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# E85 Heating / Air Conditioning System

**Model:** E85

**Production:** Start of Production MY 2003

## **Objectives:**

After completion of this module you will be able to:

- List the “visual” differences that identify IHKA from IHKS.
- Explain how are 3 sets of distribution flaps controlled by one stepper motor on the IHKS system.
- Access the microfilter for service.
- Diagnose a faulted interior temperature sensor blower (IHKA).
- Describe what occurs with the A/C compressor when MAX AC is switched off (IHKA).
- Understand how to deactivate Transportation Mode before vehicle delivery.

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## E85 Heating / Air Conditioning System

### Purpose of the System

This module describes the heating and air conditioning systems of the Z4. A differentiation is made between (depending on how the vehicle is equipped):

- Integrated heating and air conditioning control - **IHKS**
- Integrated automatic heating and climate control - **IHKA**

Compared to the predecessor (Z3), the optional IHKA including automatic recirculating air control AUC is a unique feature in the roadster.

In both variants, the control panel consists of three control zones each with a rotary knob. These are elevated from the instrument panel like "islands" to underscore the sporty characteristics and enhance the high grade appearance of the roadster. The rotary knobs feature precision adjustment and rotary function lighting.

Various function buttons that differ depending on IHKS/IHKA are integrated in the center "island."

### *Advantages at a glance:*

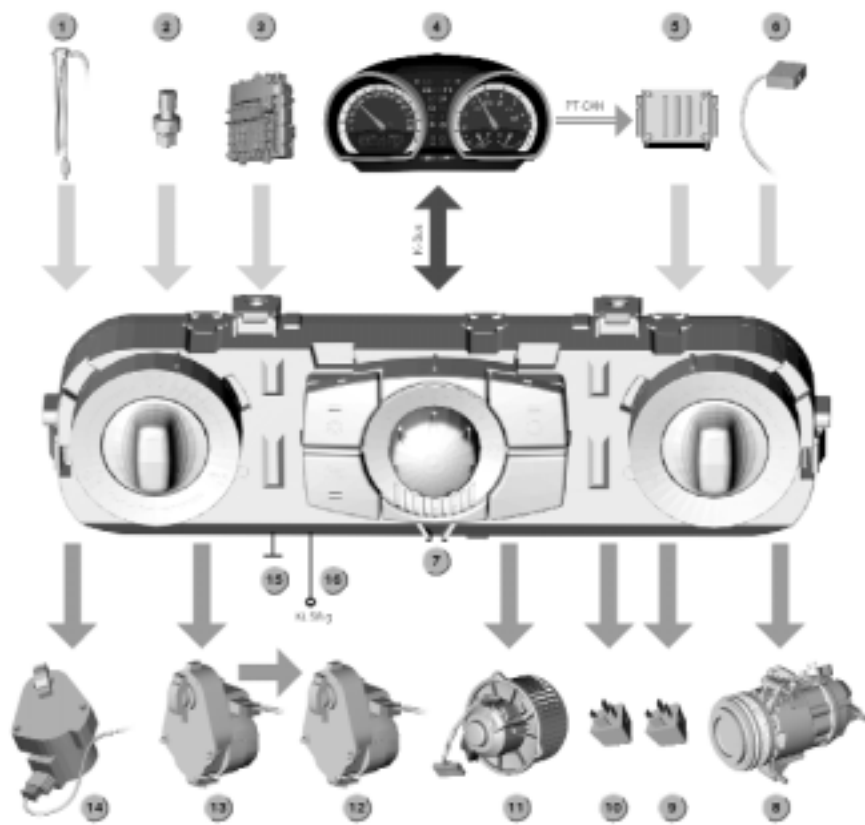
- Sporty and high grade control panel appearance.
- The island design provides clearly arranged and easy to use controls.
- Precision adjustment for air distribution, blower speed and temperature setting.
- Common parts concept implemented to a large extent.
- No water shut-off valve and auxiliary water pump due to airbased control.

### **IHKS System Components**

The IHKS system consists of following components:

- IHKS control panel/control module
- IHKS heater/air conditioner unit
- Refrigerant pressure sensor
- Evaporator temperature sensor
- A/C compressor
- Rear window defogger relay

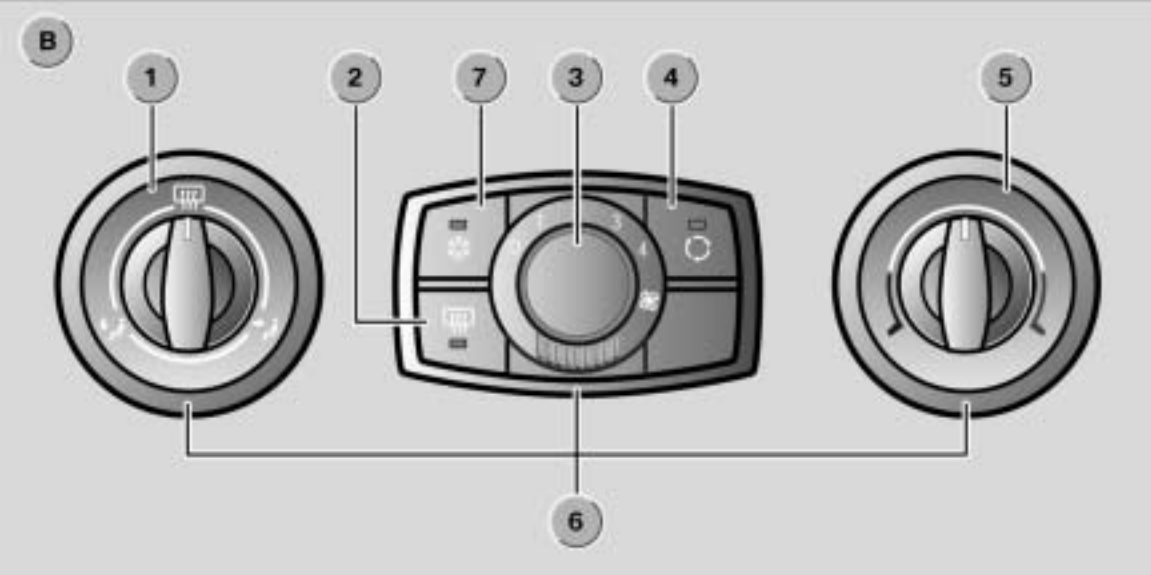
### System Overview of IHKS Input/Output Signals



Index	Explanation	Index	Explanation
1	Evaporator temperature sensor	9	Relay 1, rear window defogger
2	Refrigerant pressure sensor	10	Relay 2, rear window defogger
3	Fuse holder with terminal 30, R and 15	11	Blower output final stage and blower
4	Instrument Cluster	12	Stepper Motor, Mixed Air Flap
5	ECM (DME) Input signal	13	Stepper Motor, Air Distribution
6	Microswitch, cam disc	14	Actuator, Fresh air/recirculation air flap
7	IHKS Control Panel / Control Module	15	Ground (terminal 31)
8	Magnetic clutch for A/C compressor	16	Terminal 58g instrument lighting

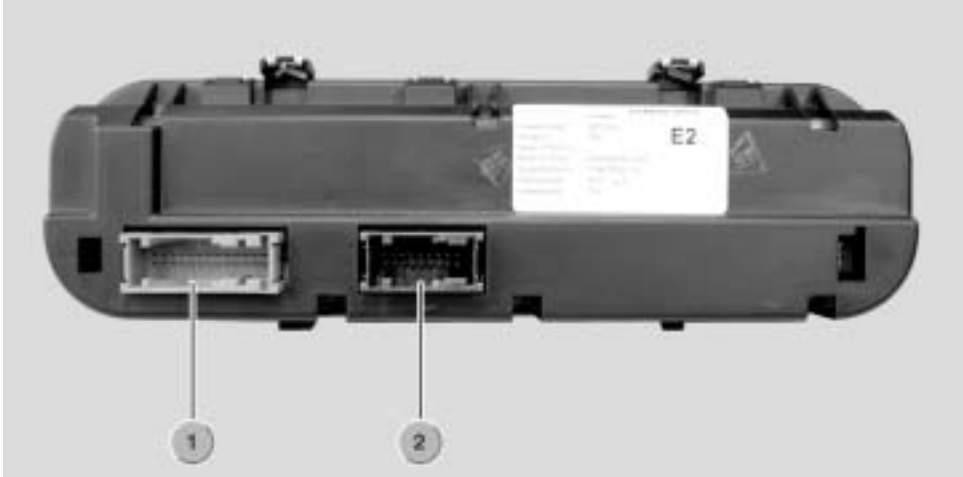
The variations of the IHKS system as compared to the IHKA are described in the following pages. IHKA is detailed later in this module.

**IHKS Control Panel/Control Module**



Index	Explanation	Index	Explanation
1	Rotary knob, air distribution	6	Trim rings (fitted from front)
2	Button, rear window defogger	7	A/C button
3	Rotary knob, blower setting		
4	Recirculating air button		
5	Rotary knob, temperature setting	B	IHKS Control Panel/Control Module

**Plug connection, rear of IHKS Control Panel/Control Module**



Index	Explanation
1	24-pin plug connection, vehicle electrical system
2	18-pin plug connection, heater/air conditioner

The rotary knob for **air distribution** (adjustment range of 360° rotation) features 3 rough settings and 9 fine settings.

The rotary knob for **blower control** (adjustment range of 104° rotation) provides the following setting options:

- 1 rough setting for zero position
- 8 fine settings for the 4 blower stages each with one intermediate stage

The rotary knob for **temperature control** (adjustment range of 244° rotation) provides the following setting options:

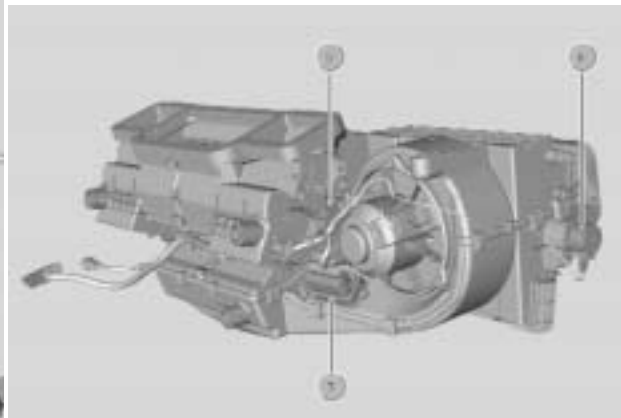
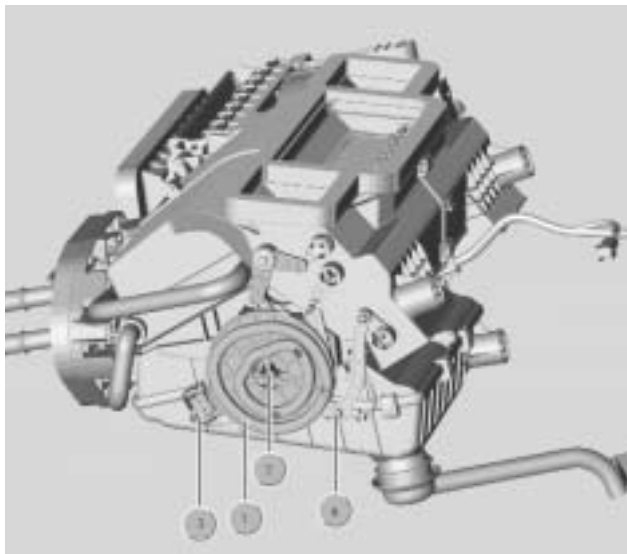
- 23 fine settings over the complete adjustment range from cold to warm.

**Note:** The rotary function light and the vehicle interior temperature sensor are features of the IHKA only.

### IHKS Heater/Air Conditioner

The following components are integrated in the IHKS heater/air conditioner unit:

- Actuator, fresh air/recirculating air flap
- Stepper motor, mixed air flap
- Stepper motor, air distribution
- Cam disc with microswitch
- Blower output final stage and blower motor
- Evaporator temperature sensor

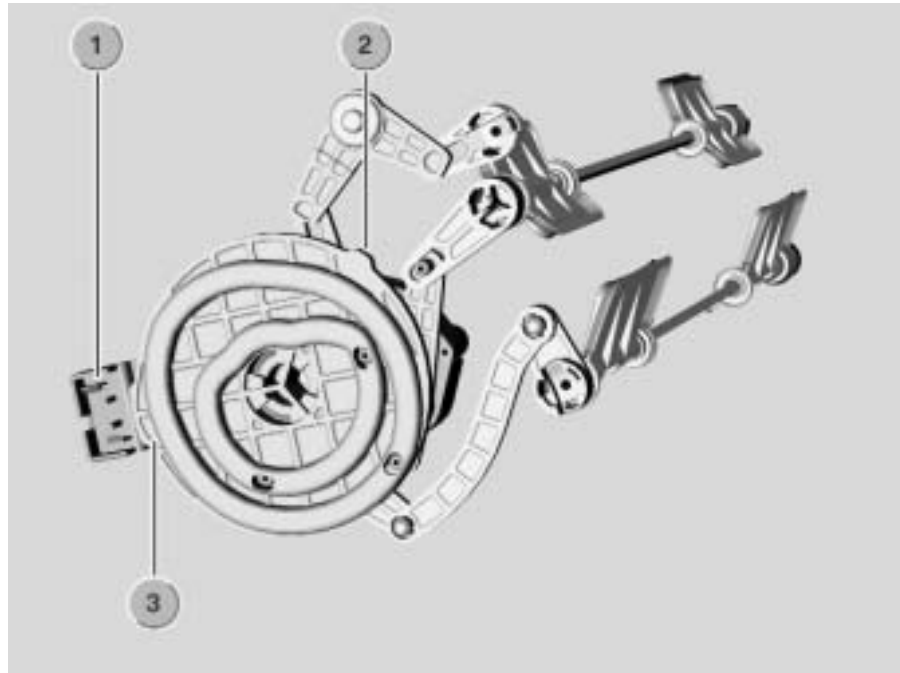


Index	Explanation	Index	Explanation
1	Cam disc	5	Stepper, motor, mixed air flap
2	Stepper motor, air distribution	6	Actuator, fresh air/Recirculation air flap
3	Microswitch	7	Blower output final stage
4	Evaporator temperature sensor		

The stepper motor for the air distribution and for adjusting the 3 air distribution flaps is mounted directly behind the cam disc. The Control module activates the stepper motor (corresponding to the required position) when the rotary control for air distribution is operated.

The cam disc moves the air distribution flaps by “central kinematics”. The actual position of the cam disc and stepper motor is detected by 2 small cams of different width that activate a microswitch. This microswitch provides feedback to the IHKS Control Module which corresponds to the air distribution flaps and their positions.

1. Microswitch
2. Narrow cam
3. Wide cam



After KL15 is switched “OFF” and a sleep mode of 10 minutes, the flaps are moved to the following end positions:

- Defrost flap dependent on outside temperature
  - > 10 °C CLOSED (50 °F),
  - < 10 °C OPEN (50 °F)
- Ventilation flap CLOSED
- Footwell flap CLOSED

**A calibration run** is carried out in the event of a system fault (e.g. implausible position of cam disc) to redetermine the position of the cam disc. The cam disc is moved until a cam trips the microswitch. Based on this position, a set position is specified and set in the control module.

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**A cam measurement (reference run)** takes place the first time the control panel/control module is operated after:

- Replacing the control panel/control module
- Replacing the cam disc
- Interruption in power supply

During this reference run, the length and distances of both cams with respect to each other are measured and stored in the control module. A fault code is stored if cam referencing cannot be concluded successfully after 3 attempts. In this case, adjustment of the central kinematics for air distribution is possible only within restricted limits.

## IHKS Principle of Operation

### Blower

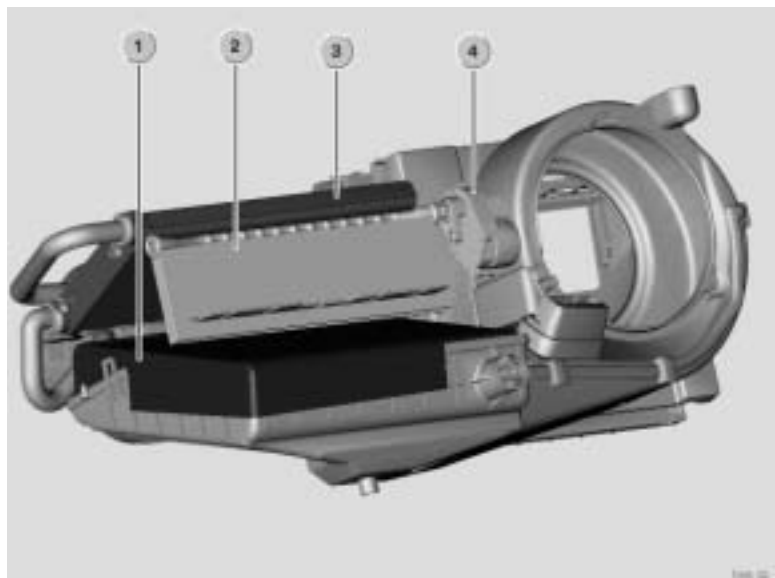
When KL15 is switched "ON", the blower is activated in linear progression from 0 to 8 Volts (depending on the selected blower speed). When the blower is switched "OFF" (zero position) the IHKS is deactivated in addition to the following:

- Blower switched off
- Fresh air/recirculating air flap closed
- Mixed air flap closed (to ensure the heat exchanger does not unnecessarily heat up the heater/air conditioner)
- Compressor switched off

**Note:** Rear window defogger can still be activated

### Temperature Control

1. Evaporator
2. Mixed air flap
3. Heat exchanger
4. Stepper motor, mixed air flap





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Warm and cold air are mixed for temperature control. The requested temperature is set by the rotary knob on the control panel/control unit. The outlet temperature is set by a stepper motor coupled to the mixed air flap.

The temperature is controlled by mixing:

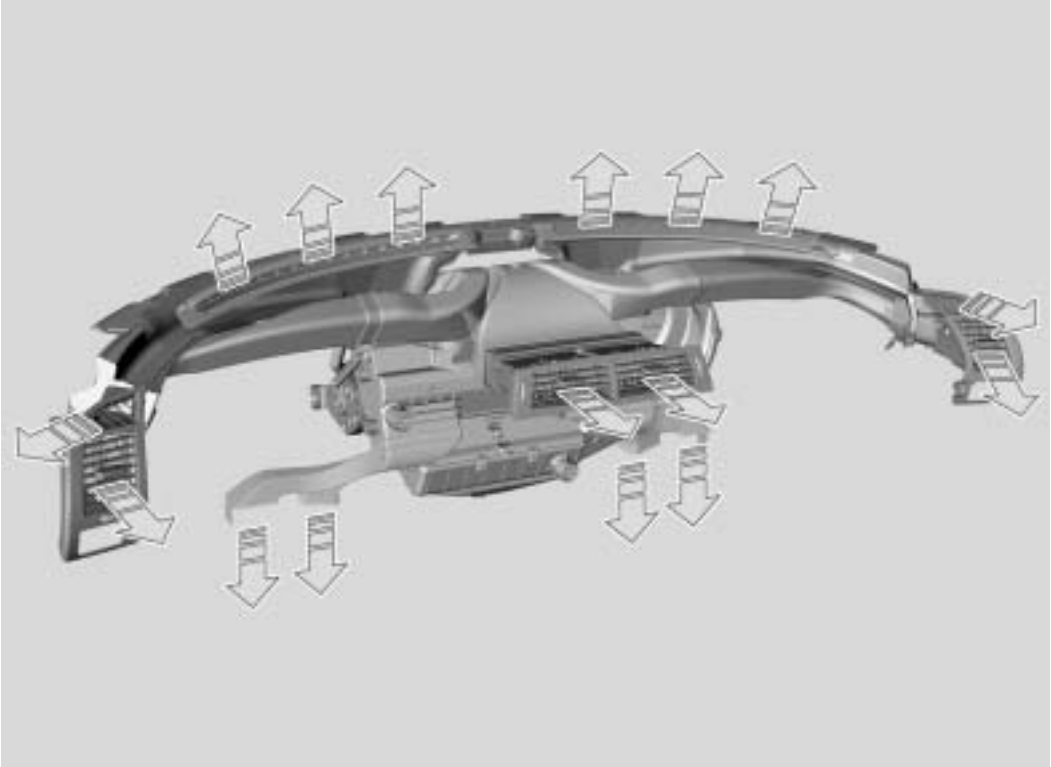
- Outside air that flows through the evaporator = cold air
- Outside air that initially flows through the evaporator and then through the heat exchanger (reheat) = warm air

**Note:** Changes in engine rpm do not trigger any temperature adjustments.

**Air Distribution**

The individual setting for the air distribution is requested with the rotary knob on the control panel. The main flap settings are:

- "Defrost"
- "Ventilation"
- "Footwell"



The central kinematics stepper motor adjusts the cam disc for air distribution.

**Notes:** \_\_\_\_\_  
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## Air Volume Control

The air volume is controlled based on the position of the fresh air/recirculating air flap and blower speed. There is 1 flap at the fresh air inlet and 2 flaps for recirculating air control. The actuator for the fresh air/recirculating air flap adjusts these 3 individual flaps by a coupling linkage.

The system assumes recirculating air mode after pressing the recirculating air button. The fresh air inlet is closed and the recirculating air channel opened. The actuator for the fresh air/recirculating air flap is not a stepper motor. Its position is determined based on the activation of 4 phases.

*Notes:*

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## IHKA

Compared to the IHKS, the integrated automatic heating and climate control (IHKA) offers the advantage of automatic adaptation for:

- Air volume control
- Temperature control
- Air distribution control



These control functions are calculated by the IHKA control module from the inputs, characteristic curves and monitored via temperature sensors. The IHKA in the E85 differs from the previous BMW systems (digital displays) in that it features an analogue control panel.

Special functions such as Defrost, Fresh air/AUC/recirculating air etc. are also controlled by the IHKA control module. The IHKA control panel and control module form one component.

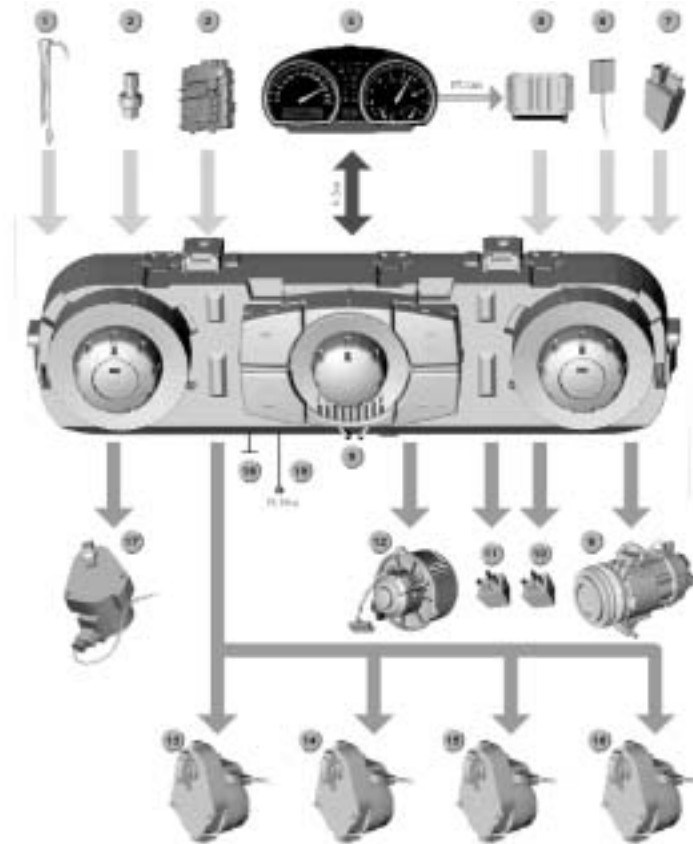
## IHKA System Components

The IHKA consists of following components:

- Control panel/control module
- Heater/air conditioner unit
- AUC sensor
- A/C compressor
- Refrigerant pressure sensor
- Rear window defogger relay

**Note:** The solar sensor is not available on the E85 IHKA system.

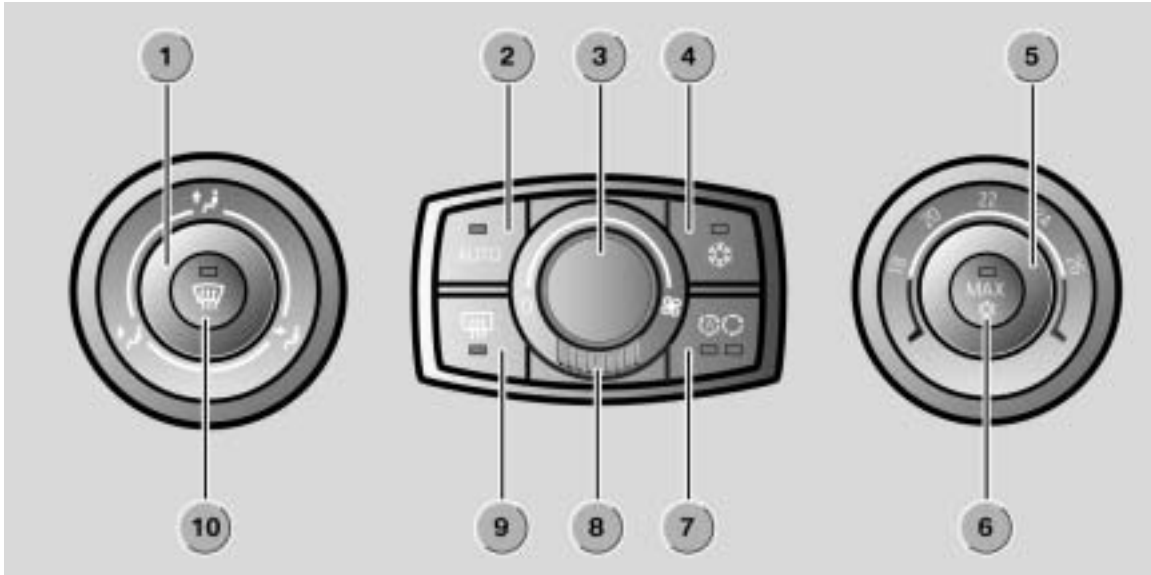
## System Overview of IHKA Input/Output Signals



Index	Explanation	Index	Explanation
1	Evaporator temperature Sensor	11	Relay 2, Rear Window Defogger
2	Refrigerant pressure sensor	12	Blower Output Final Stage and Blower
3	Power Distribution Box with Terminal 30, R and 15	13	Stepper Motor, Mixed Air Flap
4	Instrument Cluster	14	Stepper Motor, Air Distribution, top (defrost)
5	Digital Motor Electronics (ECM)	15	Stepper Motor, Air Distribution Center (ventilation)
6	Temperature Sensor, Mixed Air	16	Stepper Motor, Air Distribution, bottom (footwell)
7	AUC Sensor (Automatic Recirculation Air Control)	17	Actuator, fresh air/recirculation air flap
8	IHKA Control Panel/Control Module	18	Ground
9	Magnetic Clutch, A/C Compressor	19	Terminal 58g Instrument Lighting
10	Relay 1, Rear Window Defogger		

## IHKA Control Panel/Control Module

The IHKA control panel/control module is one component and is located in the center of the instrument panel under the radio/navigation control panel (above the center console switch center).



Index	Explanation	Index	Explanation
1	Rotary Knob, Air Distribution	6	MAX AC Button
2	AUTO Button	7	AUC/Recirculation Air Button
3	Rotary Knob, Blower Setting	8	Opening For Ventilated Interior Temperature Sensor
4	A/C Button	9	Rear Window Defogger Button
5	Rotary Knob, Temperature Setting	10	Defrost Button

## Plug connection, rear of IHKA Control Panel/Control Module



Index	Explanation
1.	24-Pin Plug Connection to Vehicle Electrical System
2.	18-Pin Plug Connection to Heater/Air Conditioning

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The 3 control elements of the control panel/control unit are enclosed by trim rings. These trim rings are clipped into the instrument panel from the front and can be replaced separately.

The rotary knob for *air distribution* (adjustment range of 360° rotation) features 3 main settings and 10 precision settings in between.

The rotary knob for *blower speed* (adjustment range of 180° rotation) features 1 main notch for the zero setting. There are 14 precision settings from the zero position up to the maximum setting.

The rotary knob for *temperature setting* (adjustment range of 240° rotation) has 2 main settings (maximum cold/maximum warm) with 23 precision settings in between. Temperature setting range:

- Maximum cold (corresponds to 60 °F)
- Individual temperature setting range (in steps of 1 °F)
- Maximum warm (corresponds to 84 °F)

The following buttons feature a green function light (LED): AUTO, A/C, MAX AC. The button for AUC/recirculating air has 2 green function lights (LEDs).

The rear window defogger and defrost buttons feature an orange colored function light (LED). When the vehicle lights are switched on, the indicator lights are activated via terminal 58g. The signal comes from the light switch center (LSZ).

The locator lights and function lights are dimmed corresponding to the dimmer control wheel position on the light switch center and/or depending on the ambient light conditions (photocell in light switch center).

## Rotating function light

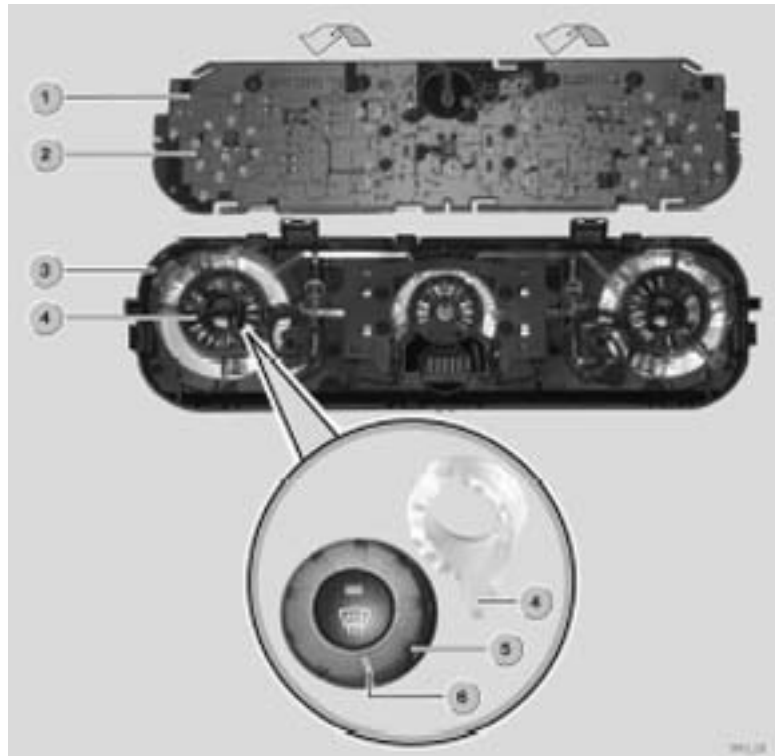
A special feature of the IHKA is the rotary function light in all three knobs. For example; the rotary knob for air distribution has an adjustment range of 360° rotation. 8 LEDs are located on the pc-board (under the knob) at its circumference to ensure it can be seen clearly from different viewing directions.

A light element is located in the rotary knob (connected mechanically) and turns together with it.

The light element functions as a light guide. It bundles the light of the LEDs and, due to its geometrical shape, guides it to the light outlet window of the rotary knob.

This ensures the full light intensity is always emitted at the light outlet window.

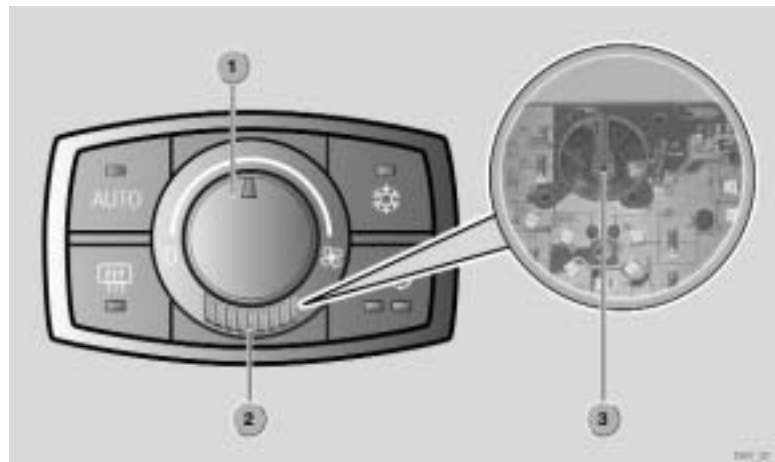
1. PC-board
2. 8 circumference LEDs
3. IHKA control housing
4. Light element
5. Rotary knob, air distribution
6. Light outlet window



## Interior Temperature Sensor

A ventilated interior temperature sensor is located in the IHKA control panel. The integrated sensor blower is activated when KL15 is switched "ON". The sensor blower continues to run for 10 minutes after KL15 is switched "OFF".

1. Rotary knob, blower setting
2. Interior temperature sensor grill opening
3. Interior temperature sensor (pc-board mounted NTC)



The afterrunning period is necessary to keep the interior temperature reading "fresh".

Otherwise, when the vehicle is parked for a short period of time (e.g. refuelling), due to interior heat build up, the sensor would supply an incorrect value for the interior temperature.

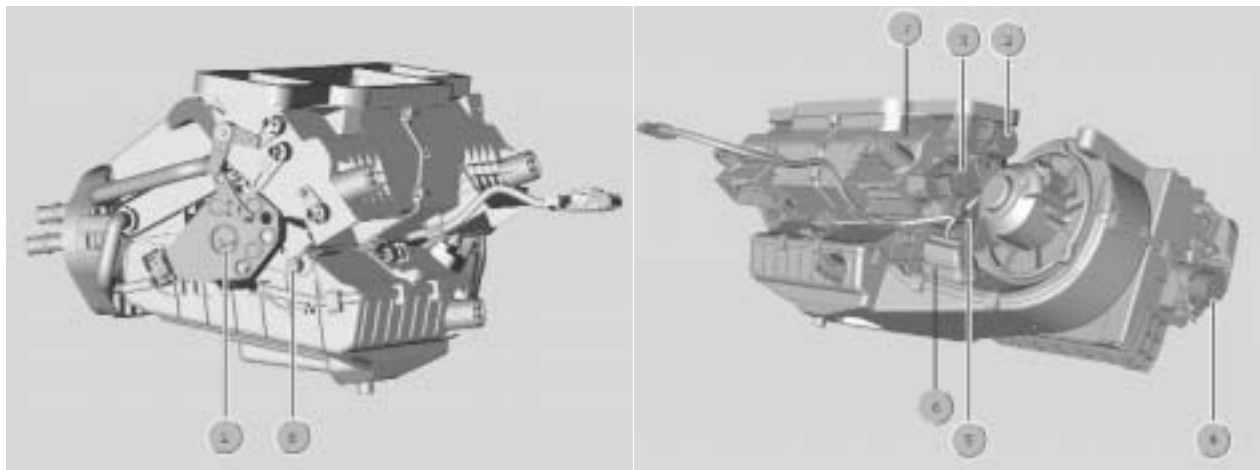
The vehicle interior temperature sensor has a value range from -49 °F to 176 °F. The evaluation range of the vehicle interior temperature sensor is between 41 °F and 122 °F. Values below -49 °F are stored as a short to B+ or a break. Values above 176 °F are stored as a short to B-. The substitute value is 68 °F.

The sensor blower is not monitored. In the event of a fault, this will influence the temperature control (regulation). An implausible temperature value may be supplied when the vehicle interior heats up.

### IHKA Heater/Air Conditioner

The following components are integrated in the IHKA heater/air conditioner:

- Actuator, fresh air/recirculating air flap
- Stepper motor, air distribution, bottom
- Stepper motor, air distribution, center
- Stepper motor, air distribution, top
- Stepper motor, mixed air flap
- Temperature sensor, mixed air
- Blower output final stage and blower motor
- Evaporator temperature sensor



1	Stepper Motor Air Distribution, (defrost)	5	Stepper Motor, Mixed Air Flap
2	Stepper Motor, Air Distribution, Center (Ventilation)	6	Blower Output Final Stage
3	Stepper Motor, Air Distribution, (footwell)	7	Temperature Sensor, Mixed Air
4	Actuator, fresh air/ Recirculating Air Flap	8	Evaporator Temperature Sensor



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## Stepper Motors

The number of steps of the individual stepper motors depends on the adjustment range of the driven flap as follows:

- Defrost, maximum number of steps 900, fail safe direction *flap open*
- Center ventilation, maximum number of steps 1390, fail safe direction *flap closed*
- Footwell, maximum number of steps 1600, fail safe direction *flap closed*
- Mixed air flap, maximum number of steps 1770, fail safe direction *maximum warm*

The flaps are moved to their limit stops after KL15 is switched "OFF". The stepper motors are not able to detect their actual position. The stepper motors always move relative to a reference point. A flap end position (0% or 100%) serves as this reference point.

## Evaporator Temperature Sensor

The evaporator temperature sensor is installed on the heater/air conditioner to measure the temperature of the air flowing out at the evaporator.

The evaporator temperature sensor has a maximum value range from -49 °F to 214 °F. The evaluation range of the evaporator temperature sensor is between 23 °F and 77 °F. Values below -49 °F are stored as a short to B+ or a break. Values above 214 °F are stored as a short to B-. The substitute value is 32 °F.

## Mixed Air Temperature Sensor

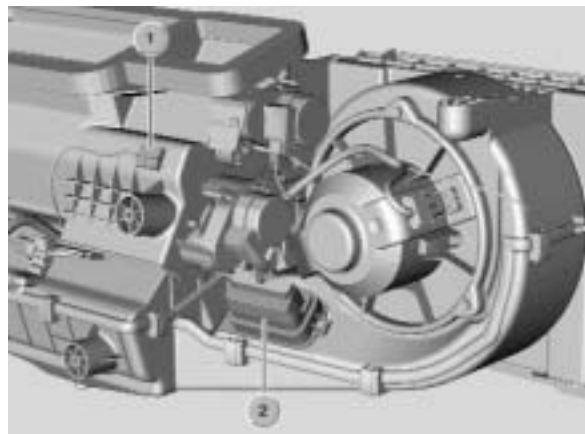
A mixed air temperature sensor is installed on the heater/air conditioner after the mixed air flap to measure the mixed air temperature.

The mixed air temperature sensor has a value range from -40 °F to 221 °F.

Values below -40 °F are stored as a short to B+ or a break.

Values above 221 °F are stored as a short to B-. The substitute value is 131 °F.

1. Temperature sensor, mixed air
2. Blower output final stage



## Blower

The radial blower in the Z4 is mounted transversely in the heater/air conditioner. The blower is activated when KL15 is switched "ON", corresponding to the function previously selected (DEFROST, MAX AC, automatic blower function, individual blower setting).

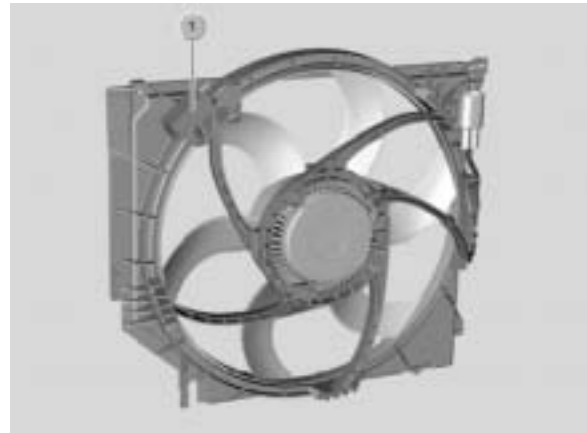
Blower activation takes place in linearly from 0 to 8 Volts. The IHKA is deactivated when the blower is switched "OFF" (zero position). The blower activation is infinitely variable in AUTO mode. The following 5 settings are possible for blower activation:

- Blower "OFF" (zero position)
- Individual blower setting
- Automatic blower (AUTO mode)
- DEFROST/MAX AC function with automatic blower setting
- DEFROST/MAX AC function with individual blower setting

## AUC Sensor

In automatic recirculating air control (AUC mode), pollutant gasses are detected by the AUC sensor. Based on this input, the IHKA decides whether the system is to assume fresh air mode or recirculating air mode.

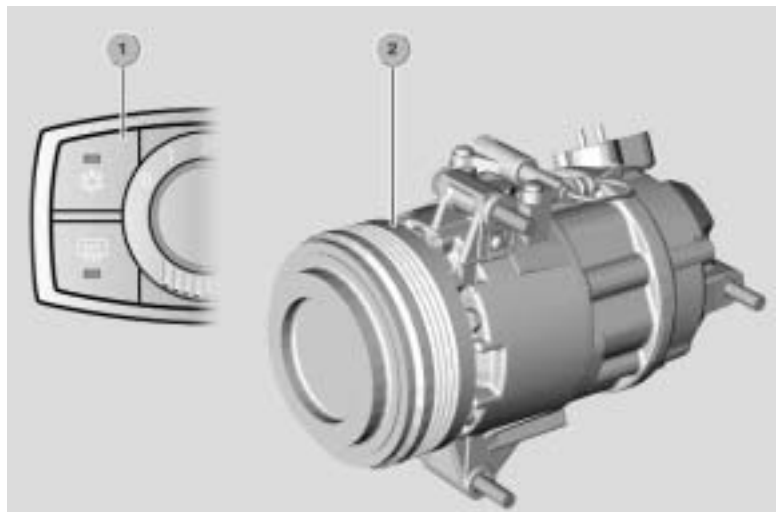
The AUC sensor requires a warm up phase of 90 seconds. The AUC sensor is located on the intake shroud of the electric cooling fan (1).



## A/C Compressor

The magnetic clutch for the A/C compressor is activated directly by the IHKA control module.

1. A/C button on the IHKA control panel/  
control module
2. A/C compressor



Air conditioning mode is activated by pressing the A/C button. The ECM is signalled to increase the idle speed to compensate for the compressor load. On receiving the "A/C compressor ON" request from the IHKA control module, the ECM responds with an enable signal on a separate control wire providing no full load cutout request is active. Consequently, the IHKA control module activates the A/C compressor magnetic clutch.

Switching conditions for the A/C compressor magnetic clutch:

**A/C Compressor "ON"**

- A/C button pressed *and*
- Evaporator temperature > 2 °C (depending on outside temperature) *and*
- Outside temperature > - 10 °C *and*
- System voltage > 9.7 V *and*
- Permissible refrigerant pressure range

**A/C Compressor "OFF"**

- Evaporator temperature < -0.5 °C (depending on outside temperature) *or*
- Blower "OFF" (zero position) *or*
- Outside temperature < -10 °C *or*
- KL15 switched "OFF" *or*
- System voltage < 9 V *or*
- Refrigerant pressure out of range (too low/high)

The current "Air conditioning ON" function is stored in the IHKA when KL15 is switched "OFF". Derived from the key memory (personalization), the function last selected is activated when KL15 is switched "ON".

**Pressure Monitoring**

The pressure in the refrigerant circuit is monitored by a pressure sensor. The anticipated A/C compressor load when switching on during operation is derived from the pressure sensor signal.

The load torque is transferred via the K-bus and PT-CAN bus to the ECM. The ECM responds by adapting air and fuel volume. An upper and lower switching threshold is defined for pressure monitoring:

Low Pressure	High Pressure
OFF <1.5 bar	OFF >32.0 bar
ON > 2.0 bar	ON < 24.0 bar

The pressure sensor is fitted in the pressure line near the receiver/dryer. The supply voltage is 5 V and the current is < 20 mA.

Depending on the system pressure, it supplies the IHKA control module with an analog signal between 0.4 V and 4.6 V.



## Rear Window Defogger

The rear window defogger has 3 operating statuses. Relay 1 for the rear window defogger is always activated as if a hardtop were installed (no hardtop detection).

**Defrost Phase** is started only after the first time the rear window defogger button is pressed after KL15 is switched "ON" (see following table for duration). Relay 2 for the rear window defogger is activated at a rate of 100%. The system then assumes cyclic switching mode.

**Cyclic Switching** takes place with one third of the total power output of the rear window defogger (pulse/pause ratio = 40 seconds ON/80 seconds OFF). Cyclic switching is deactivated when KL15 is switched "OFF".

**Restart** is possible if the rear window does not remain clear during or after cyclic switching. The full power output can be resumed by pressing the rear window defogger button again. The reheating phase is again followed by cyclic switching.

Operating Status	Defrost Phase	Cyclic Switching	Restart
Duration	10 minutes (outside temperature >15°C) 17 minutes (outside temperature < -15°C)	30 minutes	5 minutes
Function Light (LED)	ON	OFF	ON
Under Voltage Monitoring	Inactive	Active	Active
KL15 switched Off and On again during afterrunning period (sleep mode)	As before KL15 switched off	OFF	As before KL15 switched Off

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## **Rear Window Defogger Undervoltage/Overvoltage Monitoring**

To prevent discharge when the vehicle electrical system is subject to high load at low engine speeds (< 1500 rpm), the rear window defogger relays are switched off when the voltage level drops or in the event of overvoltage (> 16 Volt for 5 seconds).

If the system voltage at the IHKA drops below 11.4 Volts, the rear window defogger is switched off and only switched on again when the system voltage exceeds 12.2 Volts. The threshold values must be applied for longer than 10 seconds.

Switching off the relays when undervoltage/overvoltage is detected has no influence on the duration of the operating statuses (defrost phase, cyclic switching, restart) and the function light (LED) remains on while the relays are switched off.

The rear window defogger is also switched off during engine start up (K-bus message, KL50).

## **IHKA Principle of Operation**

### **AUTO Mode**

The following examples will be observed when operating the air distribution and the blower controls:

- A high blower speed is set manually by the blower knob.
- When AUTO mode is selected, as the result of the previous manual setting, the rotary knob is still set to high.
- Due to AUTO mode, the blower runs at medium speed.
- If the blower output is now to be increased slightly by turning the knob to the right, a very large change occurs with the blower output.

### **Automatic Temperature Control**

The temperature is controlled by mixing:

- Outside air that flows through the evaporator = cold air
- Outside air that initially flows through the evaporator and then through the heat exchanger (reheat) = warm air

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While mixing the air, the IHKA temperature control determines a set position for the mixed air flap to maintain the requested interior temperature. This set position is determined from the inputs of:

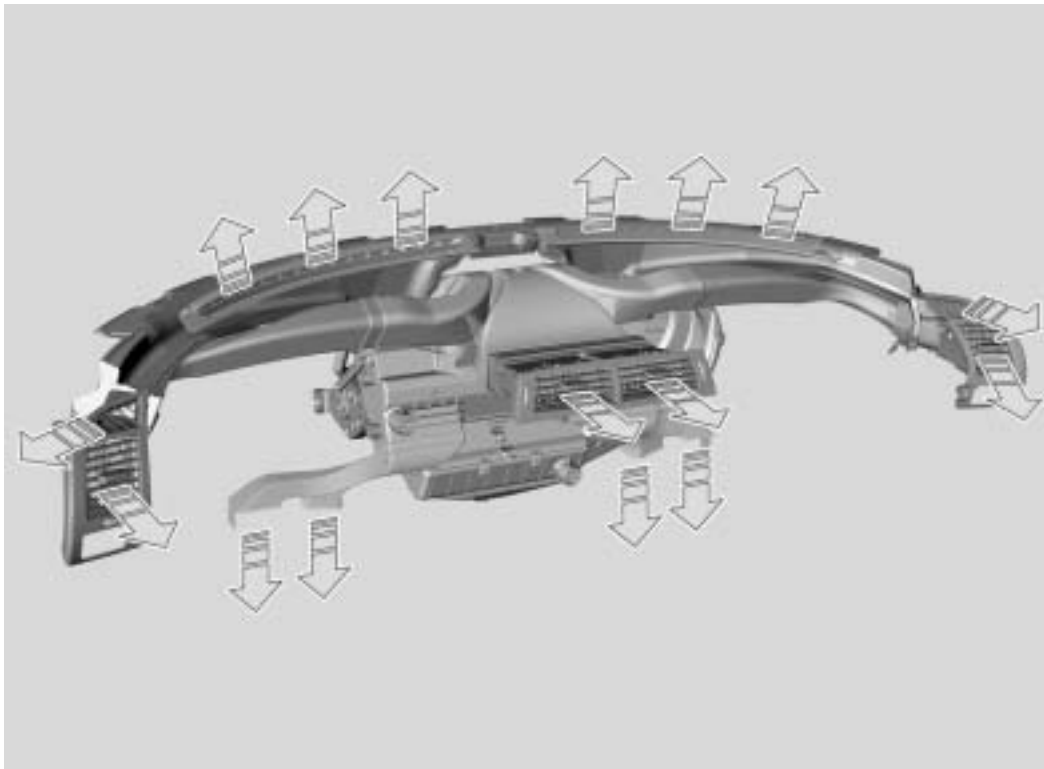
- Vehicle interior temperature sensor
- Temperature sensor, mixed air
- Evaporator temperature sensor

The outside temperature and the coolant temperature are also used (transferred via K-bus from the instrument cluster).

### **Automatic Air Distribution Control**

There are 2 setting options for the air distribution:

- Individual setting of the air distribution
- Automatic air distribution (AUTO button)



The function light in the rotary knob for air distribution goes out when the AUTO button is pressed. The IHKA control module sets the optimum air distribution corresponding to various inputs. Automatic blower mode remains active if the air distribution rotary knob is turned manually during automatic air distribution. The function light in the AUTO button goes out.

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## Automatic Air Volume Control

The air volume is controlled based on the position of the fresh air/recirculating air flap and the blower speeds. The fresh air/recirculating air flap (a total of 3 individual flaps) is powered by an actuator.

The recirculating air mode is activated by pressing the AUC/recirculating air button. The fresh air inlet is closed and the recirculating air channel opened. Air volume control features a dynamic pressure compensation function.

The automatic blower and flap function as well as the function LED "AUTO" is activated by pressing the AUTO button. The IHKA control unit sets the optimum blower speed and position of the fresh air/recirculating air flap depending on various inputs.

## Special Functions

### MAX AC

The MAX AC function allows the user to request maximum cooling capacity with the simple push of a button. The prerequisite is that the outside temperature is  $> 50^{\circ}\text{F}$ . The MAX AC function is deactivated by pressing another button or turning a rotary knob.

In the MAX AC function, the blower speed can be adjusted manually without exiting the MAX AC function. When ending the MAX AC function, the settings that were active before MAX AC are resumed.

The A/C compressor remains switched on after ending the MAX AC function. **Exception:** The A/C compressor is switched off when the MAX AC function is switched off via the A/C button.



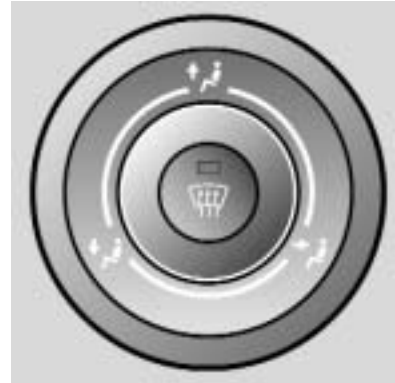
### DEFROST

Under certain circumstances the windows can fog up while driving (high humidity levels in the vehicle interior). The DEFROST function can quickly remedy this situation by preventing misting of the front field of vision. The DEFROST function assumes a higher ranking role in air distribution control.

The DEFROST function can be activated as required even when IHKA is switched off (blower zero position). The blower runs at full power. The blower output can be adjusted manually in DEFROST mode.

If KL15 is switched "OFF" with the DEFROST function active, the DEFROST function is activated again KL15 is switched "ON" within the afterrunning period (10 minutes).

The defrost function is deactivated by pressing another button or turning a rotary knob. When ending the DEFROST function, the settings that were active before DEFROST are resumed.



### AUC/Recirculating Air

Automatic recirculating air control (AUC) is a standard feature on E85 vehicles with IHKA. Initially, the AUC function is activated when the AUC/recirculating air button is pressed in fresh air mode.

Pressing the button again activates the recirculating air mode. Pressing the button once again returns to fresh air mode. Recirculating air mode and AUC mode are indicated by green function lights (LEDs) on the control panel.



As was the case with previous heating/air conditioning systems, the AUC/recirculating air function also features "forced ventilation with fresh air," the activation and duration of which depends on whether the system is in A/C mode (compressor active). The fresh air is already dehumidified if the A/C compressor is ON, therefore, the duration of recirculating air mode is longer.

"Forced ventilation" cycles:

A/C Button	Cycle
Off	3 minutes recirculating air 1 minute fresh air
ON	12 Minutes recirculating air 1 minute fresh air



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## **Cold Start Interlock**

The cold start interlock function intervenes in activation of the air distribution flaps and blower control. The cold start interlock is active at low outside temperatures and low coolant temperatures (engine cold) to prevent cold air distribution until warm air is available.

In the E85, the cold start interlock is not deactivated by a terminal change from KL15 "ON" to "OFF". When the switch on conditions are fulfilled, the defrost air distribution flap is fully opened and the ventilation and footwell air distribution flaps are completely closed. As a result, no cold air is blown directly at the driver/passenger.

The automatic blower function must be selected for intervention in blower control.

## **Cooling Mode**

Cooling mode serves the purpose of cooling a heated vehicle by forced air recirculation at high outside temperatures. Cooling mode is active during engine start and applies both in AUTO mode and manual mode. The A/C compressor must also be activated.

Cooling mode supersedes the AUC function. If the signal from the AUC sensor specifies fresh air mode, recirculating air mode is retained or set to a fresh air share of 20% when cooling mode is active.

An E85 feature is that cooling mode is extended from 12 to 15 minutes in tropics coding (hot country). When the control variable (y-factor) is below -90%, the fresh air/recirculating air flap is set to recirculating air for maximum 12 minutes. As a result, warm air is not blown directly at the driver/passenger.

After this period of 12 minutes has elapsed, if the control variable is below -90%, the fresh air/recirculating air flap is set to 20% fresh air.

## **Avoiding Fogging During Start**

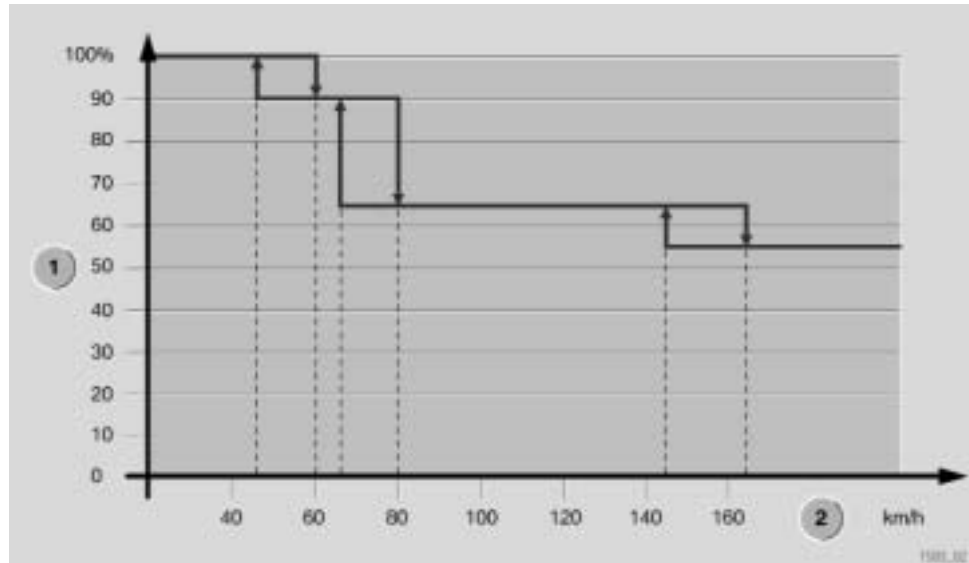
This function is activated once with KL15 "ON" in automatic mode. The prerequisite is that the outside temperature is above 32 °F. The defrost air distribution flap is closed for 12 seconds. Consequently, windshield fogging caused by moist air from the evaporator is avoided.

This function is superseded by the cold start interlock. In this case, all air distribution flaps are closed.

## Dynamic Pressure Compensation

To prevent uneven air volume as driving speeds vary, dynamic pressure is compensated by the fresh air flap reducing the fresh air inlet opening as the vehicle speed increases. The vehicle speed is made available via the K-bus from the instrument cluster. The fresh air flap reduces the opening angle within a certain speed range according to a characteristic curve. The calculation of the flap position is dampened to avoid continual flap activation as a result of variations in vehicle speed.

1. Fresh air flap opening angle
2. Vehicle speed

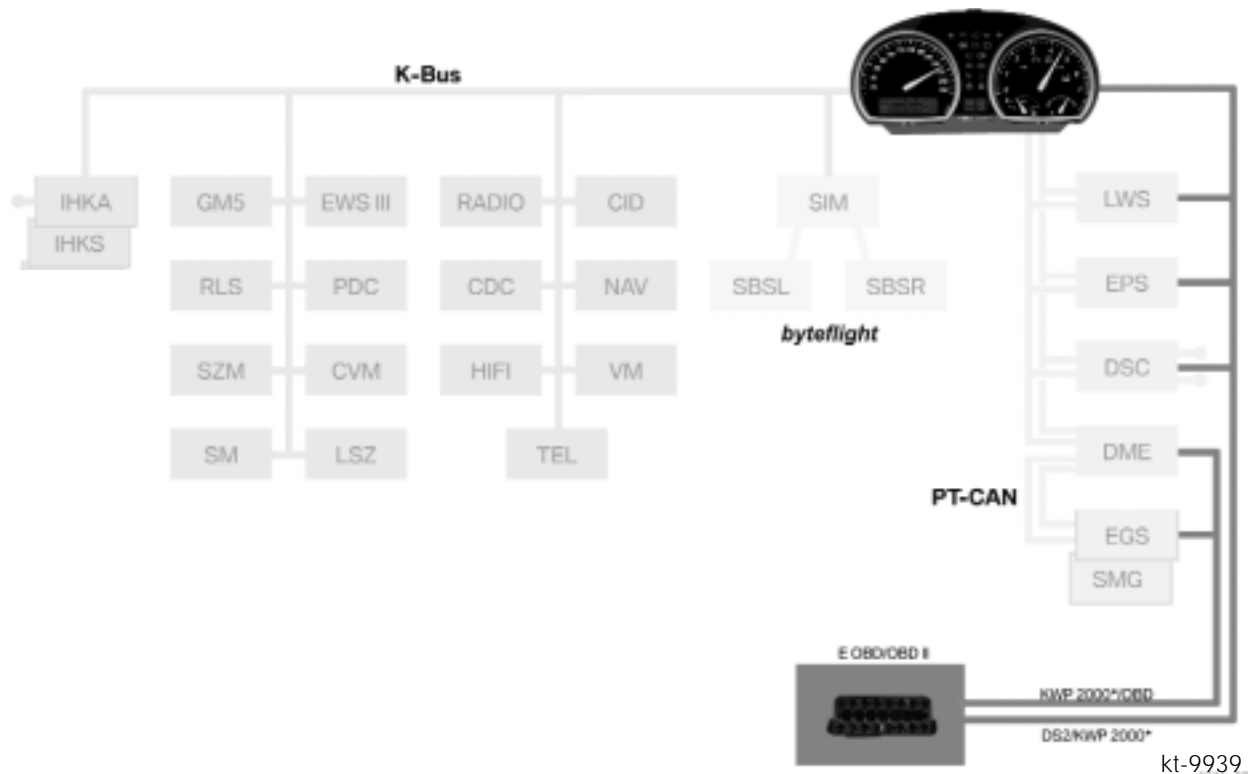


## Electric Cooling Fan

The electric cooling fan is activated by the ECM that outputs the control voltage for the final stage of the fan. Activation for the correct fan speed (15 speeds) is derived by the IHKA control module from the refrigerant pressure sensor signal and sent to the ECM.

Refrigerant pressure in bar	Fan Speed
8	0
9	2
10	3
12	5
14	6
15	7
16	8
17	9
18	10
19	11
20	12
21	13
22	14
23 - 35	15

## Workshop Hints



### Transport Mode

To preserve the vehicle battery during vehicle transport, IHKA is deactivated. Transport mode is set during vehicle production and must be disabled prior to vehicle delivery. Transport mode is deactivated with the DISplus/GT1 under Service Function "Disable transport mode."

### AUC Test Mode

Differing from the E46, there is no button combination provided on the control panel that enables a test mode for AUC.

### Compressor Run-In Protection

Compressor run-in protection is started automatically after installing a new control panel/control module (important for initial assembly at the factory). The switch on conditions for the compressor, e.g. the outside temperature, are disregarded.

**Note:** This function has a duration of 90 seconds (with engine running at idle speed). The function light in the A/C button flashes during this period.

## Vehicle & Key Memory (VKM)

The following table shows the vehicle & key memory functions for *E85 IHKA*.

Vehicle memory	Setting	Explanation
Key Memory	Active/not Active	Key memory can be activated/deactivated. When active, various functions are stored key specific.
Memory Recirculation air	Active/not Active	The recirculation air function is retained after a new start.
Cooling Capacity	Normal/hot country	Cooling capacity EU or hot country (increased cooling capacity by correspondingly increasing the blower output)

Key Memory	Setting	Explanation
Blower output	Increase/normal/decrease	The blower output in automatic mode can be increased or decreased
Correction set temperature	+3°/+2°/+1°/normal /-1°/-2°/-3°	The temperature set at the control panel can be corrected accordingly.
Air Conditioning mode "ON"	Active/not active	The air conditioning is switched on by switching on the ignition or by pressing the button on the control panel.

The following table shows the vehicle & key memory functions for *E85 IHKS*.

Vehicle Memory	Setting	Explanation
Key Memory	Active/not active	Key memory can be active/deactivated. When active, various functions are stored key-specific
Memory recirculating air	Active/not active	The recirculation air function is retained after a new start.

Key Memory	Setting	Explanation
A/C mode "ON"	Active/not active	The air conditioning is switched on by switching on the ignition or by pressing the button on the control panel.

## Coding

**Tropics coding IHKA** - The recirculating air function is retained after a new start. In addition, a previously selected recirculating air function is reactivated when the defrost function is switched off. In both cases, the tropics coding prevents moist warm air from the outside flowing into the vehicle interior.

**Hot country coding IHKA** - In the hot country coding, the increased cooling capacity is achieved by increasing the blower output.

**Control panel/control unit coding** - The function light on the button for the rear window defogger flashes if the control panel/control unit is not encoded. For instance, right-hand drive or left-hand drive must be coded for activation of the stepper motors to ensure the correct bus addresses are used.

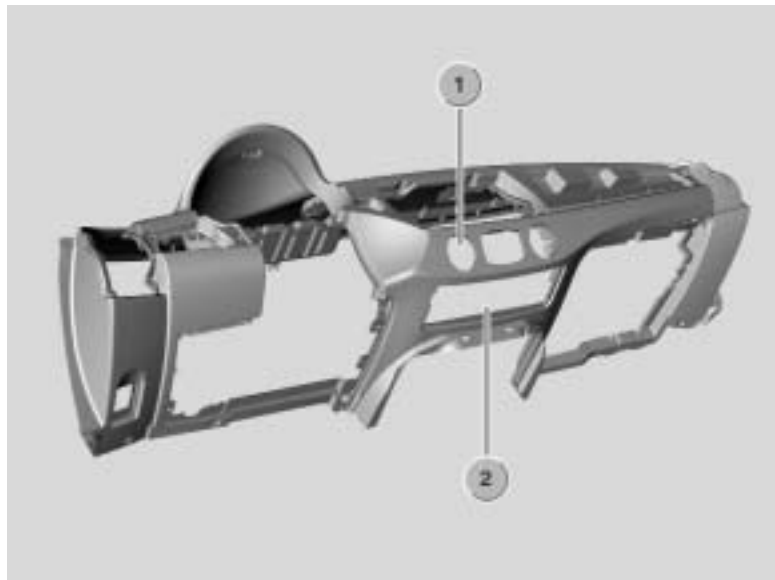
## Control Panel/Control Module Mounting

The “island” design requires a different mounting concept. The control panel/control module is mounted from the rear in the instrument panel. 3 trim rings can be individually replaced from the front. The control panel/control module is secured by 2 side clips and 2 screws at the top.

The IHKS control panel/control module can only be replaced as a complete unit. Individual parts such as rotary knobs cannot be replaced. To remove this, it is first necessary to remove the center fresh air grille outlet and the radio. The control panel/control module can then be removed by pulling down through the service opening in the instrument panel.

**Note:** Particular care must be taken when removing the control panel/control module to avoid scratches on the front of the unit.

1. Mounting opening for the control panel/control module.
2. Service opening for the control panel/control module.

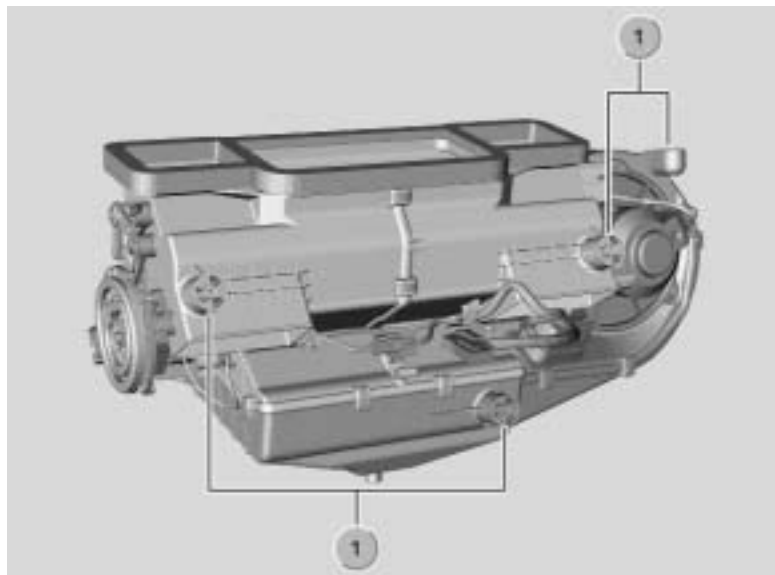


## Heater/Air Conditioner Mounting

The heater/air conditioner is mounted by 4 mounting domes on the support tube between the A pillars.

The heater/air conditioner is secured by 4 plastic screws. The plastic screws can be reused several times. Repair kits for the mounting domes are available.

1. Mounting domes



## Receiver/Dryer Mounting

The receiver/dryer is mounted with a plastic bracket to the right wheel arch behind the strut tower.

The refrigerant pressure sensor is installed on the refrigerant line leading to the receiver/dryer.

1. Refrigerant pressure sensor
2. Plastic receiver/dryer bracket



## Microfilter

The microfilter is located in the heater/air conditioner unit and is accessed via the footwell on the passenger's side below the glove box.

**Notes:**

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**Review Questions**

- 1. What are the “visual” differences that identify IHKA from IHKS? \_\_\_\_\_  
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- 2. How are 3 sets of distribution flaps controlled by one stepper motor on the IHKS system? \_\_\_\_\_  
\_\_\_\_\_
  
- 3. Where is the microfilter accessed for service? \_\_\_\_\_
  
- 4. If the interior temperature sensor blower failed, what would be the customer complaint (IHKA)? \_\_\_\_\_  
\_\_\_\_\_
  
- 5. What occurs with the A/C compressor when MAX AC is switched off (IHKA)?  
\_\_\_\_\_
  
- 6. What is Transportation Mode? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_