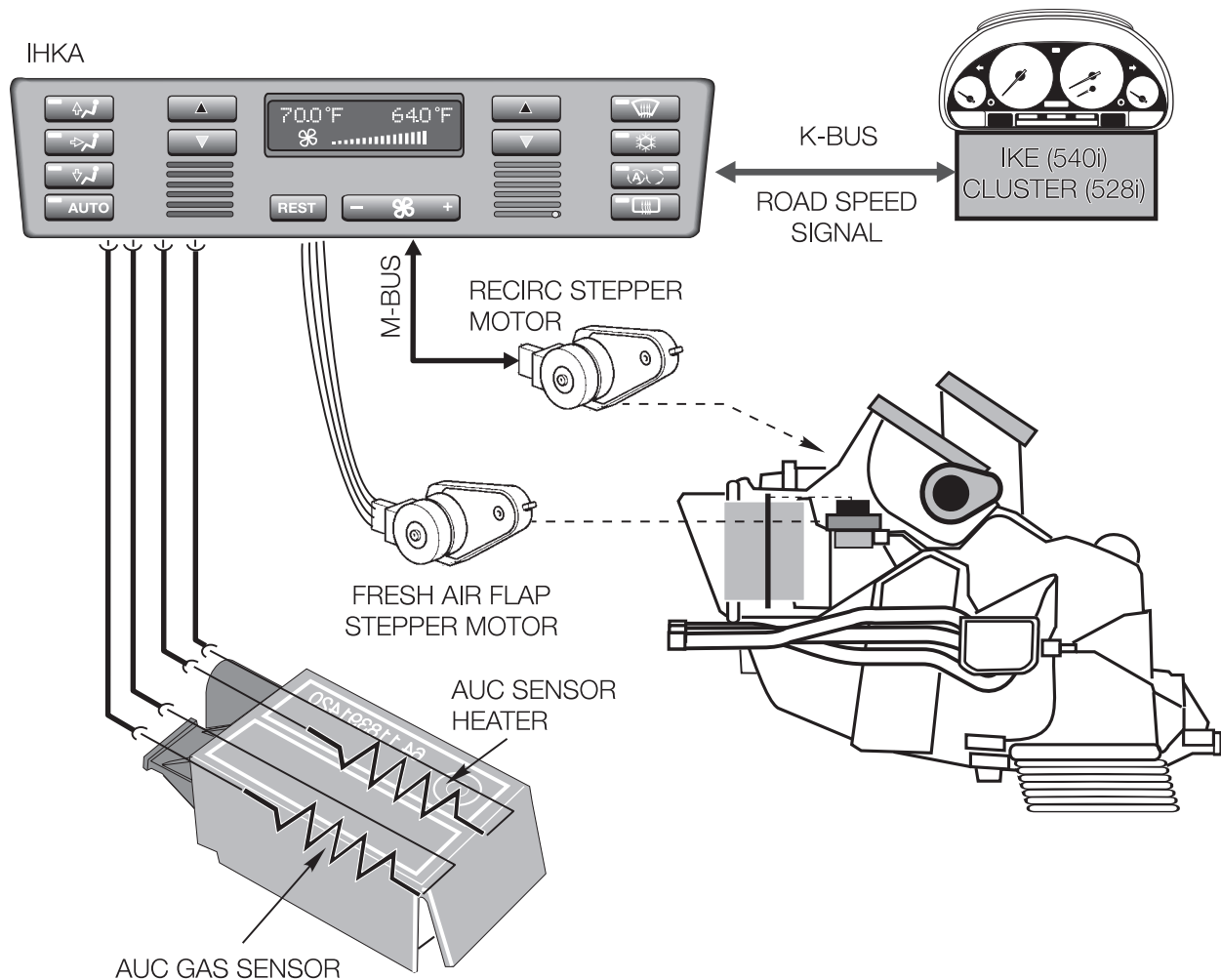
AUC functions the same as on the E38. The AUC sensor is positioned on the driver's side of the radiator shroud next to the radiator inlet hose. This location provides easy service access as well as an ideal position to monitor the levels of oxidizable gasses in the incoming air stream flowing through the radiator.

The sensor is heated to its operating temperature by the IHKA module. If the level of gasses exceeds a set threshold value, the recirc flaps are automatically opened.

When the level of noxious gasses drops, the fresh air flaps will again open.

AUC is subject to time limits to prevent glass fogging:

- 3 minute cycling when heating
- 12 minute cycling when cooling



IHKA PERSONALIZATION - E39

Important: Due to the variations in hardware and software, it is recommended that “Print List” is selected prior to programming. “Print List” will give an overview of the available Car and Key Memory options for that specific vehicle.

Car Memory Options Key Memory Options Programming Procedure

“Car Memory/Key Memory” is an additional step towards customization of a vehicle according to owner’s individual preferences. Those features are incorporated in ZCS Coding/Programming and the scope of customization of a vehicle.

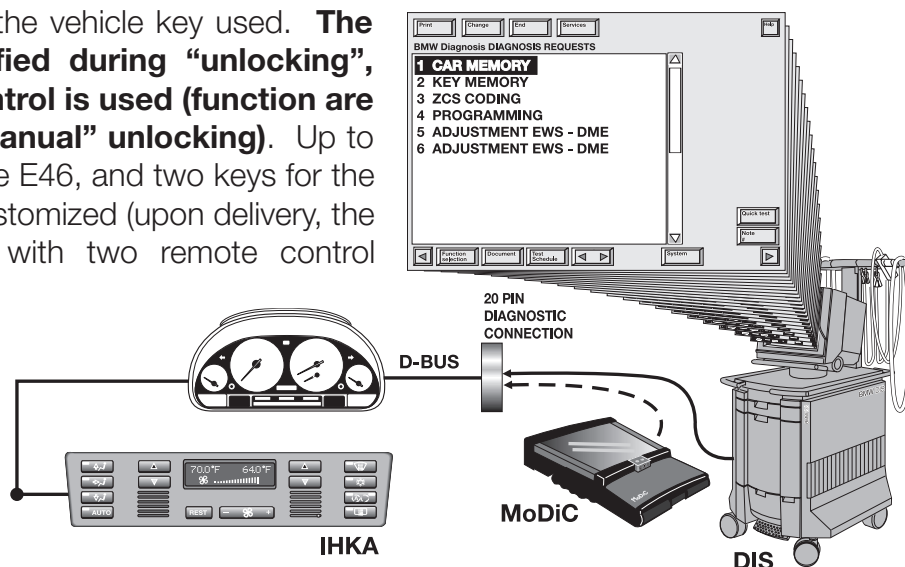
Heating/Air Conditioning/Ventilation			
Flaps			
Air recirculation memory	active =not active	Interior air is recirculated when cooling in “hot country” setting.	E38 1999 Model Year E39 1999 Model Year E38 prior to 9/98 E39 prior 9/98
Footwell closed when cooling E38 only	normal =hot country	Footwell flaps closed when cooling to allow more center vent air for maximum cold air in “hot country” setting.	E38 1999 Model Year E39 1999 Model Year E38 prior to 9/98
Defrost closed when cooling E38/E39 only	normal =hot country	Defrost vents closed to allow more center vent for maximum cold air in “hot country” setting.	E38 1999 Model Year E39 1999 Model Year E38 prior to 9/98
Ventilation when cooling	normal =hot country		E38 1999 Model Year E38 prior to 9/98
Blower			
Automatic blower speed operation E39 only	normal =hot country	More fan output during cooling when “hot country” is selected.	E39 1999 Model Year E39 prior 9/98
Air Recirculation	normal =hot country	A larger portion of cooler air is recirculated when “hot country” is selected.	E38 1999 Model Year E38 prior to 9/98
Key Selective*	=active not active	*This selection is not yet functional on the E39 but is listed.	E39 1999 Model Year

Diagnostic Software version 16.1 (DIS/MoDiC III) allows for the selection of “Car Memory” choices in E38 and E39s produced prior to 9/98 depending on the vehicle hardware/software status. “Key Memory” is **not** available for E38 and E39s produced prior to 9/98.

“Car Memory” includes functions which are activated regardless of the vehicle key being used.

“Key Memory” contains functions which can be different depending on the vehicle key used. **The vehicle key is identified during “unlocking”, only when remote control is used (function are inoperative during “manual” unlocking).** Up to four different keys for the E46, and two keys for the E38 and E39 can be customized (upon delivery, the customer is provided with two remote control transmitters).

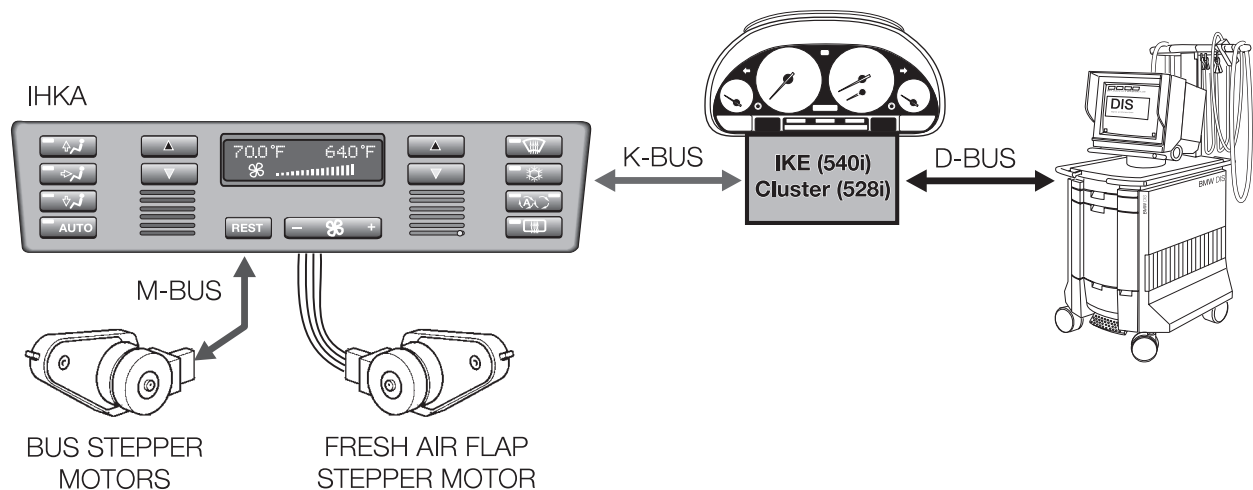
These features are programmed using the coding/programming function of the DIS/MoDiC.



DIAGNOSIS

The DIS tester and E39 software are used to troubleshoot and diagnose the IHKA system. The following displays and test programs are available, once the tester is connected and the diagnostic program is accessed:

- Testing based on a fault symptom
- Readout and testing based on the status list displays
- Simulation of outputs
- Readout and display of stored faults
- Testing/troubleshooting based on fault displays
- Canceling of the fault memory



Replacement values are stored in the control module that will allow the IHKA system to continue to function when various sensors fail. Output faults result in the switching off of the failed output.

The fault memory is contained in a non-volatile RAM so that any stored faults will not be canceled when the system is switched off or the battery is disconnected. A maximum of six faults can be stored in the fault memory.